K.R. MANGALAM UNIVERSITY
THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING AND TECHNOLOGY

Bachelor of Technology (Computer Science & Engineering)

B.Tech (CSE)

Programme Code :01

2022-26

Approved in the 29th Meeting of Academic Council Held on 09 August 2022

Academic Council
Member Secretary
K.R. Mangalam University

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K.R. Mangalam University
Sohna Road, Gurugram, (Haryana)

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PREFACE

K.R. Mangalam University is in process of transforming to National Educational Policy 2020. The Academic council in consultation with Deans, Faculty Members, Industry Experts and University Alumni constituted department wise committees to draft the model curriculum of UG engineering courses. During the meetings held for developing curriculum for undergraduate engineering courses, a concern was shared that the overall credits are too high. It is important to lower the credits to 160 across all departments to lower the burden of syllabi and credits.

The respective Head of Committees, Faculty members along with Industry Experts and Alumni discussed the existing system prevalent in various universities, industry requirements and market trends, employability, problem solving approach, need for life-long learning, and after due deliberations, the scheme and syllabus of the B.Tech (CSE) and B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM, B.Tech Computer Science Engineering with specialization in Full Stack Development in Association with Xebia / B.Tech (Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP has been formalized. Salient features of this model curriculum are enumerated below:

1. Curriculum has been designed in such a way that it encourages innovation and research as total numbers of credits have been reduced and many new courses have been incorporated in consultation with industry experts.
2. The revised curriculum has been designed where the students can understand the industry requirements and have hands-on experience. The students will develop a problem solving approach and will meet the challenges of future.
3. Emerging areas in B.Tech (CSE) has been included in sixth and seventh semester.
4. New programme in B.Tech (CSE with specialization in Full Stack Development) is being launched effective AY 2022-23 onwards.
5. New programme in B.Tech (Computer Science & Engineering with specialization in Cloud Computing) is being launched effective AY 2022-23 onwards.
6. New programme in B.Tech (CSE with specialization in UI/UX) is being launched effective AY 2022-23 onwards.
7. Emphasis on hands-on training has been promoted by including two industrial training of 4 weeks and 6 weeks respectively, mini project and project in sixth and seventh semester, and six month Industrial Internship in eight semester.
8. The School will ensure the revision of the curriculum to help students to achieve better employability; start-ups and other avenues for higher studies.

1. Introduction

The K.R. Mangalam Group has made a name for itself in the field of education. Over a period of time, the various educational entities of the group have converged into a fully functional corporate academy. Resources at KRM have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly inter-disciplinary environment wherein they develop integrative skills through interaction with students from engineering, management, journalism and media study streams.

The K.R. Mangalam story goes back to the chain of schools that offered an alternative option of world-class education, pitching itself against the established elite schools, which had enjoyed a position of monopoly till then. Having blazed a new trail in school education, the focus of the group was aimed at higher education. With the mushrooming of institutions of Higher Education in the National Capital Region, the university considered it very important that students take informed decisions and pursue career objectives in an institution, where the concept of education has evolved as a natural process.

K.R. Mangalam University was founded in the year 2013 by Mangalam Edu Gate, a company incorporated under Section 25 of the Companies Act, 1956.

K. R. Mangalam University is unique because of its

i. Enduring legacy of providing education to high achievers who demonstrate leadership in diverse fields.
ii. Protective and nurturing environment for teaching, research, creativity, scholarship, social and economic justice.

Objectives

i. To impart undergraduate, post-graduate and Doctoral education in identified areas of higher education.
ii. To undertake research programmes with industrial interface.
iii. To integrate its growth with the global needs and expectations of the major stake holders through teaching, research, exchange & collaborative programmes with foreign, Indian Universities/Institutions and MNCs.
iv. To act as a nodal center for transfer of technology to the industry.
v. To provide job oriented professional education to the pecia student community with particular focus on Haryana.

2. About School

The School of Engineering and Technology offers three undergraduate Programmes: four years B. Tech, three years BCA, B.Sc. in four specialization courses (Electronics Science/Computer Science/Data Sciences/Cyber Security) and postgraduate Programme: MCA, M.Tech. in various disciplines. These engineering programs have the distinct objective of equipping the students with knowledge, skills, and attitude in engineering and technology to make them capable of successfully meeting the present requirements and future challenges in the engineering profession. SOET brings together outstanding academics, industry professionals, experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

The curriculum of programs has been designed to cater to the industry's ever-changing needs and demands. The syllabus and curriculum are regularly updated. The school has the best infrastructure, including domain-specific labs. SOET aims to provide exposure to the principles and practices of Design / Developments and Projects in engineering. SOET is offering Ph.D. programs also.

School Vision

Aspires to become an internationally recognized School through excellence in interdisciplinary education, research and innovation, preparing socially responsible life-long learners contributing to nation building.

School Mission

- Foster employability and entrepreneurship through interdisciplinary curriculum and progressive pedagogy with cutting-edge technology.
- Instill notion of lifelong learning through stimulating research, Outcomes-based education and innovative thinking.
- Integrate global needs and expectations through collaborative programs with premier universities, research centers, industries and professional bodies
- Enhance leadership qualities among the youth having understanding of ethical values and environmental realities
- Developing active leadership skills, ethical values, and environmental responsibility.
- Foster employability and entrepreneurship through futuristic curriculum and progressive pedagogy with cutting-edge technology.
- Instill notion of lifelong learning through stimulating research, Outcomes-based education, and innovative thinking.

- Integrate global needs and expectations through collaborative programs with premier universities, research centers, industries, and professional bodies
- Enhance leadership qualities among the youth understanding ethical values and environmental reality.

3. Programmes offered by the School

School offers undergraduate B.Tech Programme, B.Sc. (Hons) Programmes, postgraduate MCA, M.Tech Programmes and Doctoral Programmes. All these programmes are designed to impart scientific knowledge to the students and will provide theoretical as well as practical training in their respective fields.

3.1 Computer Science & Engineering

The Sc Bachelors, Masters and Doctoral degree programs in Computer Science & Engineering. The department is committed to provide quality, cutting-edge educational experiences that give students a holistic view of the engineering education and prepare them to take up their career in wide range of industries or establishing startup companies. Core strength of the department lays in its experienced and extremely competent faculty, advanced computing facilities, good placements, ever growing alumni network, emphasis on developing students' skill set while focusing on leadership and ethics in parallel.

Programme Outcomes (PO)

PO 1 Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO 2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3 Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6 The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering employability.

PO 7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO 11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects through entrepreneurship skills and in multidisciplinary environments.

PO 12 Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change through skill development.

3.1.1 B.Tech. Computer Science & Engineering

This programme is designed to provide a sound knowledge of computing principles and applications in scientific and engineering domains. It develops the ability to analyze problems and generate solutions in the areas of computing. It also aims to provide exposure to the principles and practices of design and development of computing system. An initiative to make the teaching-learning framework better and enhance the student learning outcomes, Department of Computer Science and engineering has taken a thoughtful step by introducing the concept of Learning Outcome Based Curriculum Framework (LOCF)and Choice Based Credits System (CBCS) system.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: - Python Programming / Operating Systems/ Computer networks / Compiler Design / Databases / Cloud Computing / Artificial Intelligence.

Career Options: - Opportunities exist in IT industry, freelancers, education and forensics.

3.1.2 B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM

K.R. Mangalam University, IBM and Samatrix has jointly designed a curriculum on new course B. Tech in CSE with specialization in Artificial Intelligence and Machine Learning to equip students with the next generation of technologies like building intelligent machines, software, or applications with a cutting-edge combination of Machine Learning, Deep leaning, Natural Language Processing, Sensor technologies, Artificial Neural Network, IOT, Big Data analytics and Visualization technologies.

IBM and Samatrix will provide training, knowledge expertise and resources on new technologies leveraging its expertise in the field of computing. The students will be provided learning opportunities in real world work situations that will keep them abreast of the latest skills and knowledge. The programme aims to prepare the students to analyze problems and generate solutions in the areas of AI & ML.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: - Clean coding with Python / R programming for data science and data analytics/Operating Systems/ Computer networks /Data visualization and storytelling/ Cloud Computing / Artificial Intelligence.

Career Options: - Opportunities exist in IT industry, freelancers, education and forensics.

3.1.3 B.Tech - Computer Science Engineering with specialization in Full Stack Development in Association with Xebia

K.R. Mangalam University, Xebia has designed a curriculum on new course B. Tech in CSE with specialization in Full Stack Development to equip students with the next generation of technologies like the end-to-end application software development, including the front end and back end. The front end consists of the user interface, and the back end takes care of the business logic and application workflows.

Xebia will provide training, knowledge expertise and resources on new technologies leveraging its expertise in the field of computing. The students will be provided learning opportunities in real world work situations that will keep them abreast of the latest skills and knowledge. The programme aims to prepare the students to analyze problems and generate solutions in the areas of application and software development.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: - HTML/CS Programming with Javascrip ReactJS Development NodeJS Development MongoDB Python Version Control system

Career Options: - Opportunities exist in IT industry, freelancers, education and forensics.

3.1.4 B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia

K.R. Mangalam University, Xebia has designed a curriculum on new course B. Tech in CSE with specialization in Cloud Computing which introduces core concepts of cloud computing. You gain the foundational knowledge required for understanding cloud computing from a business perspective as also for becoming a cloud practitioner. You understand the definition and essential characteristics of cloud computing, its history, the business case for cloud computing, and emerging technology usecases enabled by cloud. We introduce you to some of the prominent service providers of our times (e.g. AWS, Google, IBM, Microsoft, etc.) the services they offer, and look at some case studies of cloud computing across industry verticals.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: - Clean coding with Python / R programming for data science and data analytics/Operating Systems/ Computer networks /Data visualization and storytelling/ Cloud Computing / Artificial Intelligence.

Career Options: - Cloud administrator Cloud security analyst, Cloud network engineer, Cloud automation engineer, Cloud consultant, Cloud software engineer, Cloud engineer, Cloud architect, Opportunities exist in IT industry, freelancers, education and forensics.

3.1.5 B.Tech. in (Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP

K.R. Mangalam University, ImaginXp has jointly designed a curriculum on new course B. Tech in CSE with specialization in UX/UI. UX Design refers to the term “User Experience Design”, while UI Design stands for “User Interface Design”. Both elements are crucial to a product and work closely together. But despite their professional relationship, the roles are distinct different, referring to very different parts of the process and the design discipline. Where UX Design is a more analytical and technical field, UI Design is closer to what we refer to as graphic design, though the responsibilities are somewhat more complex.

UX/UI will provide training, knowledge expertise and resources on new technologies leveraging its expertise in the field of computing. The students will be provided learning opportunities in real world work situations that will keep them abreast of the latest skills and knowledge. The programme aims to prepare the students to analyze problems and generate solutions in the areas of UX/UI.

Eligibility Criteria: - The student should have passed the 10+2 examination conducted by the Central Board of Secondary Education or equivalent examination from a recognized Board in Science with mathematics as one of the subjects and with an overall aggregate of 50% or more.

Course Outline:- The focus of the courses is on Introduction to UX Design, Need of UX in Industry, Information Architecture Task Flow, Understanding Information Architecture, Patterns, Guidelines and Deliverables with the help of various tools such as XD/ Figma /Invision. Along with Wire framing& Prototyping Guidelines for Wire framing, Paper wire framing, Digital Wireframes, would enhance the basic skills of the students.

Career Options:-

- UX Researcher
- Usability Analyst / UX Analyst
- UX Architect/Information Architect
- Interaction Designer
- Wireframe Expert
- UX/ UI/ Visual Designer
- UX Developer
- Virtual Reality
- Augmented Reality
- Automotive UX Designer

Programme Specific Outcomes (PSO)

B.Tech. Computer Science & Engineering, B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM, Computer Science Engineering with specialization in Full Stack Development in Association with Xebia, B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia and B.Tech. in (Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP.

PSO1. Applications of Concepts: Ability to apply fundamentals of mathematics, science and engineering knowledge to understand, analyze and develop computer programs in the areas related to algorithms, multimedia, big data analytics, networks including cloud and edge computing, cyber security, machine learning, and IoTs for efficient design of computer-based systems of varying complexity.

PSO2. Innovation and Industry Friendly: Ability to apply appropriate techniques and modern engineering hardware and software tools for the design and integration of computer system and related technologies, understand contemporary issues in industry and research and thereby innovate original ideas and solutions, culminating into a modern, easy to use tool, by a larger section of the society with longevity and to engage in lifelong learning for the advancement of technology and its adaptation in multi-disciplinary environments.

PSO3. Ethics and Communication Skills: Implementation of professional engineering solutions for the betterment of society keeping the environmental context in mind, be aware of professional ethics and be able to communicate effectively.

4. Programme Duration:

The maximum completion period of the B.Tech. (CSE) Programme offered by the University shall be four years.

The maximum completion period of the B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM programme offered by the University shall be four years.

The maximum completion period of the B.Tech. Computer Science Engineering with specialization in Full Stack Development in Association with Xebia programme offered by the University shall be four years.

The maximum completion period of the B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia programme offered by the University shall be four years.

The maximum completion period of the B.Tech. in (Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP programme offered by the University shall be four years.

5. Class Timings

The classes will be held from Monday to Friday from 09:10 am to 04:30 pm.

6. Syllabi

The syllabi of B.Tech. (CSE) , B.Tech. B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM programme, B.Tech- Computer Science Engineering with specialization in Full Stack Development in Association with Xebia programme, B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia programme and B.Tech.(Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP programme for all semesters is given in the following pages. These are arranged as semester-wise.

For each course, the first line contains; Course Code and Credits (C) of the course.

This is followed by the course objectives, course outcome and the syllabus (Unit I to IV), Text book and reference books.

Four Year B.Tech (CSE) Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Course	9	8	11	9	9	7	5	1
Credits	26	25	29	23	21	23	18	12

Four Year B.Tech (CSE) in AI & ML with Samatrix and IBM Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Course	11	9	10	9	10	9	8	1
Credits	28	23	24	24	22	20	19	12

Four Year B.Tech (CSE) in Full Stack Development (FSD) Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Course	9	9	10	11	10	9	8	1
Credits	26	24	26	27	22	22	19	12

Four Year B.Tech (CSE) in Cloud Computing (CC) Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Course	9	9	10	10	11	10	5	1
Credits	26	25	27	26	23	27	18	12

Four Year B.Tech (CSE) in UI/UX Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Semester VII	Semester VIII
Course	9	10	9	10	11	9	6	1
Credits	26	27	27	26	28	27	17	12

6.1 Scheme of Studies as per Choice-Based Credit System (CBCS) and Learning Outcome-Based Curriculum Framework (LOCF)

SEMESTER I

SNo		Course Code	Course Title	L	T	P	C
1	SE	ETMA105A	Applied Mathematics-I	3	1	-	4
2	SE	ETPH109A	Engineering Physics	3	1	-	4
3	SE	UCES125A	Environmental Studies	3	-	-	3
4	SE	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	-	4
5	SE	ETME101A	Basics of Mechanical Engineering	3	1	-	4
6	SE	ETPH151A	Engineering Physics Lab	-	-	2	1
7	SE	ETEC151A	Basics of Electrical & Electronics Engineering Lab	-	-	2	1
8	SE	ETME151A	Basics of Mechanical Engineering Lab	-	-	2	1
9	SE		Open Elective	4	-	-	4
	TOTAL			**19**	**4**	**6**	**26**

SEMESTER II

SNo		Course Code	Course Title	L	T	P	C
1	SE	ETMA105A	Applied Mathematics-II	3	1	-	4
2	CC	ETCS104A	Introduction to Computer Science and Programming in Python	3	1	-	4
3	SE	ETCH119A	Engineering Chemistry	3	1	-	4
4	SE	ETEC 215A	Embedded Robotics and IOT	4	-	-	4
5	SE	ETME 155A	Engineering Graphics Lab	-	-	3	1.5
6	CC	ETCS150A	Introduction to Computer Science and Programming in Python Lab	-	-	2	1
7	SE	ETCH159A	Engineering Chemistry Lab	-	-	2	1
8	SE	ETME 157A	Workshop Practices	-	-	3	1.5
	SE		Open Elective	4	-	-	4

	TOTAL	**17**	**3**	**10**	**25**

SEMESTER III

S.No		Course Code	Course Title	L	T	P	C
1	CC	ETMA215A	Probability and Statistics	4	-	-	4
2	CC	ETCS321A	Java Programming	3	1	-	4
3	CC	ETCS231A	Discrete Mathematics	3	1	-	4
4	CC	ETCS217A	Data Structures	3	1	-	4
5	SE	UCDM301A	Disaster Management	3	-	-	3
6	SE	ETCS367A	Java Programming Lab	-	-	2	1
7	SE	ETCS257A	Data Structures Lab	-	-	2	1
8	SE		MOOC	1	-	-	3
10	SE	ETEC 210A	Digital Electronics	3	1	-	4
11	SE	ETEC 256A	Digital Electronics Lab	-	-	2	1
	TOTAL			**20**	**4**	**6**	**29**

SEMESTER IV

S.No		Course Code	Course Title	L	T	P	C
1	CC	ETCS222A	Computer Organization & Architecture	3	1	-	4
2	CC	ETCS210A	Web Programming with Python and JavaScript	3	-	-	3
3	CC	ETCS220A	Analysis and Design of Algorithms	3	1	-	4
4	CC	ETCS307A	Database Management Systems	3	1	-	4
5	SE	ETMC602A	Essentials of Organizational Behaviour	3	-	-	3
6	SE	ETCS228A	Employability and Analytical Skills-I	2	-	-	2
7	SE	ETCS 355A	Database Management Systems Lab	-	-	2	1
8	SE	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
9	SE	ETCS264A	Web Programming with Python and JavaScript Lab	-	-	2	1
	TOTAL			**17**	**3**	**6**	**23**

SEMESTER V

S.No		Course Code	Course Title	L	T	P	C
1	CC	ETCS 214A	Theory of Computation	3	1	-	4
2	CC	ETCS211A	Operating Systems	3	1	-	4
3	CC	ETCS304A	Computer Networks	3	1	-	4
4	SE	ETCS367A	iOS Development Lab	-	-	2	1
5	SE	ETCS365A	Computer Networks Lab	-	-	2	1
6	SE	ETCS255A	Operating System Lab	-	-	2	1
7	SE	ETCS381A	Practical Training I	-	-	-	1
8	SE	ETCS325A	Employability and Analytical Skills-II	2	-	-	2
9	SE	ETCS375A	Mini Project	-	-	-	3
		TOTAL		**11**	**3**	**6**	**21**

SEMESTER VI

S.No		Course Code	Course Title	L	T	P	C
1	CC	ETCS412A	Compiler Design	3	1	-	4
2	CC	ETCS401A	Artificial Intelligence	3	1	-	4
3	CC	ETCS 202A	Software Engineering	3	1	-	4
4	SE	ETCS451A	Artificial Intelligence Lab	-	-	2	1
5	SE	ETCS330A	Employability and Analytical Skills-III	2	-	-	2
6		**Elective I**					
(i)	CC	ETCS420A	Graph Theory	3	-	-	3
(ii)	CC	ETCS309A	Distributed Computing Systems	3	-	-	3
(iii)	CC	ETCS310A	Advanced Computer Architecture	3	-	-	3
7	SE	ETCS462A	Minor Project	-	-	-	5
		TOTAL		**14**	**3**	**2**	**23**

SEMESTER VII

S.No		Course Code	Course Title	L	T	P	C
1	SE	ETCS464A	Major Project	-	-	-	6
2	SE	ETCS481A	Practical Training II	-	-	-	2
3	SE		Boot Camp (Training and Placement)	2	-	-	-
4		**Elective - II**					
(i)	CC	ETCS426A	Natural Language Processing	4	-	-	4
	SE	ETCS465A	Natural Language Processing Lab	-	-	2	1
(ii)	CC	ETCS424A	Data Warehousing and Data Mining	4	-	-	4
	SE	ETCS463A	Data Warehousing and Data Mining Lab	-	-	2	1
(iii)	CC	ETCS423A	Neural Network	4	-	-	4
	SE	ETCS460A	Neural Network Lab	-	-	2	1
5		**Elective - III**					
(i)	CC	ETCS422A	Cloud Computing	4	-	-	4
	SE	ETCA362A	Cloud Computing Lab	-	-	2	1
(ii)	CC	ETCS421A	Internet of Things	4	-	-	4
	SE	ETCS457A	Internet of Things Lab	-	-	2	1
(iii)	CC	ETCS425A	Machine Learning	4	-	-	4
	SE	ETCS455A	Machine Learning Lab	-	-	2	1
			TOTAL	**10**	-	**4**	**18**

SEMESTER VIII

S.No		Course Code	Course Title	L	T	P	C
1	SE	ETCS490A	**Industrial Internship**				12
	TOTAL			-	-	-	12
	Total Credits [C]			**177**			

6.2 Syllabus of Common Courses in B.Tech. (CSE) Programme ,B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM programme, B.Tech- Computer Science Engineering with specialization in Full Stack Development in Association with Xebia programme, B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia programme and B.Tech.(Computer Science & Engineering) (CSE) with specialization in UX/UI in

ETMA105A	**Applied Mathematics-I**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Association with ImaginXP programme included here.

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of complex variable.

CO2. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO3. Applied the differential calculus method for curve tracing and radios of curvatures.

CO4. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO5. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO6. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices.The concepts of applied mathematics-Iare extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10 lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**

CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**
CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETMA 105A	Applied Mathematics - I	3	3	3	3				1					3		

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO 2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	-	-	-	-	**3**	-	-	-	-	**3**	-	-
CO3	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO6	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon of non dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations.

CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens ‘Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young’s double slit experiment, Newton’s rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

1. Ian G. Main, Oscillations and waves in physics

2. H.J. Pain, The physics of vibrations and waves
3. E. Hecht, Optics
4. A. Ghatak, Optics
5. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH109A	Engineering Physics	2	2	-	3	3	a	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	3	-	-
CO4	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-

1=lightly mapped 2= moderately mapped 3=strongly mapped

UCES125A	Environmental Studies	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.
2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

1. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. S.E. Manahan, Environmental Chemistry, CRC Press.
3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
4. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	**PO7**
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	**PO8**
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

	Programme and Course Mapping														
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	-	-	-	-	-	-	**3**	-	-	-	-	-	-	**1**	-
CO 2	-	-	-	-	-	-	-	**3**	-	-	-	-	-		**2**
CO 3	-	-	-	-	-	-	-	-	-	**3**	-	-	-		**2**
CO 4	-	-	-	-	-	**2**	-	-	-		-	-	-	**1**	
CO 5	-	-	-	-	-	-	**3**	-	-	-	-	-	-	-	**2**
1=lightly mapped				2= moderately mapped					3=strongly mapped						

ETEC 101A	**Basics Of Electrical & Electronics Engineering**	L	T	P	C
		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.

2. B L Thareja – A text book of Electrical Technology

3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.

4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	**3**	-	-
CO5	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO6	-	-		**3**	-	-	-	-	-	-	-	-	-	-	-
1=lightly mapped			2= moderately mapped						3=strongly mapped						

ETME 101A	**Basics of Mechanical Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

1. Understanding Basic Materials and Manufacturing Processes.
2. Have an understanding of laws of thermodynamics and Thermodynamic processes.
3. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
4. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.

CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.

CO3. Get the knowledge about power transmission method and device with mechanical properties.

CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: **10 lecture hours**

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: **12 lecture hours**

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: **6 lecture hours**

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

1. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
2. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
3. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
4. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
5. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
6. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
7. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

1. Strength of Materials – Popov, Pub. PHI, New Delhi.
2. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
3. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics and workshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**
CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 101A	Basics of Mechanical Engineering	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped					2= moderately mapped						3=strongly mapped				

		L	T	P	C
ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.
CO2. Better insight aboutwave nature of light.
CO3. Better understanding of data interpretation which enhances problem solving approach.
CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

1	To determine the value of acceleration due to gravity using Bar pendulum	2 lab hours
2	To determine the value of acceleration due to gravity using Kater's pendulum	2 lab hours
3	To determine the wavelength of sodium light using Newton`s ring apparatus	2 lab hours
4	To determine the wavelength of prominent lines of mercury by plane diffraction grating	2 lab hours
5	To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer	2 lab hours
6	To determine the specific rotation of cane sugar solution with the help of half shade polarimeter	2 lab hours
7	To determine the wavelength of He-Ne LASER using transmission diffraction grating	2 lab hours

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	**PO1& PO2**
CO2	Better insight aboutwave nature of light.	**PO4**
CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	2	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-		**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	**3**	-	-	-	-	-	-	**3**	-	-
1=lightly mapped					2= moderately mapped						3=strongly mapped				

ETEC 151A	**Basics Of Electrical & Electronics Engineering Lab**	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

<u>Course Objectives</u>

1.To understand the DC and AC circuit behavior by application of network theorems.

2.To elaborate complex signals over oscilloscope devices with reading.

3.To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.

4.To analyses the BJT in build circuits as per practical application point of view.

5.To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

<u>Course Outcomes</u>

On completion of this course, the students will be able to

CO1 Get an exposure to common electrical components and their ratings.

C02 Determines proper electrical connections as per wires of appropriate ratings.

CO3 Understand the usage of common electrical measuring instruments.

CO4 Ability to discover applications related to seven segment display type of devices

<u>Catalog Description</u>

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application inreal time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:
   a) Cathode ray oscilloscope (CRO)
   b) Multimeter (Analog and Digital)
   c) Function generator
   d) Power supply
2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem
4. To Verify the Superposition theorem
5. To measure voltage, current and power in an A.C. circuit by LCR impedance method
6. To study the frequency response curve in series and parallel R-L-C circuit
7. a)Plot the forward and reverse V-I characteristics of P-N junction diode
   b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, “Microelectronic Circuits” 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, “Digital Systems – Principles and Applications”, 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, “A course in Electrical & Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

Course Code	Course Title	Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2										3	3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	-	-	-	-	-	**3**	-	**3**	-	-

1=lightly mapped 2= moderately mapped 3=strongly mapped

ETME151A	**Basics of Mechanical Engineering Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

1. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
2. To study simple screw jack and compound screw jack and determine their efficiency.
3. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)
4. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
5. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
6. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.

CO2 Understand concepts of screw jack, friction, law of moments.

CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.

CO4 Get the knowledge of various Refrigeration and Air- Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**
CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**
CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air-Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-		**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	**3**	-	-	-	-	-	-	-	**3**	-	-	**3**	-	-

1=lightly mapped 2= moderately mapped 3=strongly mapped

ETMA105A	**Applied Mathematics-II**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of Laplace transform.

CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.

2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand and able to apply the basic concept of Laplace transform.	PO1
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.	PO8
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	PO2
CO4	Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.	PO4
CO5	Determine and find Extend the concept of series	PO3

	solutions to solve differential equations and learn orthogonality about the functions.	
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
ETMA1 05A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	-	-	-	-	**2**	-	-	-	-	**3**	-	-
CO3	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-		**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO6	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

		L	T	P	C
ETCS104A	**Introduction To Computer Science And Programming In Python**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley

4. Kenneth A. Lambert, "Fundamentals of Python,First Programs", CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS104A	Introduction to Computer Science and Programming in Python	2	2	2	2	-	-	-	-	-	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	2	-	-	-	-	2	-	-		2	2	3
CO2	1	2	3	2	-	-	-	-	2	-	-		2	2	3
CO3	1	2	3	2	-	-	-	-	2	-	-		3	2	3
CO4	1	2	3	2	-	-	-	-	2	-	-	-	3	2	3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12th Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to

become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **8 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **12 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: 10 lecture hours

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na_2SO_4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the understanding of Technology involved in improving quality of water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.	**PO1**
CO3	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its properties and applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	3	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-
CO3	-	-	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	-	-	-	-	-	-	3	-	-	-	-	-	3	3	-
CO5	-	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-	-	3	3	-

1=lightly mapped	2= moderately mapped	3=strongly mapped

ETEC 215A	**EMBEDDED ROBOTICS & IOT**	L	T	P	C
		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				
Course Teacher(s):	Dr. Bhavesh Vyas				

Course Objectives

1. To understand the basic of embedded system.
2. To analyse the complex circuits and build new designs of analog to digital conversion.
3. To be able to perform analysis of embedded C based circuits with robotics applications
4. To gain basic insight of semiconductors-based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

- CO1 Understand and apply Knowledge of Embedded Circuits in making real time projects to solve engineering difficulties.
- C02 Determine an understanding of logic gates and C language with electronic devices.
- CO3 Demonstrate the ability to identify digital circuits. Utilization of the knowledge gained to solve problems.
- CO4 Create an understanding of IOT & robotics devices application to existing setup.

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	-	-	-	-	-	-	-	-		1	-	1	-	1
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	1	-	-		1			2	-	-	-	-	-	-	-
CO4	-	2	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	-	-	-	-	-	1	2	-	-	-	-	-	-	2	-
CO6	-	-	-	-	1	-	-	-	-	2	3	-	3	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

1=weakly mapped
2= moderately mapped
3=strongly mapped

Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	20	
2	Mid Term Examination	90Minutes	20	

	(Written Examination)			
3	Attendance		10	
4	End Term Examination (Written Examination)	180 Minutes	50	
Total			**100**	

Course Content

UNIT I **14 HRS**

Introduction to Embedded Systems: Introduction to Basic Electronics Components, Introduction to Microprocessor and Microcontroller, Difference between Microcontroller and Microprocessor, Introduction to Embedded System, Introduction to Arduino, Types of Microcontrollers: 8051, PIC, AVR & ARM, parametric comparisons among all, Reading Datasheet & schematics, Advantages of Atmega328,

UNIT II **10 HRS**

Robotics: Introduction to robotics: Automation, Anatomy of Robots, Manipulators, Robot control, History of robots, Types of Main bodies, Tasks Planning for robots, Robot's mechanisms, Manipulators Mechanisms-I, Actuators for Robots-Part I, Stepper motor, Performance characteristic, Sensors and Controllers in robots, Incremental encoders and position, velocity sensors, external state sensors.

UNIT III **8 HRS**

Internet of Things: IOT Introduction and its Architecture (Why, What and How), Hardware in IOT, Future in IOT, Introduction to ESP8266 Wi-Fi Module, IOT Basics: IOT definition, applications in different domains, trends in IOT market. IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP).

UNIT IV **8 HRS**

Sensors For Robotic Applications: Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer. Recap of Embedded C: Datatypes, Array, Conditional Statements, Functions / Call-back function Structures, Pointers, Storage classes, Embedded Controllers, Interfaces, Operating System - Industrial Robots.

TEXT BOOKS:

1. Peter Marwedel, book**: Embedded System Design** 1st Edition, Kindle Edition
2. "Rise of the Robots: Technology and the Threat of a Jobless Future", by Author: Martin Ford
3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", by Author: Peter Mckinnon

REFERENCE BOOKS:

1. "Making Simple Robots: Exploring Cutting-Edge Robotics with Everyday Stuff", by Author: Kathy Ceceri
2. "Real-Time C++: Efficient Object-Oriented and Template Microcontroller Programming", 14 May 2018 by Author Christopher Kormanyos.

ETME155A	**Engineering Graphics Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.

CO2. Interpret engineering drawings using fundamental technical mathematics.

CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.

CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface,

structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	**3**	-	-	-	-	**3**	-	-	**3**	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped					

<table>
<tr><td>ETCS150A</td><td>Introduction To Computers And Programming In Python Lab</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Version 1.0</td><td></td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Pre-requisites/Exposure</td><td colspan="5">Practical learning</td></tr>
<tr><td>Co-requisites</td><td colspan="5">--</td></tr>
</table>

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**
4	Develop programs to understand the control structures of python	**2 lab hours**
5	Develop programs to implement function with stress on scoping	**2 lab hours**
6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**
8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS150A	Introduction to computers and programming in python Lab		2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	2	-	-	-	-	2	-	-	-	2	2	3
CO2	1	2	3	2	-	-	-	-	2	-	-	-	2	2	3
CO3	1	2	3	2	-	-	-	-	2	-	-	-	3	2	3
CO4	1	2	3	2	-	-	-	-	2	-	-	-	3	2	3
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCH159A	Engineering Chemistry Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

Course Outcomes

On completion of this course, the students will be able to

CO1: Analyze & generate experimental skills.
CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.
CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.
CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.
CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.
CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution, given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hyposolution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol formaldehyde resins.	**2 lab hours**
13	Determination of dissolved oxygen in the given sample of	**2 lab hours**

	water.	
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	**PO9**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCH159	Engineering Chemistry Lab	3	3	2	-	2	-	-	-	3	-	-	3	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO2	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO4	-	**3**	-	-	-	-	-	-	-	**3**	-	-	**3**	-	**3**
CO5	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	**3**
CO6	-	-	-	-	-	-	-	-	**3**	-	-	-	**3**	-	**3**

1=lightly mapped 2= moderately mapped 3=strongly mapped

ETME157A	Workshop Practice	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need
3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**
CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	**2**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	**3**	-	-	-	-	-	-	-	**3**	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1. To understand distributions in the study of the joint behaviour of two random variables.
2. To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.
3. To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
2. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
3. Jim Pitman (1993). Probability, Springer-Verlag.
4. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
5. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel

Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**
CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**
CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**
CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3	-	-	-	-	-	2	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	**3**	-	-	-	-	-	-	-	-	**2**	-	-
CO2	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**
CO3	-	-	**2**	-	-	-	-	-	-	-	-	-	2	-	-
CO4	-	**2**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO5	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	**3**
CO6	-	-	-	-	-	-	-	-	-		**2**	-	-	-	**3**
1=lightly mapped				2= moderately mapped						3=strongly mapped					

ETCS 321A	**Java Programming**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	NIL				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn the syntax of Java Programming Language and implement applications using it.

CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.

CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.

CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.

CO5. Understand multithreading and evaluate exception handing to create new applications.

CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

Course Content

Unit I: **10 lecture hours**

Introduction to Java: Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping: if..else, switch,?: operator, while, do, for statements, labeled loops, jump statements: break, continue return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.

Unit II: **9 lecture hours**

Arrays and Strings: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy, abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Unit III: **9 lecture hours**

Exceptional Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Run able interface, inter thread Communication, suspending, resuming and stopping threads.

Unit IV: **12 lecture hours**

Input/output Programming: Basics Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (Lang, util, io, net).

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes.

Text Books

1. Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

Reference Books/Materials

1. Herbert Schildt, "Java – The Complete Reference", Oracle Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS321A	Java Programming	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**2**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	-	-	**2**	-	-	-	-	**3**	-	-
CO5	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO6	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-

1=lightly mapped 2= moderately mapped 3=strongly mapped

ETCS231A	Discrete Mathematics	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: **10 lecture hours**

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: **12 lecture hours**

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: **12 lecture hours**

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: **10 lecture hours**

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, “Discrete Mathematics and Its Applications”, TMH.
2. C.L. Liu, “Elements of Discrete Mathematics”, TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, “Discrete Mathematical Structures”, PHI.

2. NarsinghDeo, “Graph Theory with Application to Engineering and Computer Science”, PHI.
3. J. P. Trembly& P. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw Hill.
4. Vinay Kumar, “Discrete Mathematics”, BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	2	-	-
C	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-

O 4															
CO5	-	-	2	-	-	-	-	-	-	-	-	-	2	-	-

1=lightly mapped 2= moderately mapped 3=strongly mapped

		L	T	P	C
ETCS217A	**Data Structures**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course

introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: **8 lecture hours**

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: **12 lecture hours**

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: **12 lecture hours**

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: **8 lecture hours**

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.
2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.
2. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	**2**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped					

UCDM301A	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people’s responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: **8 lecture hours**

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc, Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: **8 lecture hours**

Disaster Preparedness and Response Preparedness

Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan. Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies. Role of IT in Disaster Preparedness, Role of Engineers on Disaster Management. Relief and Recovery, Medical Health Response to Different Disasters

Unit III: **6 lecture hours**

Rehabilitation, Reconstruction and Recovery

Reconstruction and Rehabilitation as a Means of Development. Damage Assessment, Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction, Sanitation and Hygiene, Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

Disaster Management Act, 2005:

Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

Liability for Mass Disaster

Statutory liability, Contractual liability, Tortiousliability, Criminal liability, Measure of damages

Epidemics Diseases Act, 1897: Main provisions, loopholes.

Project Work: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.

- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	**20**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management	-	-	2	-	-	3	-	-	-	-	-	2	-	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	**2**	-	-	-	-	-	-	-	-	-	-	**2**
CO2	-	-	**2**	-	-	-	-	-	-	-	-	-	-	**2**
CO3	-	-		-	-	-	-	-	-	-	-	-	-	**2**
CO4	-	-	-	-	-	**3**	-	-	-	**3**	-	-	-	**2**

1=lightly mapped 2= moderately mapped 3=strongly mapped

ETCS367A	**Java Programming Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn to the syntax of Java Programming Language and implement applications in it.
CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.
CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.
CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.
CO5. Understand multithreading and evaluate exception handing to create new applications.
CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

This course complements ETCS 323A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments help organizing the data in

variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**
3	Write a java program to implement various shapes using Abstract class	**2 lab hours**
4	Write a java program to demonstrate interfaces.	**2 lab hours**
5	Write a java program to show multithreaded producer and consumer application.	**2 lab hours**
6	Create a java programs that make use of all the 5 exception keywords.	**4 lab hours**
7	Convert the content of a given file into the uppercase content of the same file.	**4 lab hours**
8	Develop a scientific calculator using swings.	**4 lab hours**
9	Create a servlet that uses Cookies to store the number of times a user has visited your servlet.	**4 lab hours**
10	Create a simple java bean having bound and constrained properties.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS361A	Java Programming Lab	2	3	3		2			2	3				3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS257A	**Data Structures Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.
CO2. Implement a given Search problem (Linear Search and Binary Search).
CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.
CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in

variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours
14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	**2**	-	-	-	-	-	-	-	**3**	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS222A	**Computer Organization and Architecture**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will

learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: **12 lecture hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: **10 lecture hours**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: **8 lecture hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: **10 lecture hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

1. “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. “Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. “Computer Organization and Design: The Hardware/Software Interface”, 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. “Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand the concepts of microprocessors, their principles and practices.	PO2
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors.	PO3
CO3	Organize a modern computer system and be able to relate it to real examples.	PO4
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	PO9
CO5	Implement embedded applications using Emulator.	PO5

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	-	-	-	3	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	-	-	-	3	-	-
CO5	-	-	-		3	-	-	-	-	-	-	-	3	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped					

ETCS220A	**Analysis And Design Of Algorithms**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.

2. Students should be able to understand the necessary divide and conquer algorithms.

3. To familiarize students with greedy and dynamic programming concepts

4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness.

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.
2. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-		**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS307A	**Database Management Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.

2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.

3. To understand and use data manipulation language to query, update, and manage a database.

4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.

5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the data base design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: 12 lecture hours

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: 8 lecture hours

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: **12 lecture hours**

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: **8 lecture hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

1. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**
CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**
CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems		2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO6	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO7	-	-	-	-	-	-	-	-	**3**				**3**	-	-
CO8	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped					

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer's needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace.

This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception-concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

1. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
2. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
3. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning
4. McSchane, Organisation Behaviour, TMH, New Delhi
5. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
6. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi
7. Nelson, Debra L and James C Quick, Organisational Behaviour, Thomson Learning

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	**3**	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	-	**3**	-
CO5	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

Course Code	Course Title	L	T	P	S	C
ETCS228A	**Employability and Analytical Skills-I**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					

COURSE OBJECTIVES

Professional development of the students.

To develop a platform with Intelligent combination of training, technology and interactive learning.

Converting fresh graduates into priced assets who are ready to face any challenge head-on.

Crafting candidates to be winners and train them to handle their failures as well

To train students and make them job ready

To understand HR perspective and Industry hiring patterns

To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO2	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO3	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO4	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO5	-	-	-	**3**	**3**	-	-	-	-	-	-	-	-	-	**3**
CO6	-	-	-	**3**	**3**	-	-	-	-	-	-	-	-	-	**3**
CO7	-	-	-	**3**	**3**	-	-	-	-	-	-	-	-	-	**3**
1=lightly mapped					2= moderately mapped						3=strongly mapped				

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	

3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- Communication
- Introduction to Communication
- Types of communication
- Verbal & Nonverbal Communication
- Barriers to Communication
- Body language
- Listening Skills
- Activity
- Language

Quant

- Types of Numbers, HCF & LCM
- Divisibility, Unit Digit.
- Remainder Theorem
- Equations, Factorials.

UNIT II

- Basic Grammar/Communicative Grammar
- Parts of speech
- Nouns
- Pronouns: Noun Pronoun Agreement, Types with special emphasis over relative pronouns
- Verbs: Introduction Principal verbs and auxiliary verbs, subject-verb agreement
- Adjectives: degrees of comparison
- Adverb: Types and its usage in sentences
- Conjunctions: Coordinating and Co-relative conjunctions
- Prepositions
- Articles: Definite and Indefinite articles
- Usage of Tenses
- Subject verb agreement
- Sentence Structure: Simple Complex and Compound sentences
- Clauses

Quant

- Progression, Probability
- Permutation & Combination, Average, Percentage, Ratio & Proportion, Partnership
- Profit & Loss

UNIT III

- Word formation
- Theory and exercise
- Synonyms and antonyms
- One-word substitutes
- Idioms
- Phrasal verbs
- Pair of words
- Homonyms, hyponyms, hypernyms
- Linking words: sequencing of sentences (to form a coherent paragraph
- Paragraph writing
- Supplying a suitable beginning/ending/middle sentence to make the paragraph coherent
- Idiomatic language (with emphasis on business communication),
- Punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices

Quant

- Problems on Ages.
- Mixture & Allegation
- Simple Interest & Compound Interest.

UNIT IV

- General Essay writing, Writing Issues and Arguments (with emphasis on creativity and analysis of a topic)
- Story writing
- Business letter writing: Guidance in framing a ‘Statement of purpose’,
- Letters of Recommendation
- Email writing, email and business letter writing etiquette,
- Letters of complaints/responses to complaint

Quant

- Time & Work.
- Time, Speed and Distance
- Data Interpretation.

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To facilitate students in Database design.
4. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

<u>Text Books</u>

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

<u>Reference Books/Materials</u>

1. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.
2. "Fundamentals of Database Systems", R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 355A	Database Management Systems Lab	-	3	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	Analysisand Design of Algorithms Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. To understand concept of different sorting algorithms.
2. To understand the concept of dynamic programming.
3. To understand concept of divide and conquer.
4. To understand Dictionary (ADT)
5. To understand concept of greedy algorithms.
6. To understand concept & features like max heap, min heap

Course Outcomes

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**
6	To Implement Matrix Chain Multiplication.	**2 lab hours**
7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical

Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	**Theory of Computation**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: **12 lecture hours**

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: **8 lecture hours**

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: **12 lecture hours**

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: **8 lecture hours**

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education.

2. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education.

3. Raymond Greenlaw an H.James Hoover, "Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers.

4. MichealSipser, “Introduction of the Theory and Computation”, Thomson Brokecole.

5. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**
CO2	Design finite automata to accept a set of strings of a language	**PO3**
CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

Programme and Course Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-		-	-	-	-	-	-	-	-	3	-	-
CO2	-	-	3	-	-	-	-	-	-	-	-	-	3	-
CO3	-	3	-	-	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	3	-	-	-	-	-	3	-	-	3	-
1=lightly mapped					2= moderately mapped						3=strongly mapped			

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	Operating Systems	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit III: **12 lecture hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: **10 lecture hours**

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

1. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

1. Tannenbaum, "Operating Systems", PHI, 4th Edition.
2. William Stallings, "Operating Systems Internals and Design Principles", PHI
3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	**2**	-	-	-	-	-	-	**3**	-	**3**	-	-
CO5	-	-	-	-	**3**	-	-	-	-	-	-	**3**	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped				

ETCS304A	Computer Networks	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
C02. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: **8 lecture hours**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.

2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	-	**3**	-	-	-	-	-	-	-	-	-	**3**	**2**	**2**	-
CO2	-	-	-	-	-	-	-	-	-	-	-	**3**	**2**	**2**	-
CO3	-	**3**	-	-	-	-	-	-	-	-	-	-	**2**	**2**	-
CO4	-	-	-	**3**	-	-	-	-	-	**3**	-	-	**2**	**2**	-

CO5	-	-	-	-	**3**	-	-	-	-	-	-	-	**2**	**2**	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

3=strongly mapped

ETCS367A	**iOS Development Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of MAC OS				
Co-requisites	--				

Course Objectives

1. To be able to Understand the basics of Swift Programming language
2. To Learn and practice the iOS App that commonly used in iPhone
3. Understand and able to differentiate between the concept of iOS and OS X
4. Apply necessary information to program for automation.
5. Apprehend the basic of MAC System and how to publish iOS app on AppStore.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.

C02. Understand and know how to use properly UIKit, asynchronous code, Core Image, NSURL Session and JSON Map Kit and Core Location, Auto Layout, Source Control, Core Data, Animation, and the app submission process.

CO3. Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects

CO4. Organize their code professionally using objects and blocks, prototype several entry-level apps and try to publish on App store.

Catalog Description

The objective of the course is to provide skills to develop applications for OS X and iOS. It includes introduction to development framework Xcode. Objective-C is used as programming language to develop the applications. Objective-C is the superset of the C programming language and provides object-oriented capabilities and a dynamic runtime. Objective-C inherits the syntax, primitive types, and flow control statements of C and adds syntax for defining classes and methods. The list of experiments helps in making static and dynamic iOS App on based on real time systems.

List of Experiments (Indicative)

1	Case Study of Objective-C language.	2 lab hours
2	Case study of Windows and MAC systems	2 lab hours
3	Case Study of XCode based on MAC Systems	2 lab hours
4	Design an App for UISwitch based on Objective-C language	2 lab hours
5	Design an App for UISlider based on Objective-C language	2 lab hours
6	Design an App for UIStepper based on Objective-C language	2 lab hours
7	Write a program for creating Story Boards	2 lab hours
8	Design an App for UIAnimation based on Objective-C language	3 lab hours
9	Create a Simple Calculator using Objective-C Language	3 lab hours
10	Write an Objective-C program that displays the Phrase “Hello World”	1 lab hours
11	Write an Objective-C program for displaying the value of variables	2 lab hours
12	Write an Objective-C program for displaying the sum and subtraction of two variables	2 lab hours
13	Write an Objective-C program for displaying the multiplication and division of the two variables	2 lab hours
14	Write an Objective-C program that demonstrate control structure of Objective-C language	3 lab hours
15	Create a Button using Objective-C	2 lab hours

16	Make an interactive project based on iOS App using Objective-C Language	3 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.	**PO2**
CO2	Understand and know how to use properly UIKit, asynchronous code, CoreImage, NSURLSession and JSON MapKit and CoreLocation, AutoLayout, Source Control, Core Data, Animation, and the app submission process.	**PO3**
CO3	Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects	**PO5**
CO4	Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on Appstore.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS367A	iOS Development Lab		2	3		3				3				3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		**2**											**3**		
CO2			**3**										**3**		
CO3					**3**								**3**		
CO4									**3**				**3**		
1=lightly mapped					2= moderately mapped							3=strongly mapped			

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
2. Provides a practical approach to assemble Ethernet/Internet networking.
3. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.
CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.
CO3. Demonstrate and measure different network scenarios and their performance behavior.
CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra's algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**

12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)	**4 lab hours**
14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**

CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**
CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**
CO2	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**-**
CO3	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
CO4	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**-**	**-**	**3**	**3**	**-**
CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS 255A	**Operating Systems Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

List of Experiments (Indicative)

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**
8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical	**4 lab hours**

9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**2**	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-

3															
CO4	-	-	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	-	-	-	**3**	-	-	-	-	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS381A	**Practical Training – I**	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enable students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I	-	-	3		3		2	-	-	3		-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	**3**	-	-	-	-	-	-	**3**	**3**	**3**	-
CO2	-	-	-	-	-	-	**3**	-	-	-	-	**3**	**3**	**3**	-
CO3	-	-	**2**		-	-	-	-	-	-	-	-	**3**	**3**	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	**3**	**3**	-
1=lightly mapped				2= moderately mapped						3=strongly mapped					

Course Code	Course Title	L	T	P	S	C
ETCS325A	**Employability and Analytical Skills-II**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

Professional development of the students.

To develop a platform with Intelligent combination of training, technology and interactive learning.

Converting fresh graduates into priced assets who are ready to face any challenge head-on.

Crafting candidates to be winners and train them to handle their failures as well

To train students and make them job ready

To understand HR perspective and Industry hiring patterns

To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO2	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO3	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
CO4	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-	-	**3**
1=lightly mapped					2= moderately mapped						3=strongly mapped				

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- General speaking -Just a minute session,
- Reading news clippings in the class,
- Extempore speech, expressing opinions,
- Making requests/suggestions/complaints, telephone etiquette.
- Professional Speaking
- Elocutions
- Debate

Quant

- Mensuration.

Reasoning

- Number Series, Alpha-Numeric Series.

UNITII

- Describing incidents and developing positive nonverbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)
- Group discussion,
- Intricacies of a group discussion, topics for GD (with special focus on controversial topics),
- Structure of participation in a group discussion,
- Words often mis-used, words often mis-spelt,
- Multiple meanings of the same word (differentiating between meanings with the help of the given context),
- Business idioms and expressions foreign phrases, Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

Reasoning

- Seating Arrangement, Puzzle.
- Blood Relation, Coding & Decoding.

UNIT III

- Group discussion Advance
- Role Plays
- Video Showcasing
- Just a minute rounds
- Extempore

- Presentations – Team and Individual
- Team Lead activities
- Debates
- Free speech sessions

Reasoning

- Seating Arrangement, Puzzle.
- Data Sufficiency.
- Ranking Test, Venn-diagram, Statement and Conclusion, Statement and Inferences, Statement and Course of Action, Statement and Assumptions, Syllogism.

UNIT IV

- Professional grooming
- Inter personal skills,
- brushing up on general awareness,
- latest trends in their respective branches,
- resume preparation,
- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities, Importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

ETCS375A	**Mini Project**	L	T	P	C
Version 1.0		-	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.

2. Preparing an Action Plan for conducting the investigation, including team work.

3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.

4. Final development of product/process, testing, results, conclusions and future directions.

5. Preparing a report in the standard format for being evaluated by the Department.

6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 375A	Mini Project Lab	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	**2**	-	-	-	-	-	-	-	-	-	-
CO3	-	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	-	-	-
1=lightly mapped				2= moderately mapped							3=strongly mapped				

ETCS412A	**Compiler Design**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation.

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.
A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.
Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.
Type Checking: Type systems, Specification of a simple type checker.
Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.

Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.

Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, "Principles of Compiler Design", Pearson Education.

Reference Books/Materials

1. Andrew L. Appel, "Modern Compiler Implementation in C",Delhi, Foundation Books.
2. Dick Gruneet. Al., "Modern Compiler Design", Wiley Dreamtech.
5. R. J. Schalkoff, "Artificial Intelligence – An Engineering Approach", McGraw Hill Int. Ed. Singapore.
6. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House.
7. Tim Johns, "Artificial Intelligence, Application Programming", Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**

CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**
CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**
CO5	Distinguish between computability and non-computability and Decidability and undecidability.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	**3**	-	-	-	-	-	-	-	**3**	-	-
CO2	-	**3**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**2**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped															

		L	T	P	C
ETCS401A	**Artifical Intelligence**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

CO2. Apply these techniques in applications which involve perception, reasoning and learning.

CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.

CO4. Acquire the knowledge of real world Knowledge representation.

CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.

CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: 8 lecture hours

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: 12 lecture hours

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: 12 lecture hours

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: 8 lecture hours

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

1. Artificial Intelligence, P. H. Winston,Pearson Education.
2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
3. Principles of AI, N. J. Nilsson, Narosa Publishing House

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	**PO1**
CO2	Apply these techniques in applications which involve perception, reasoning and learning.	**PO4**
CO3	Explain the role of agents and how it is related to environment and the way of evaluating it and how	**PO5**

	agents can act by establishing goals.	
CO4	Acquire the knowledge of real world Knowledge representation.	**PO2**
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.	**PO3**
CO6	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.	**PO3**
CO7	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS401A	ARTIFICAL INTELLIGENCE	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped

2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**2**									**2**	-
CO4	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	**3**	-	-	-	-	-	-	-	-	-	-	-	**2**
CO6	-	-	-	**2**	-	-	-	-	-	-	-	-	**3**	-	-
CO7	-	**1**	-	-	-	-	-	-	-	**3**	-	-	**3**	-	**2**
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS 202A	Software Engineering	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

On completion of this course, the students will be able to:

CO1. To learn and understand the Concepts of Software Engineering
CO2. To Learn and understand Software Development Life Cycle
CO3. To apply the project management and analysis principles to software project development.
CO4. To apply the design & testing principles to software project development.
CO5. Ability to execute tests, design test cases, use test tools, etc.
CO6. To Study about Software maintenance tools

Catalog Description

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

Unit I: **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

Unit II: 12 lecture hours

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO, COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding:TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

Unit III: 8 lecture hours

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

Unit IV: 12 lecture hours

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International.
2. R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
3. W.S. Jawadekar, "Software Engineering – Principles and Practices", McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, TMH.
2. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
3. I. Sommerville, "Software Engineering", Addison Wesley.
4. K. Chandrasehakhar, "Software Engineering & Quality Assurance", BPB.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 202A	Software Engineering	3	3	3	3	3						2		3	3	2

1=weakly mapped

2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO3	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**3**	**2**	**1**
CO4	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO5	**-**	**-**		**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS451A	**Artificial Intelligence Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs

CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving

CO4. Know how to build simple knowledge-based systems

CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**
2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	**PO1**
CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	**PO4**
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	**PO5**
CO4	Know how to build simple knowledge-based systems	**PO2**
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS451A	ARTIFICIAL INTELLIGENCE LAB	2	3		3	3										3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**											**3**		
CO2			**3**										**3**	
CO3		**3**										**3**		
CO4				**3**						**3**			**3**	
1=lightly mapped				2= moderately mapped						3=strongly mapped				

Course Code	Course Title	L	T	P	S	C
ETCS330A	**Communication & Analytical Skills 3**	**3**	**1**	**0**	**0**	**4**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	**Course Outcome**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I **(Lectures-)**

- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- Answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities,

- importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,
- handling stress,
- Suggestions for responding to tough/unknown questions, preparation on self and personality development

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNITII

- Profile Building On LinkedIn
- Resume Building
- Video CV building.
- Professional Grooming
- E mail Writing

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT III (Lectures-)

- Interview Role Plays
- Individual Intro Video making
- Team Building sessions
- Self-analysis
- Telephone etiquettes

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions

- Mock tests
- One to One Feedback sessions

UNIT IV (Lectures-)

- Industry readiness (Resume writing, grooming, GDPI etc.)
- Grooming
- Mock sessions
- FAQs discussions
- Multiple Test series
- Brush-up on GDPI and Industry readiness

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

ETCS420A	Graph Theory	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **10 lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on

Graph, The Travelling Salesman Problem, Sperner'sLeema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley's Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: **10 lecture hours**

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski's Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: **12lecture hours**

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: **8 lecture hours**

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

1. Introduction to Graph Theory, R.J. Wilson, Pearson Education.

2. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
3. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3		1						2	3	1	

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	**2**	-	-	-	-	-	-	-	-	-	**3**	**2**	**1**
CO2	**3**	**1**	-	-	**2**	-	-	-	-	-	-	-	**3**	**2**	**1**
CO3		**3**	**3**	-	-	-	-	-	-	-	**2**	-	**3**	**2**	**1**
CO4	**2**	-	**3**	-	-	-	-	-	-	-	-	-	**3**	**2**	**1**
1=lightly mapped 2= moderately mapped 3=strongly mapped															

ETCS309A	Distributed Computing Systems	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

Unit I: **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

Unit II: **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

Unit III: **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

Unit IV: **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

1. Ajay D. Kshemkalyani and MukeshSinghal, "Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press.

Reference Books/Materials

1. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", Pearson Education, 4th Edition.
2. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	**PO1**
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	**PO1**
CO3	Design and implement distributed applications	**PO3**
CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Distributed Computing Systems	2		3	3								2			

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**P012**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	**1**	-	-	-	-	-	-	-	-	-	-	**3**	-	**1**
CO2	-	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO3	-	-	-	-	**3**	-	**2**	-	-	-	-	-		**2**	-
CO4	-	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO5	-	-	**3**	-	-	-	-	-	-	-	-	-	-	-	**2**
1=lightly mapped				2= moderately mapped						3=strongly mapped					

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

1. Understand the Concept of Parallel Processing and its applications.
2. .Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. .Develop the Pipelining Concept for a given set of Instructions.
5. .Distinguish the performance of pipelining and non-pipelining environment in a processor.
6. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture

focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein's Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl's law, Gustafson'slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

Unit III: **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Unit IV: **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

1. Advanced computer architecture, Kai Hwang, McGraw Hills.
2. Computer Organization and Design, D. A. Patterson and J. L. Hennessey, Morgan Kaufmann.

REFERENCE BOOKS:

1. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
2. Memory System and Pipelined Processors, HarveyG.Cragon, Narosa Publication.
3. Parallel Computer, V.Rajaranam & C.S.R. Murthy, PHI.
4. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
5. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
6. Computer Organization & Architecture, Stalling W, PHI.
7. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**

CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3							2	3	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping															
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-
CO3	-	**3**	-	-	-	-	-	-	-	-	-	**3**		-
CO4	-	-	-	**3**	-	-	-	-	-	**3**	-	-	**3**	-
1=lightly mapped				2= moderately mapped						3=strongly mapped				

ETCS462A	**Minor Project**	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Minor Project			3		2					3			3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-
CO	-	**3**	-	-	-	-	-	-	-	-	-	**3**	-	-

3														
CO4	-	-	-	**3**	-	-	-	-	-	**3**	-	-	**3**	-
1=lightly mapped 2= moderately mapped 3=strongly mapped														

ETCS464A	Major Project	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project			3		2					3			3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	**3**	-	-	-	-	-	-	-	-	**3**	-	-
CO2	-	-	-	-	**3**	-	-	-	-	-	-	**3**	-	-
CO3	-	-	**2**	-	-	-	-	-	-	-	-	**3**	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	-	-
1=lightly mapped					2= moderately mapped						3=strongly mapped			

		L	T	P	C
ETCS481A	**Practical Training – II**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Completion of sixth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Have an exposure to industrial practices and to work in teams.	PO5
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	PO7
CO3	Develop the ability to engage in research and to involve in life-long learning	PO3
CO4	Communicate effectively and learn to be a team player	PO10

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS481A	Practical Training – II			3		3		2			3					

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	**3**	-	-	-	-	-	-	-
CO3	-	-	**2**	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	**3**	-	-	-	-
1=lightly mapped					2= moderately mapped						3=strongly mapped			

ETCS 426A	**Natural Language Processing**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Explain the concepts of artificial intelligence to solve problems.
2. Appraise the concept of natural languages processing components using NLP tools.
3. Create scalable applications that can robustly handle errors in runtime applications.
4. Designing applications using pre-built NLP processor.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand approaches to syntax and semantics in NLP.

CO2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Understand current methods for statistical approaches to machine translation.

CO4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Catalog Description

The intent of the course is to present a fairly broad graduate-level introduction to Natural Language Processing, the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical and neural-network learning algorithms that train on (annotated) text corpora to automatically acquire the knowledge needed to perform the task. Class lectures will discuss general issues as well as present abstract algorithms. Implemented versions of some of the algorithms will be provided in order to give a feel for how

the systems discussed in class "really work" and allow for extensions and experimentation as part of the course projects.

Course Content

Unit I: **10 lecture hours**

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

Unit II: **7 lecture hours**

Introduction to semantics and knowledge representation, Some applications like machine translation, database interface. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

Unit III: **7 lecture hours**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

Unit IV: **10 lecture hours**

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Text Books

1. Natural Language Understanding, Allen, Pearson Education.

Reference Books/Materials

1. Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, D. Jurafsky & J. H. Martin, Pearson Education.
2. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich SchutzeMIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand approaches to syntax and semantics in NLP.	**PO1**
CO2	Understand approaches to discourse, generation, dialogue and summarization within NLP.	**PO2**
CO3	Understand current methods for statistical approaches to machine translation.	**PO3**
CO4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 426A	Natural Language Processing	2	3	3						3				3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	**3**	**3**	**2**
CO2	**3**		**3**	-	-	-	-	-	-	-	-	**3**	**3**	**2**
CO3	-	**3**	-	-	-	-	-	-	-	-	-	**3**	**3**	**2**
CO4	-	**3**	-	-	-	-	-	-	-	-	-	**3**	**2**	**3**
CO5	-	-	-	**2**	**3**	-	-	-	-	-	-	-	-	-
1=lightly mapped				2= moderately mapped						3=strongly mapped				

		L	T	P	C
ETCS465A	**Natural Language Processing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.

The experiments in this lab are arranged in a logical sequence to inculcate a new concept at every step, starting from very basic ones to advanced ones.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.

CO2. Able to design, implement, and analyze NLP algorithms

CO3. Able to design different language modeling Techniques

CO4. Analyze large volume text data generated from a range of real-world applications.

Course Description

The lab complements ETCS426A.

List of Experiments (Indicative)

1	To learn about morphological features of a word by analysing it. (Word Analysis)	**2 lab hours**
2	To generate word forms from root and suffix information. (Word Generation)	**2 lab hours**
3	Understanding the morphology of a word by the use of Add-Delete table (Morpgology)	**2 lab hours**
4	To learn to calculate bigrams from a given corpus and calculate probability of a sentence. (N-Grams)	**2 lab hours**
5	To learn how to apply add-one smoothing on sparse bigram table. (N-Gram Smoothing)	**2 lab hours**

6	To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model. (POS Tagging – Hidden Markov Model)	**2 lab hours**
7	To find POS tags of words in a sentence using Viterbi decoding. (POS Tagging – Viterbi Decoding).	**2 lab hours**
8	To know the importance of context and size of training corpus in learning Parts of Speech. (Building POS Tagger).	**2 lab hours**
9	To understand the concept of chunking and get familiar with the basic chunk tagset. (Chunking).	**2 lab hours**
10	To know the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking. (Building Chunker)	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.	**PO2, PO3, PO4**
CO2	Able to design, implement, and analyze NLP algorithms.	**PO2, PO3, PO4**
CO3	Able to design different language modeling techniques	**PO3, PO5**
CO 4	Analyze large volume text data generated from a range of real-world applications.	**PO2, PO3, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS465A	Natural Language Processing Lab		2	3	3	3							3	3	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 424A	Data Warehouse And Data Mining	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component

CO2. Appreciate the strengths and limitations of various data mining and data warehousing models

CO3. Explain the analyzing techniques of various data

CO4. Describe different methodologies used in data mining and data ware housing

CO5. Compare different approaches of data ware housing and data mining with various technologies

Catalog Description

This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Content

Unit I: **10 lecture hours**

Introduction: Evolution Of Data Warehousing (Historical Context), The Data Warehouse - a Brief Overview, Characteristics, Operational Database Systems and Data Warehouse(OLTP & OLAP), Data Marts, Metadata.

Principles of Data Warehousing(Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

Unit II: **12 lecture hours**

Multidimensional Data Models: Types of Data and Their Uses, From Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Fact Tables, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas- STAR Schema, Snowflake Schema, OLAP, OLAP Operations**,** Hypercube**,** ROLAP, MOLAP, From Data warehousing to Data Mining, Data warehouse Usage

Unit III: **12 lecture hours**

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

Unit IV: **12 lecture hours**

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

Text Books

Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd

Reference Books/Materials

1. W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley.
2. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons.
3. Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the functionality of the various data mining and data warehousing component	**PO1**
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models	**PO1**
CO3	Explain the analyzing techniques of various data	**PO2**
CO4	Describe different methodologies used in data mining and data ware housing	**PO2**
CO5	Compare different approaches of data ware housing and data mining with various technologies	**PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO 2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
ETCS4 63A	Data warehouse and data mining	3	3	2	3	3	1							3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	-	-	-	-	-	-	-	-	-	-	**3**	**3**	**2**
CO2	**3**	-	**3**	-	-	-	-	-	-	-	-	**3**	**3**	**2**
C	-	**3**		-	-	-	-	-	-	-	-	**3**	**3**	**2**

O 3														
CO4	-	**3**	-	-	-	-	-	-	-	-	-	**3**	**2**	**3**
CO5	-	-	-	**2**	**3**	-	-	-	-	-	-	-	-	-
1=lightly mapped 2= moderately mapped 3=strongly mapped														

ETCS463A	**Data Warehousing And Data MiningLab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Able to get the acquaintance to WEKA tool

CO2. Competent to preprocess the data for mining

CO3. Proficient in generating association rules

CO4. Able to build various classification models

CO5. Able to realize clusters from the available data

Catalog Description

The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. At the end, the course provides a comparison of different conceptions of data mining.

List of Experiments (Indicative)

1	Demonstration of data pre-processing on datasets	**2 lab hours**
2	To list all the categorical (or nominal) attributes and the real valued attributes	**4 lab hours**
3	Create a data classification model using decision tree	**4 lab hours**
4	Create a data classification model using Naive Bayes	**2 lab hours**
5	Create a data classification model using rule based classifies	**2 lab hours**
6	Create a data classification model using statistical classifiers.	**4 lab hours**
7	Create a data classification model using neural networks.	**4 lab hours**
8	Create a data classification model	**4 lab hours**
9	Demonstrate the working of k-means algorithm for clustering the data.	**4 lab hours**
10	Create a clustering model using hierarchical clustering algorithm.	**2 lab hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to get **the** acquaintance to WEKA tool	**PO5**
CO2	Competent to preprocess the data for mining	**PO2**
CO3	Proficient in generating association rules	**PO4**
CO4	Able to build various classification models	**PO3**
CO5	Able to realize clusters from the available data	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 463A	Data wareho	2	2	3	3	3	-	-	-	-	-	-	-	3	3	3

	use and data mining Lab															

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	-		-	-	**3**	-	-	-	-	-	-	**3**	**2**	-
CO2	-	**2**	-		-	-	-	-	-	-	-	**3**	**3**	-
CO3	-		-	**3**	-	-	-	-	-	-	-	**3**	**3**	-
CO4	-		**3**	-	**2**	-	-	-	-	**3**	-	**3**	**3**	-
CO5	-	-	-	**3**	-	-	-	-	-	-	-	**3**	**3**	-
1=lightly mapped				2= moderately mapped						3=strongly mapped				

ETCS423A	**Neural Networks**	L	T	P	C
Version 1.0		4	-	0	4
Pre-requisites/Exposure	Artificial Intelligence and Machine learning				
Co-requisites	--				

Course Objectives

1. To be able to understand the analogy of biological and artificial neural networks.

2. To be able to use learning methods, optimization techniques, activation functions, variable transformations, pattern storage networks during the designing of Machine learning models.

3.To be able to understand the role of data mining and data analytics while designing the algorithms by using neural networks.

4.How neural networks can be used in prediction models and competitive leanings.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand all terminologies that are used in Neural network designing.

CO2. Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.

CO3. Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.

CO4.Write an algorithm for prediction modeling with the best performance.

Catalog Description

This course imparts the basic concepts of neural network algorithms. It enables them to write algorithms for solving problems with the help of supervised and unsupervised learning techniques. The course of neural networks helps to organize the historical data in a variety of ways to solve future problems. The course introduces the basic concepts about neural network activation functions, hyper parameter selection techniques, optimization techniques, it also discusses the pattern storage networks, competitive learning architecture, and applications.

Course Content

Unit I: **8 lecture hours**

Introduction to ANN: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation,

Artificial Intelligence and Neural Networks, Trends in Computing Comparison of BNN and ANN

Basics of Artificial Neural Networks: characteristics of neural networks terminology, models of neuron Mc Culloch - Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

Unit II: **12 lecture hours**

Backpropagation networks: Architecture of feed forward network, single layer ANN: Adaptive filtering problem, Unconstrained Organization Techniques, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Unit III: **12 lecture hours**

Activation & Synaptic Dynamics: Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network, Feed forward neural networks – Linear responsibility X-OR problem and solution, Analysis of pattern mapping networks summary of basic gradient search methods, Feedback neural networks - Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning

Unit IV: **8 lecture hours**

Competitive learning neural networks: Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

Applications of ANN: Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.

Text Books

1. Neural networks A comprehensive foundations, Simon Haykin, Pearson Education

Reference Books/Materials

1. Artificial neural networks, B. Vegnanarayana, Prentice Hall of India (P) Ltd

2. Neural networks, Fuzzy logic and Genetic Algorithms, S. Rajsekaran , Vijayalakshmi Pari, PHI

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand all terminologies that are used in Neural network designing.	**PO1**
CO2	Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.	**PO1, PO2, PO4**
CO3	Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.	**PO5, PSO1, PSO2**
CO4	Write an algorithm for prediction modelingwith the best performance.	**PO5, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS423A	Neural Networks	2	3	-	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS460A	**Neural Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to

1. make students familiar with basic concepts and tool used in neural networks

Programme and Course Mapping											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**P**
CO1					**3**						
CO2		**2**									
CO3				**3**							
CO4			**3**		**2**					**3**	
CO5				**3**							
1=lightly mapped					2= moderately mapped					3=strongly	

2. teach students structure of a neuron including biological and artificial
3. teach learning in network (Supervised and Unsupervised)
4. teach concepts of learning rules.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems

CO2. Design single and multi-layer feed-forward neural networks

CO3. Understand supervised and unsupervised learning concepts & understand unsupervised learning

CO4. Apply convolution neural and recurrent neural net.

Course Description

The lab complements ETCS423A.

List of Experiments (Indicative)

1	To write a program to implement Perceptron	**2 lab hours**
2	To write a program to implement AND OR gates using Perceptron.	**2 lab hours**
3	To implement Crab Classification using pattern net	**2 lab hours**
4	To write a program to implement Wine Classification using Back propagation.	**2 lab hours**
5	To write a Script containing four functions Addition, Subtraction, Multiply and Divide functions	**2 lab hours**
6	Write a program to implement classification of linearly separable Data with a perceptron	**2 lab hours**
7	To study Long Short Term Memory for Time Series Prediction.	**2 lab hours**
8	To study Convolution Neural Network and Recurrent Neural Network.	**2 lab hours**
9	To study ImageNet, GoogleNet, ResNet convolutional Neural Networks	**2 lab hours**
10	To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems	**PO2, PO3,PO4**
CO2	Design single and multi-layer feed-forward neural networks	**PO2, PO3, PO4, PO5**
CO3	Understand supervised and unsupervised learning concepts & understand unsupervised learning.	**PO2, PO3, PO4, PO5**
CO 4	Apply convolution neural and recurrent neural net.	**PO2, PO3, PO4, PO5, PO12**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS460A	Neural Networks Lab	-	3	3	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**
CO4	**-**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**
CO5	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
1=lightly mapped					2= moderately mapped							3=strongly mapped		

ETCS422A	**Cloud Computing**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multi core operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMW are, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: 10 lecture hours

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: Open Stack.

Unit II: 6 lecture hours

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: 10 lecture hours

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

1. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS422A	Cloud Computing	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**
CO4	**-**	**3**	**3**		**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**
CO5	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
1=lightly mapped				2= moderately mapped						3=strongly mapped				

ETCA 362A	**Cloud Computing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. Define & implement Virtualization using different types of Hypervisors
2. Describe steps to perform on demand application delivery
3. Examine the installation and configuration of Open stack cloud
4. Analyze and understand the functioning of different components involved in Amazon web services cloud platform.
5. Describe the functioning of Platform as a Service
6. Design & Synthesize Storage as a service using own Cloud

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, concepts, principles and applications. This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). A variety of real case studies and existing in market cloud- based tools will be identified and studied in order to provide students with a close overview to Cloud Computing applications.

Course Content

1	Development of applications on Google app engine.	**4 lab hours**
2	Case study of private Cloud setup through Open Stack	**4 lab hours**
3	Case study of private Cloud setup through Cloud Stack	**4 lab hours**
4	Case study of XEN/VMware/KVM hypervisor	**4 lab hours**
5	Case study of Amazon ec2.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA362A	Cloud Computing Lab	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**
CO4	**-**	**3**	**3**		**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**
CO5	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**
1=lightly mapped				2= moderately mapped						3=strongly mapped				

ETCS421A	**Internet of Things**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O devices, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: **8 lecture hours**

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit II: **9 lecture hours**

Network and Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit III: **10 lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12 lecture hours**

Developing IoT's: Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**

CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS421A	Internet of Things	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	3	-	-	3	-	-	-	-	-	-	3	2	1
CO2	2		-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	3	-	-	-	3	-	-	3	3	-
CO4	-	3	3		2	-	-	-	-	3	-	-	-	3
1=lightly mapped					2= moderately mapped						3=strongly mapped			

ETCS457A	**Internet of Things Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCS 418A. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

List of Experiments (Indicative)

1	Start Raspberry Pi and try various Linux commands in command terminal window	**2 lab hours**
2	Read your name and print Hello message with name.	**2 lab hours**
3	Read two numbers and print their sum, difference, product and division.	
4	Word and character count of a given string	
5	Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input	**2 lab hours**
6	Print a name 'n' times, where name and n are read from standard input, using for and while loops.	
7	Handle Divided by Zero Exception.	

8	Print current time for 10 times with an interval of 10 seconds.	**2 lab hours**
9	Read a file line by line and print the word count of each line.	
10	To inter face LED/Buzzer with Arduino/Raspberry Piandwriteaprogramtoturn ONLEDfor1 secafterevery2 seconds.	**2 lab hours**
11	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	**2 lab hours**
12	To install MySQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
13	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
14	WriteaprogramonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedat aandprint it.	**2 lab hours**
15	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumidity data to TCP client when requested..	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS457A	Internet of Things Lab	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**-**	**3**		**3**				**3**			**3**	**3**	**-**
CO4	**-**	**-**	**-**	**3**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**
1=lightly mapped					2= moderately mapped						3=strongly mapped			

ETCS425A	Machine Learning	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	NIL				
Co-requisites					

Course Objectives

1. To develop an appreciation for what is involved in learning from data.
2. To understand a wide variety of learning algorithms.
3. To understand how to apply a variety of learning algorithms to data.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. To become familiar with Dimensionality reduction Techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge about basic concepts of Machine Learning

CO2. Identify machine learning techniques suitable for a given problem.

CO3. Solve the problems using various machine learning techniques.

CO4. Apply neural networks for suitable application.

CO5. Use a tool to implement typical clustering algorithms for different types of applications.

CO6. Apply Dimensionality reduction techniques.

Catalog Description

This course imparts comprehensive introduction to various topics in machine learning. It enables them to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content

UNIT I **8 Hours**

Machine learning: overview and survey of its applications. Problem of induction and statistical inference: Input-output functions, Boolean functions, Parametric and nonparametric inference, Probability, uncertainty and Bayes theorem, Introduction to typical learning tasks: regression, pattern recognition, feature selection, classification, clustering, rule induction (association). Model validation techniques: cross-validation, leave-one-out, majority, Measures of performance (sensitivity, specificity, ROC curves, etc.)

UNIT II **8 Hours**

Dimensionality Reduction: Subset Selection, Shrinkage Methods, Principle Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification

UNIT III **9 Hours**

Neural Networks: Non-linear Hypothesis, Biological Neurons, Model representation, Intuition for Neural Networks, Multiclass classification, Cost Function, Back Propagation Algorithm, Back Propagation Intuition, Weights initialization, Neural Network Training.

Support Vector Machines: Optimization Objective, Large Margin Classifiers, Kernels, SVM practical considerations

UNIT IV **10 Hours**

Supervised Learning: Additive model: logistic regression, Generative model: naïve Bayes classifier, Discriminative model: Decision trees, Neural networks.

Unsupervised Learning: Clustering: k-means, hierarchical, self-organizing map, EM algorithm, Feature selection principal component analysis.

Reinforcement Learning: Q-learning, Value function approximation, Policy search.

Text Books:

1. The Elements of Statistical Learning, T. Hastie, R. Tibshirani and J. H. Friedman, Springer.

Reference Books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
4. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
5. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
6. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
7. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
8. http://www.deeplearningbook.org
9. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publisher

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Gain knowledge about basic concepts of Machine Learning	**PO1**
CO2	Identify machine learning techniques suitable for a given problem.	**PO4**
CO3	Solve the problems using various machine learning techniques.	**PO5**

CO4	Apply neural networks for suitable application.	**PO2**
CO5	Use a tool to implement typical clustering algorithms for different types of applications.	**PO3**
CO6	Apply Dimensionality reduction techniques.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS425A	Machine Learning	2	3	3	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**3**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**
CO2	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**1**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**-**
CO4	**-**	**3**	**3**		**2**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**3**
CO5	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO6	**1**	**-**	**-**	**3**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
1=lightly mapped					2= moderately mapped						3=strongly mapped			

ETCS455A	Machine Learning Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Develop the technical and practical skills to apply machine learning to solve real-world problems.
2. Explore regression as a supervised machine learning technique to predict a continuous variable (response or target) from a set of other variables (features or predictors)
3. Discover how variable selection and shrinkage methods are used to improve the efficiency of a regression model when applied to complex data sets
4. Explore classification as a supervised machine learning technique to predict binary (or discrete) response variables from a set of features
5. Understand what neural networks are, its most successful applications, and how it can be used within a business context

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the implementation procedures for the machine learning algorithms .

CO2. Design Java/Python programs for various Learning algorithms.

CO3. Apply appropriate data sets to the Machine Learning algorithms.

CO4. Identify and apply Machine Learning algorithms to solve real world problems.

Note: The programs can be implemented in either JAVA or Python.

1.For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.

2.Datasetscan be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Catalog Description

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as FIND-S, Candidate Elimination Algorithm, Decision tree (ID3 Algorithm), Back propagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbor Algorithm, Locally Weighted Regression Algorithm.

List of Experiments (Indicative)

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	**2 lab hours**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**2 lab hours**
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**2 lab hours**
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	**2 lab hours**
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**2 lab hours**
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	**4 lab hours**

7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	**4 lab hours**
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	**4 lab hours**
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	**4 lab hours**
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the implementation procedures for the machine learning algorithms.	**PO2**
CO2	Design Java/Python programs for various Learning algorithms.	**PO3**
CO3	Apply appropriate data sets to the Machine Learning algorithms.	**PO5**
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS455A	Machine learning Lab	-	3	3	-	2	-	-	2	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.

C02. Write technical documentation for the project implement.

CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.

CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

Course Code	Course Title	Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship		3	3		3	2							3		2

1=weakly mapped
2= moderately mapped
3=strongly mapped

Programme and Course Mapping														
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**
CO2	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**
CO3	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**
CO4	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**2**
1=lightly mapped 2= moderately mapped 3=strongly mapped														

6.2.1 Syllabus of Courses in specific to B.Tech(CSE)

ETMA105A	**Applied Mathematics-I**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO7. Understand and able to apply the basic concept of complex variable.

CO8. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO9. Applied the differential calculus method for curve tracing and radios of curvatures.

CO10. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO11. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO12. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices.The concepts of applied mathematics-Iare extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: 10 lecture hours

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: 10 lecture hours

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: 10 lecture hours

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: 10 lecture hours

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

8. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
9. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**

CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA 105A	Applied Mathematics - I	3	3	3	3	-	-	-	1	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

5. Learning different types of harmonic oscillators.
6. Understanding phenomenon of non dispersive and transverse waves in strings.
7. Analyzing propagation of light, geometric and wave optics.
8. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations.

CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens ‘Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young’s double slit experiment, Newton’s rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

6. Ian G. Main, Oscillations and waves in physics
7. H.J. Pain, The physics of vibrations and waves
8. E. Hecht, Optics
9. A. Ghatak, Optics
10. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH109A	Engineering Physics	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

5. To aware the students about the environment.
6. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
7. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
8. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

6. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

5. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
6. S.E. Manahan, Environmental Chemistry, CRC Press.
7. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
8. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	**PO7**
CO2	Students will acquire the techniques to protect	**PO8**

	our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

ETEC 101A	**Basics Of Electrical & Electronics Engineering**	L	T	P	C
		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
7. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
8. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
9. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
10. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin’s, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.

2. B L Thareja – A text book of Electrical Technology

3. Boylestad&Nashelsky, “Electronic Devices & Circuits”, Pearson Education, 10th Edition.

4. V. K. Mehta & Rohit Mehta, “Principles of Electronics”, S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

3. Electrical Engineering Fundamentals, V.Del Toro

4. Problems in Electrical Engineering – Parker Smith.S.

3. Sedra A S and Smith K C, “Microelectronic Circuits” 4th Ed., New York, Oxford University Press, New York.

4. Tocci R J and Widmer N S, “Digital Systems – Principles and Applications”, 8th Ed., Pearson Education India, New Delhi.

5. A.K. Sawhney, “A course in Electrical & Electronics Measurements & Instrumentation”, DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME 101A	**Basics of Mechanical Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

5. Understanding Basic Materials and Manufacturing Processes.
6. Have an understanding of laws of thermodynamics and Thermodynamic processes.
7. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
8. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.

CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.

CO3. Get the knowledge about power transmission method and device with mechanical properties.

CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: **10 lecture hours**

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: **12 lecture hours**

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: **6 lecture hours**

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

8. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
9. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
10. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
11. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
12. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.

13. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
14. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

4. Strength of Materials – Popov, Pub. PHI, New Delhi.
5. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
6. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics and workshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**
CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 101A	Basics of Mechanical Engineering	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
10. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
11. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.

CO2. Better insight aboutwave nature of light.

CO3. Better understanding of data interpretation which enhances problem solving approach.

CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

1	To determine the value of acceleration due to gravity using Bar pendulum	2 lab hours
2	To determine the value of acceleration due to gravity using Kater's pendulum	2 lab hours
3	To determine the wavelength of sodium light using Newton`s ring apparatus	2 lab hours
4	To determine the wavelength of prominent lines of mercury by plane diffraction grating	2 lab hours
5	To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer	2 lab hours
6	To determine the specific rotation of cane sugar solution with the help of half shade polarimeter	2 lab hours
7	To determine the wavelength of He-Ne LASER using transmission diffraction grating	2 lab hours

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes

CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	**PO1& PO2**
CO2	Better insight aboutwave nature of light.	**PO4**
CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 151A	Basics Of Electrical & Electronics Engineering Lab	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the DC and AC circuit behavior by application of network theorems.
2. To elaborate complex signals over oscilloscope devices with reading.
3. To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.
4. To analyses the BJT in build circuits as per practical application point of view.
5. To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

Course Outcomes

On completion of this course, the students will be able to

CO1	Get an exposure to common electrical components and their ratings.
C02	Determines proper electrical connections as per wires of appropriate ratings.
CO3	Understand the usage of common electrical measuring instruments.
CO4	Ability to discover applications related to seven segment display type of devices

Catalog Description

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application inreal time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:
   e) Cathode ray oscilloscope (CRO)
   f) Multimeter (Analog and Digital)
   g) Function generator
   h) Power supply
2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem
4. To Verify the Superposition theorem
5. To measure voltage, current and power in an A.C. circuit by LCR impedance method
6. To study the frequency response curve in series and parallel R-L-C circuit
7. a)Plot the forward and reverse V-I characteristics of P-N junction diode
   b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Innovation and Industry Friendly	PSO3 Ethics and Communication Skills
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME151A	**Basics of Mechanical Engineering Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

7. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
8. To study simple screw jack and compound screw jack and determine their efficiency.
9. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)
10. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
11. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
12. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.

CO2 Understand concepts of screw jack, friction, law of moments.

CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.

CO4 Get the knowledge of various Refrigeration and Air- Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**

CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**
CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air-Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA105A	**Applied Mathematics-II**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

6. Provide the brief idea to students of Laplace transformation.
7. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
8. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
9. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
10. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of Laplace transform.

CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: 10 lecture hours

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.	**PO8**
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
	CO4															
	CO5															
	CO6															
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA105A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

ETCS104A	**Introduction To Computer Science And Programming In Python**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS104A	Introduction to Computer Science and Programming in Python	2	2	2	2	-	-	-	-	-	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12^{th} Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **8 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **12 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: 10 lecture hours

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na2SO4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

4. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
5. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
6. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the understanding of Technology involved in improving quality of water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze	**PO1**

	the quality parameters of chemical fuels.	
CO3	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its properties and applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 215A	EMBEDDED ROBOTICS & IOT	L	T	P	C
		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				
Course Teacher(s):	Dr. Bhavesh Vyas				

Course Objectives

5. To understand the basic of embedded system.
6. To analyse the complex circuits and build new designs of analog to digital conversion.
7. To be able to perform analysis of embedded C based circuits with robotics applications
8. To gain basic insight of semiconductors-based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

- CO1 Understand and apply Knowledge of Embedded Circuits in making real time projects to solve engineering difficulties.
- C02 Determine an understanding of logic gates and C language with electronic devices.
- CO3 Demonstrate the ability to identify digital circuits. Utilization of the knowledge gained to solve problems.
- CO4 Create an understanding of IOT & robotics devices application to existing setup.

Program Articulation Matrix: Mapping of Course Outcome (COs) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4
ETEC215 A ER&I	CO1	1	-	-	-	-	-	-	-	-	-	1	-	1	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
	CO3	1	-	-	-	1	-	-	2	-	-	-	-	-	-
	CO4	-	2	3	3	-	-	-	-	-	-	-	1	-	-
	CO5	-	-	-	-	-	1	2	-	-	-	-	2	-	-
	CO6	-	-	-	-	1	-	-	-	-	2	3	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Examination Scheme:

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	20	
2	Mid Term Examination (Written Examination)	90Minutes	20	
3	Attendance		10	
4	End Term Examination (Written Examination)	180 Minutes	50	
Total			**100**	

Course Content

UNIT I **14 HRS**

Introduction to Embedded Systems: Introduction to Basic Electronics Components, Introduction to Microprocessor and Microcontroller, Difference between Microcontroller and Microprocessor, Introduction to Embedded System, Introduction to Arduino, Types of Microcontrollers: 8051, PIC, AVR & ARM, parametric comparisons among all, Reading Datasheet & schematics, Advantages of Atmega328,

UNIT II **10 HRS**

Robotics: Introduction to robotics: Automation, Anatomy of Robots, Manipulators, Robot control, History of robots, Types of Main bodies, Tasks Planning for robots, Robot's mechanisms, Manipulators Mechanisms-I, Actuators for Robots-Part I, Stepper motor, Performance characteristic, Sensors and Controllers in robots, Incremental encoders and position, velocity sensors, external state sensors.

UNIT III **8 HRS**

Internet of Things: IOT Introduction and its Architecture (Why, What and How), Hardware in IOT, Future in IOT, Introduction to ESP8266 Wi-Fi Module, IOT Basics: IOT definition, applications in different domains, trends in IOT market. IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP).

UNIT IV **8 HRS**

Sensors For Robotic Applications: Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer. Recap of Embedded C: Datatypes, Array, Conditional Statements, Functions / Call-back function Structures, Pointers, Storage classes, Embedded Controllers, Interfaces, Operating System - Industrial Robots.

TEXT BOOKS:

1. Peter Marwedel, book: Embedded System Design 1st Edition, Kindle Edition
2. "Rise of the Robots: Technology and the Threat of a Jobless Future", by Author: Martin Ford
3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", by Author: Peter Mckinnon

REFERENCE BOOKS:

1. "Making Simple Robots: Exploring Cutting-Edge Robotics with Everyday Stuff", by Author: Kathy Ceceri
2. "Real-Time C++: Efficient Object-Oriented and Template Microcontroller Programming", 14 May 2018 by Author Christopher Kormanyos.

ETME155A	**Engineering Graphics Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

5. Learn to sketch and take field dimensions.
6. Learn to take data and transform it into graphic drawings.
7. Learn basic Auto Cad skills and learn basic engineering drawing formats.
8. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.

CO2. Interpret engineering drawings using fundamental technical mathematics.

CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.

CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS150A	**Introduction To Computers And Programming In Python Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**
4	Develop programs to understand the control structures of python	**2 lab hours**
5	Develop programs to implement function with stress on scoping	**2 lab hours**

6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**
8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS150A	Introduction to computers and programming in python Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH159A	**Engineering Chemistry Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

Course Outcomes

On completion of this course, the students will be able to

CO1: Analyze & generate experimental skills.

CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.

CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.

CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.

CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.

CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution, given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hyposolution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol formaldehyde resins.	**2 lab hours**
13	Determination of dissolved oxygen in the given sample of water.	**2 lab hours**
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH159	Engineering Chemistry Lab	3	3	2		2				3			3	3		3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

4. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
5. The selection of a suitable technique for meeting a specific fabrication need
6. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**

2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**
CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1 To understand distributions in the study of the joint behaviour of two random variables.

2 To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.

3 To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least

squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

6. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
7. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
8. Jim Pitman (1993). Probability, Springer-Verlag.
9. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
10. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**
CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**

CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**
CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3	-	-	-	-	-	2	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 321A	Java Programming	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	NIL				
Co-requisites	--				

Course Objectives

5. Explain the concepts of object oriented paradigms to solve problems.
6. Appraise the concept of reusable software components using inheritance, packages and interfaces
7. Create scalable applications that can robustly handle errors and exceptions in runtime applications
8. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn the syntax of Java Programming Language and implement applications using it.

CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.

CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.

CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.

CO5. Understand multithreading and evaluate exception handing to create new applications.

CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

Course Content

Unit I: **10 lecture hours**

Introduction to Java: Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping: if..else, switch,?: operator, while, do, for statements, labeled loops, jump statements: break, continue return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.

Unit II: **9 lecture hours**

Arrays and Strings: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy, abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Unit III: **9 lecture hours**

Exceptional Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Run able interface, inter thread Communication, suspending, resuming and stopping threads.

Unit IV: **12 lecture hours**

Input/output Programming: Basics Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (Lang, util, io, net).

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes.

Text Books

2. Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

Reference Books/Materials

2. Herbert Schildt, “Java – The Complete Reference”, Oracle Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	PO2
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	PO3
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	PO5
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	PO8
CO5	Understand multithreading and evaluate exception handing to create new applications.	PO1
CO6	Design GUI applications using pre-built frameworks available in Java.	PO9

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS321A	Java Programming	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS231A	Discrete Mathematics	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

6. Use mathematically correct terminology and notation.
7. Construct correct direct and indirect proofs.
8. Use division into cases in a proof.
9. Use counterexamples.
10. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: **10 lecture hours**

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: **12 lecture hours**

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: **12 lecture hours**

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: **10 lecture hours**

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, “Discrete Mathematical Structures”, PHI.
2. NarsinghDeo, “Graph Theory with Application to Engineering and Computer Science”, PHI.
3. J. P. Trembly& P. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw Hill.
4. Vinay Kumar, “Discrete Mathematics”, BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS217A	Data Structures	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

5. To be able to compute the efficiency of algorithms in terms of time and space complexities.
6. To understand concepts of searching and sorting algorithms.
7. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
8. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: 8 lecture hours

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: 12 lecture hours

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: 12 lecture hours

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: 8 lecture hours

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

3. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.
4. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books/Materials

3. Schaum's outline series, "Data Structure", McGraw Hills.
4. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCDM301A	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

5. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
6. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
7. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
8. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: **8 lecture hours**

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: **8 lecture hours**

Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

Unit III: **6 lecture hours**

Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment

- Post Disaster effects and Remedial Measures.
- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology,
- Long-term Counter Disaster Planning
- Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

- **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

- **Liability for Mass Disaster**

  - Statutory liability
  - Contractual liability
  - Tortiousliability
  - Criminal liability
  - Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

- **Project Work**: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.

- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	**CAT**	**Mid Term Exam**	**Attendance/ Class performance**	**End Term Exam**
Weightage (%)	**20**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non-governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management	-	-	2	-	-	3	-	-	-	-	-	2	-	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**Java Programming Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

5. Explain the concepts of object oriented paradigms to solve problems.
6. Appraise the concept of reusable software components using inheritance, packages and interfaces
7. Create scalable applications that can robustly handle errors and exceptions in runtime applications
8. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn to the syntax of Java Programming Language and implement applications in it.

CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.

CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.

CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.

CO5. Understand multithreading and evaluate exception handing to create new applications.

CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

This course complements ETCS 323A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments help organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**

3	Write a java program to implement various shapes using Abstract class	**2 lab hours**
4	Write a java program to demonstrate interfaces.	**2 lab hours**
5	Write a java program to show multithreaded producer and consumer application.	**2 lab hours**
6	Create a java programs that make use of all the 5 exception keywords.	**4 lab hours**
7	Convert the content of a given file into the uppercase content of the same file.	**4 lab hours**
8	Develop a scientific calculator using swings.	**4 lab hours**
9	Create a servlet that uses Cookies to store the number of times a user has visited your servlet.	**4 lab hours**
10	Create a simple java bean having bound and constrained properties.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and	**PO3**

	composition of systems based on object identity.	
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS361A	Java Programming Lab	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS257A	**Data Structures Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

5. To be able to compute the efficiency of algorithms in terms of time and space complexities.
6. To understand concepts of searching and sorting algorithms.
7. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
8. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours
14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETEC 210A	**Digital Electronics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To understand number representation and conversion between different representation in digital electronic circuits.
3. To analyze logic processes and implement logical operations using combinational logic circuits.
4. To understand characteristics of memory and their classification.
5. To understand concepts of sequential circuits and to analyze sequential systems in terms of state machines.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create the appropriate truth table from a description of a combinational logic function.

CO2. Create a gate-level implementation of a combinational logic function described by a truth table using and/or/not gates, multiplexers or ROMs, and analyse its timing behaviour.

CO3. Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.

CO4. Describe the operation and timing constraints for latches and registers.

CO5. Draw a circuit diagram for a sequential logic circuit and analyse its timing properties (input setup and hold times, minimum clock period, output propagation delays).

CO6. Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.

Catalogue Description

This course helps the student to develop a digital logic and apply it to solve real life problems and will able to analyze, design and implement combinational logic circuits and sequential logic circuits.

Course Contents

Unit I: **10 lecture hours**

UNIT – I

Number Systems and Codes: Review of number systems, BCD codes and arithmetic, Gray code, self-complimenting codes, Error detection and correction principles.

Digital Circuits: Switching algebra & simplification of Boolean expressions. De Morgan‘s Theorem. Implementations of Boolean expressions using logic gates

Unit II: **10 lecture hours**

Combinational Logic Design: Combinational circuit analysis and synthesis, Techniques for minimization of Boolean functions such as Karnaugh map, VEM and Quine-Mc Cluskey methods. Design of arithmetic circuits, code convertors, multiplexers, demultiplexers, encoders, decoders & comparators. Parity generators and checker.

Introduction to Sequential Logic: Need for sequential circuits, Binary cell, Latches and flip-flops. RS, JK, Master-Slave JK, D & T flip flops.

Unit III: **10 lecture hours**

Synchronous Sequential Circuit Design: Fundamentals of Synchronous sequential circuits, Classification of synchronous machines, Analysis of Synchronous Sequential circuits, Design of Synchronous and Asynchronous Counters, Shift registers & Ring counters, Analysis and design of Finite State Machines. Timing issues in synchronous circuits.

Logic Families**:** Performance metrics of logic gates, Basic Transistor-Transistor Logic and CMOS logic.

Unit IV: **10 lecture hours**

Asynchronous Sequential Circuits: Fundamentals of Asynchronous Sequential circuits. Analysis and design of Asynchronous Sequential circuits. Pulse mode and Fundamental-mode Circuits. Cycles, Races and Hazards in asynchronous circuits.

Text Books

1. William I. Fletcher, ―An Engineering approach to Digital Design‖, Prentice Hall of India
2. C.H.Roth, ―Fundamentals of Logic Design, Thomson
3. Morris Mano, "Digital Design", PHI, 2nd Ed.

Reference Books/Materials

1. J. Nagrath, "Electronics, Analog & Digital", PHI.
2. B. S. Nai, "Digital Electronics and Logic Design", PHI.
3. Balabanian and Carlson, "Digital Logic Design Principles", Wiley Pub.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create the appropriate truth table from a description of a combinational logic function.	**PO1**
CO2	Create a gate-level implementation of a combinational logic function described by a truth table using and/or/not gates, multiplexers or ROMs, and analyze its timing	**PO2**

	behavior.	
CO3	Create a state transition diagram from a description of a sequential logic function and then convert the diagram into an implementation of a finite-state machine with the appropriate combinational and sequential components.	**PO3**
CO4	Describe the operation and timing constraints for latches and registers.	**PO4**
CO5	Draw a circuit diagram for a sequential logic circuit and analyze its timing properties (input setup and hold times, minimum clock period, output propagation delays).	**PO5**
CO6	Evaluate combinational and sequential logic designs using various metrics: switching speed, throughput/latency, gate count and area, energy dissipation and power.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Employability	Ethics and Behaviour	Knowledge
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC210A	Digital Electronics	2	2	3	3	3	-	-	-	-	-	-	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strngly mapped

ETEC256A	**Digital Electronics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

1. Explain the elements of digital system abstractions such as digital representations of information, digital logic, Boolean algebra, state elements and finite state machine (FSMs).
2. Design simple digital systems based on these digital abstractions, using the "digital paradigm" including discrete sampled information.
3. Use the "tools of the trade": basic instruments, devices and design tools.
4. Work in a design team that can propose, design, successfully implement and report on a digital systems project.
5. Communicate the purpose and results of a design project in written and oral presentations.

Course Outcomes:

On completion of this course, the students will be able to

CO1. Identify relevant information to supplement to the Digital Electronic ETEC210A course.

CO2. Construct basic combinational circuits and verify their functionalities

CO3. To understand the basic digital circuits and to verify their operation.

CO4. To understand the concepts of flip flops, registers and counters.

CO5. To understand how gates are the basic building blocks for digital world.

Catalogue Description:

Labs on digital logic, PALs, flip-flops, timing, counters, synchronization, and finite-state machines prepare students for the design and implementation of a final project of their choice, e.g., games, music, digital filters, wireless communications, graphics, etc. Extensive use of

Verilog for describing and implementing digital logic designs. Students engage in extensive written and oral communication exercises

Course Content

List of experiments:

- Introduction to digital electronics lab- nomenclature of digital ICs, specifications, study of the data sheet, concept of Vcc and ground, verification of the truth tables of logic gates using TTL ICs.
- Implementation of the given Boolean function using logic gates in both SOP and POS forms.
- Verification of state tables of RS, JK, T and D flip-flops using NAND & NOR gates.
- Implementation and verification of Decoder/De-multiplexer and Encoder using logic gates.
- Implementation of 4x1 multiplexer using logic gates.
- Implementation of 4-bit parallel adder using 7483 IC.
- Design, and verify the 4-bit synchronous counter.
- Design, and verify the 4-bit asynchronous counter.
- Static and Dynamic Characteristic of NAND and Schmitt-NAND gate(both TTL and MOS)
- Study of Arithmetic Logic Unit

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Identify relevant information to supplement to the DigitalElectronic ETEC210A course	**PSO1, PSO3**
CO2	Construct basic combinational circuits and verify their functionalities	**PO2**
CO3	To understand the basic digital circuits and to verify their operation.	**PO1**
CO4	To understand the concepts of flipflops, registers and counters.	**PO4**
CO5	To understand how gates are the basic building blocks for digital world.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Employability	Ethics and Behaviour	Knowledge
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC256A	Digital Electronics Lab	2	2	3	2	-	-	-	-	-	-	-	-	1	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS222A	**Computer Organization and Architecture**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will

learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: **12 lecture hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: **10 lecture hours**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: **8 lecture hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: **10 lecture hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

3. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

4. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the concepts of microprocessors, their principles and practices.	**PO2**
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors.	**PO3**

CO3	Organize a modern computer system and be able to relate it to real examples.	**PO4**
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO5	Implement embedded applications using Emulator.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 210A	**Web Programming with Python and Java Script**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.
2. Master the fundamentals of Django framework.
3. Discover how to work with Git and GitHub.
4. Position students so that they can create, share, test and deploy web application projects.

Course Outcomes:

At the end of the course, the students should be able to:

CO1. To design simple web pages using HTML and CSS

CO2. To use GIT and GIT HUB for project management

CO3. To apply Django web framework to create websites

CO4. To create interactive and responsive website using Javascript

CO5. To test and deploy application web applications

Catalog Description

This course concerns with the design and implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Topics include database design, scalability, security, and user experience. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.

Course Content

UNIT I:

Introduction, Web Programming, HTML (Hypertext Markup Language), Document Object Model (DOM), More HTML Elements, Forms, CSS (Cascading Style Sheets), Responsive Design, Bootstrap, SASS (Syntactically Awesome Style Sheets), Introduction to Git, GitHub, Commits, Merge Conflicts, Branching, More GitHub Features

UNIT II:

Decorators and Lambda Function in Python, Introduction to Web Applications, HTTP, Django, Routes, Templates: Conditionals and Styling, Tasks, Forms: Django Forms, Sessions

Introduction to SQL: Databases, Column Types; Tables ; SELECT: Working with SQL in the Terminal, Functions, UPDATE, DELETE, Other Clauses, Joining Tables: JOIN Query, Indexing, SQL Vulnerabilities;

Django Models, Migrations, Shell: Starting our application, Django Admin, Many-to-Many Relationships, Users

UNIT III:

Introduction to JavaScript, Events, Variables, query Selector, DOM Manipulation: JavaScript Console, Arrow Functions, TODO List; Intervals, Local Storage, APIs: JavaScript Objects, Currency Exchange.

Introduction to User Interfaces, Single Page Applications, Scroll: Infinite Scroll; Animation, React: Addition

UNIT IV

Introduction to Testing, Assert: Test-Driven Development, Unit Testing, Django Testing: Client Testing, Selenium, CI/CD, GitHub Actions, Docker

Scalability, Scaling, Load Balancing, Autoscaling: Server Failure, Scaling Databases: Database Replication, Caching, Security: Git and GitHub, HTML, HTTPS: Secret-Key Cryptography,Public-Key Cryptography, Databases : APIs, Environment Variables;
JavaScript: Cross-Site Request Forgery

Textbooks:

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson
2. Django for APIs: Build web APIs with Python and Django, Willam S. Vincent,

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford University Press
2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.
3. SQL, PL/SQL: Programming Language of Oracle, Ivan Bayross, BPB Publications

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To design simple webpages using HTML and CSS	**PO5**
CO2	To use GIT and GIT HUB for project management	**PO11**
CO3	To apply Django web framework to create websites	**PO4**
CO4	To create interactive and responsive website using	**PO3**

	Javascript	
CO5	To test and deploy application web applications	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS210A	Web Programming with PYTHON and Java Script	-	-	3	3	3	-	-	-	-	-	2	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS220A	**Analysis And Design Of Algorithms**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

3. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
4. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.

2. Y. Langsamet. al., “Data Structures using C and C++”, PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS307A	**Database Management Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the data base design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: 12 lecture hours

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: 8 lecture hours

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: 12 lecture hours

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: **8 lecture hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

2. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**

CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**
CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems	-	2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer's needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace. This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception- concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

1. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
2. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
3. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning
4. McSchane, Organisation Behaviour, TMH, New Delhi
5. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
6. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi
7. Nelson, Debra L and James C Quick, Organisational Behaviour, Thomson Learning

Course Code	Course Title	L	T	P	S	C
ETCS228A	**Employability and Analytical Skills-I**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

- Communication
- Introduction to Communication
- Types of communication
- Verbal & Nonverbal Communication
- Barriers to Communication
- Body language
- Listening Skills
- Activity

- Language

Quant

- Types of Numbers, HCF & LCM
- Divisibility, Unit Digit.
- Remainder Theorem
- Equations, Factorials.

UNITII

Objective: Vocabulary Building & general speaking

- Basic Grammar/Communicative Grammar
- Parts of speech
- Nouns
- Pronouns: Noun Pronoun Agreement, Types with special emphasis over relative pronouns
- Verbs: Introduction Principal verbs and auxiliary verbs, subject-verb agreement
- Adjectives: degrees of comparison
- Adverb: Types and its usage in sentences
- Conjunctions: Coordinating and Co-relative conjunctions
- Prepositions
- Articles: Definite and Indefinite articles
- Usage of Tenses
- Subject verb agreement
- Sentence Structure: Simple Complex and Compound sentences
- Clauses

Quant

- Progression, Probability
- Permutation & Combination, Average, Percentage, Ratio & Proportion, Partnership
- Profit & Loss

UNIT III

- Word formation
- Theory and exercise
- Synonyms and antonyms
- One-word substitutes
- Idioms
- Phrasal verbs
- Pair of words
- Homonyms, hyponyms, hypernyms
- Linking words: sequencing of sentences (to form a coherent paragraph

- Paragraph writing
- Supplying a suitable beginning/ending/middle sentence to make the paragraph coherent
- Idiomatic language (with emphasis on business communication),
- Punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices

Quant

- Problems on Ages.
- Mixture & Allegation
- Simple Interest & Compound Interest.

UNIT IV

- General Essay writing, Writing Issues and Arguments (with emphasis on creativity and analysis of a topic)
- Story writing
- Business letter writing: Guidance in framing a ‘Statement of purpose’,
- Letters of Recommendation
- Email writing, email and business letter writing etiquette,
- Letters of complaints/responses to complaint

Quant

- Time & Work.
- Time, Speed and Distance
- Data Interpretation.

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

5. To explain basic database concepts, applications, data models, schemas and instances.
6. To demonstrate the use of constraints and relational algebra operations.
7. To facilitate students in Database design.
8. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the
system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

Text Books

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books/Materials

3. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.
4. "Fundamentals of Database Systems", R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 355A	Database Management Systems Lab	-	3	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	**Analysisand Design of Algorithms Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

7. To understand concept of different sorting algorithms.
8. To understand the concept of dynamic programming.
9. To understand concept of divide and conquer.
10. To understand Dictionary (ADT)
11. To understand concept of greedy algorithms.
12. To understand concept & features like max heap, min heap

Course Outcomes

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**

6	To Implement Matrix Chain Multiplication.	**2 lab hours**
7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS264A	**Web programming with Python and Javascript Lab**				
Version 1.0		-	-	2	1
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.
2. Master the fundamentals of Django framework.
3. Discover how to work with Git and GitHub.
4. Position students so that they can create, share, test and deploy web application projects.

Course Outcomes:

At the end of the course, the students should be able to:

CO1. To design simple web pages using HTML and CSS

CO2. To use GIT and GIT HUB for project management

CO3. To apply Django web framework to create websites

CO4. To create interactive and responsive website using Javascript

CO5. To test and deploy application web applications

Catalog Description

This course complements ETCS210A. This course concerns the implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS210A.

Textbooks:

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson
2. Django for APIs: Build web APIs with Python and Django, Willam S. Vincent,

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford University Press
2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.
3. SQL, PL/SQL: Programming Language of Oracle, Ivan Bayross, BPB Publications

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To design simple webpages using HTML and CSS	**PO5**
CO2	To use GIT and GIT HUB for project management	**PO11**

CO3	To apply Django web framework to create websites	**PO4**
CO4	To create interactive and responsive website using Javascript	**PO3**
CO5	To test and deploy application web applications	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS264A	Web programming with python and JavaScript Lab	-	-	3	3	3	-	-	-	-	-	2	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	**Theory of Computation**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: **12 lecture hours**

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: **8 lecture hours**

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: **12 lecture hours**

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: **8 lecture hours**

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

2. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education.

2. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education.

3. Raymond Greenlaw an H.James Hoover, "Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers.

4. MichealSipser, "Introduction of the Theory and Computation", Thomson Brokecole.

5. J. Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**
CO2	Design finite automata to accept a set of strings of a language	**PO3**
CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	**Operating Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit III: **12 lecture hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: **10 lecture hours**

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

2. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

5. Tannenbaum, "Operating Systems", PHI, 4th Edition.
6. William Stallings, "Operating Systems Internals and Design Principles", PHI
7. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
8. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS304A	Computer Networks	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
C02. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: 8 lecture hours

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization:

Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

3. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
4. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	iOS Development Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of MAC OS				
Co-requisites	--				

Course Objectives

6. To be able to Understand the basics of Swift Programming language
7. To Learn and practice the iOS App that commonly used in iPhone
8. Understand and able to differentiate between the concept of iOS and OS X
9. Apply necessary information to program for automation.
10. Apprehend the basic of MAC System and how to publish iOS app on AppStore.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.

C02. Understand and know how to use properly UIKit, asynchronous code, Core Image, NSURL Session and JSON Map Kit and Core Location, Auto Layout, Source Control, Core Data, Animation, and the app submission process.

CO3. Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects

CO4. Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on App store.

Catalog Description

The objective of the course is to provide skills to develop applications for OS X and iOS. It includes introduction to development framework Xcode. Objective-C is used as programming language to develop the applications. Objective-C is the superset of the C programming language and provides object-oriented capabilities and a dynamic runtime. Objective-C inherits the syntax, primitive types, and flow control statements of C and adds syntax for defining classes and methods. The list of experiments helps in making static and dynamic iOS App on based on real time systems.

List of Experiments (Indicative)

1	Case Study of Objective-C language.	2 lab hours
2	Case study of Windows and MAC systems	2 lab hours
3	Case Study of XCode based on MAC Systems	2 lab hours
4	Design an App for UISwitch based on Objective-C language	2 lab hours
5	Design an App for UISlider based on Objective-C language	2 lab hours
6	Design an App for UIStepper based on Objective-C language	2 lab hours
7	Write a program for creating Story Boards	2 lab hours
8	Design an App for UIAnimation based on Objective-C language	3 lab hours
9	Create a Simple Calculator using Objective-C Language	3 lab hours
10	Write an Objective-C program that displays the Phrase "Hello World"	1 lab hours
11	Write an Objective-C program for displaying the value of variables	2 lab hours
12	Write an Objective-C program for displaying the sum and subtraction of two variables	2 lab hours
13	Write an Objective-C program for displaying the multiplication and division of the two variables	2 lab hours
14	Write an Objective-C program that demonstrate control structure of Objective-C language	3 lab hours
15	Create a Button using Objective-C	2 lab hours
16	Make an interactive project based on iOS App using Objective-C Language	3 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.	**PO2**
CO2	Understand and know how to use properly UIKit, asynchronous code, CoreImage, NSURLSession and JSON MapKit and CoreLocation, AutoLayout, Source Control, Core Data, Animation, and the app submission process.	**PO3**
CO3	Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects	**PO5**
CO4	Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on Appstore.	**PO9**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS367A	iOS Development Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

4. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
5. Provides a practical approach to assemble Ethernet/Internet networking.
6. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.

CO3. Demonstrate and measure different network scenarios and their performance behavior.

CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra’s algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**
12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool	**4 lab hours**

	(Ethereal/Wireshark)	
14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**

CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**
CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 255A	**Operating Systems Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

List of Experiments (Indicative)

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**

8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical	**4 lab hours**
9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS381A	Practical Training – I	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.

CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.

CO3. Develop the ability to engage in research and to involve in life-long learning.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market. In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I	-	-	3		3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS325A	**Employability and Analytical Skills-II**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

8. Analytical and Calculative skills
1. Technical Knowledge
2. Logic building
3. Communication skills
4. Grooming
5. Presentation skills
6. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- General speaking -Just a minute session,
- Reading news clippings in the class,
- Extempore speech, expressing opinions,
- Making requests/suggestions/complaints, telephone etiquette.
- Professional Speaking
- Elocutions
- Debate

Quant

- Mensuration.

Reasoning

- Number Series, Alpha-Numeric Series.

UNITII

- Describing incidents and developing positive nonverbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)
- Group discussion,
- Intricacies of a group discussion, topics for GD (with special focus on controversial topics),
- Structure of participation in a group discussion,
- Words often mis-used, words often mis-spelt,
- Multiple meanings of the same word (differentiating between meanings with the help of the given context),
- Business idioms and expressions foreign phrases, Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

Reasoning

- Seating Arrangement, Puzzle.
- Blood Relation, Coding & Decoding.

UNIT III

- Group discussion Advance
- Role Plays
- Video Showcasing
- Just a minute rounds
- Extempore
- Presentations – Team and Individual
- Team Lead activities
- Debates
- Free speech sessions

Reasoning

- Seating Arrangement, Puzzle.
- Data Sufficiency.
- Ranking Test, Venn-diagram, Statement and Conclusion, Statement and Inferences, Statement and Course of Action, Statement and Assumptions, Syllogism.

UNIT IV

- Professional grooming
- Inter personal skills,
- brushing up on general awareness,
- latest trends in their respective branches,
- resume preparation,
- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities, Importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

		L	T	P	C
ETCS375A	**Mini Project**	L	T	P	C
Version 1.0		-	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 375A	Mini Project Lab	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS412A	**Compiler Design**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

7. To understand and list the different stages in the process of compilation.
8. Identify different methods of lexical analysis
9. Design top-down and bottom-up parsers
10. Identify synthesized and inherited attributes
11. Develop syntax directed translation schemes
12. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.

A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.

Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.

Type Checking: Type systems, Specification of a simple type checker.

Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.

Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.

Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, "Principles of Compiler Design", Pearson Education.

Reference Books/Materials

1. Andrew L. Appel, "Modern Compiler Implementation in C",Delhi, Foundation Books.
2. Dick Gruneet. Al., "Modern Compiler Design", Wiley Dreamtech.
12. R. J. Schalkoff, "Artificial Intelligence – An Engineering Approach", McGraw Hill Int. Ed. Singapore.
13. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House.
14. Tim Johns, "Artificial Intelligence, Application Programming", Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**
CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**
CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**
CO5	Distinguish between computability and non-computability and Decidability and undecidability.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS401A	**Artifical Intelligence**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.

CO2. Apply these techniques in applications which involve perception, reasoning and learning.

CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.

CO4. Acquire the knowledge of real world Knowledge representation.

CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.

CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: **8 lecture hours**

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: **12 lecture hours**

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: **12 lecture hours**

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: **8 lecture hours**

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

2. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

4. Artificial Intelligence, P. H. Winston,Pearson Education.
5. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
6. Principles of AI, N. J. Nilsson, Narosa Publishing House

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	**PO1**
CO2	Apply these techniques in applications which involve perception, reasoning and learning.	**PO4**
CO3	Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.	**PO5**

CO4	Acquire the knowledge of real world Knowledge representation.	**PO2**
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.	**PO3**
CO6	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.	**PO3**
CO7	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS401A	ARTIFICAL INTELLIGENCE	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 202A	**Software Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

On completion of this course, the students will be able to:

CO1. To learn and understand the Concepts of Software Engineering

CO2. To Learn and understand Software Development Life Cycle

CO3. To apply the project management and analysis principles to software project development.

CO4. To apply the design & testing principles to software project development.

CO5. Ability to execute tests, design test cases, use test tools, etc.

CO6. To Study about Software maintenance tools

Catalog Description

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

Unit I: **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

<u>Unit II:</u> **12 lecture hours**

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO,COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding:TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

<u>Unit III:</u> **8 lecture hours**

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

<u>Unit IV:</u> **12 lecture hours**

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International.
2. R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
3. W.S. Jawadekar, "Software Engineering – Principles and Practices", McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, TMH.
2. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
3. I. Sommerville, "Software Engineering", Addison Wesley.
4. K. Chandrasehakhar, "Software Engineering & Quality Assurance", BPB.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 202A	Software Engineering	3	3	3	3	3	-	-	-	-	-	2	-	3	3	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS451A	**Artificial Intelligence Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

7. To have clear understanding of the problem-solving processes.
8. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
9. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
10. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
11. To gain idea of supervised, unsupervised and reinforcement learning is covered.
12. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs

CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving

CO4. Know how to build simple knowledge-based systems

CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**
2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	**PO1**
CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	**PO4**
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	**PO5**
CO4	Know how to build simple knowledge-based systems	**PO2**
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PSO3**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS451A	ARTIFICIAL INTELLIGENCE LAB	2	3	-	3	3	-	-	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS330A	**Communication & Analytical Skills 3**	**3**	**1**	**0**	**0**	**4**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

8. Analytical and Calculative skills
9. Technical Knowledge
10. Logic building
11. Communication skills
12. Grooming
13. Presentation skills
14. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

<u>Evaluation Scheme:</u>				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- Answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities,
- importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

- handling stress,
- Suggestions for responding to tough/unknown questions, preparation on self and personality development

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNITII

- Profile Building On LinkedIn
- Resume Building
- Video CV building.
- Professional Grooming
- E mail Writing

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT III

- Interview Role Plays
- Individual Intro Video making
- Team Building sessions
- Self-analysis
- Telephone etiquettes

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT IV

- Industry readiness (Resume writing, grooming, GDPI etc.)
- Grooming
- Mock sessions
- FAQs discussions
- Multiple Test series
- Brush-up on GDPI and Industry readiness

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

ETCS420A	**Graph Theory**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **10 lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on

Graph, The Travelling Salesman Problem, Sperner’sLeema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley’s Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: **10 lecture hours**

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski’s Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: **12lecture hours**

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: **8 lecture hours**

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

4. Introduction to Graph Theory, R.J. Wilson, Pearson Education.

5. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
6. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3	-	1	-	-	-	-	-	2	3	1	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS309A	Distributed Computing Systems	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

Unit I: **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

Unit II: **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

Unit III: **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

Unit IV: **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

2. Ajay D. Kshemkalyani and MukeshSinghal, "Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press.

Reference Books/Materials

3. George Coulouris, Jean Dellimore and Tim KIndberg, “Distributed Systems Concepts and Design”, Pearson Education, 4th Edition.
4. MukeshSinghal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	**PO1**
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	**PO1**
CO3	Design and implement distributed applications	**PO3**
CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Distributed Computing Systems	2	-	3	3	-	-	-	-	-	-	-	2	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

7. Understand the Concept of Parallel Processing and its applications.
8. Implement the Hardware for Arithmetic Operations.
9. Analyze the performance of different scalar Computers.
10. Develop the Pipelining Concept for a given set of Instructions.
11. Distinguish the performance of pipelining and non-pipelining environment in a processor.
12. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture

focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein's Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl's law, Gustafson'slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

Unit III: **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Unit IV: **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

3. Advanced computer architecture, Kai Hwang, McGraw Hills.
4. Computer Organization and Design, D. A. Patterson and J. L. Hennessey, Morgan Kaufmann.

REFERENCE BOOKS:

8. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
9. Memory System and Pipelined Processors, HarveyG.Cragon, Narosa Publication.
10. Parallel Computer, V.Rajaranam & C.S.R. Murthy, PHI.
11. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
12. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
13. Computer Organization & Architecture, Stalling W, PHI.
14. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**
CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS462A	Major Project	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS464A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

<u>Course Outcomes</u>

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

<u>Catalog Description</u>

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS481A	**Practical Training – II**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Completion of sixth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	50	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS481A	Practical Training – II	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 426A	**Natural Language Processing**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

5. Explain the concepts of artificial intelligence to solve problems.
6. Appraise the concept of natural languages processing components using NLP tools.
7. Create scalable applications that can robustly handle errors in runtime applications.
8. Designing applications using pre-built NLP processor.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand approaches to syntax and semantics in NLP.

CO2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Understand current methods for statistical approaches to machine translation.

CO4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Catalog Description

The intent of the course is to present a fairly broad graduate-level introduction to Natural Language Processing, the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical and neural-network learning algorithms that train on (annotated) text corpora to automatically acquire the knowledge needed to perform the task. Class lectures will discuss general issues as well as present abstract algorithms. Implemented versions of some of the algorithms will be provided in order to give a feel for how the systems discussed in class "really work" and allow for extensions and experimentation as part of the course projects.

Course Content

Unit I: **10 lecture hours**

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

Unit II: **7 lecture hours**

Introduction to semantics and knowledge representation, Some applications like machine translation, database interface. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

Unit III: **7 lecture hours**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

Unit IV: **10 lecture hours**

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Text Books

2. Natural Language Understanding, Allen, Pearson Education.

Reference Books/Materials

3. Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, D. Jurafsky & J. H. Martin, Pearson Education.
4. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich SchutzeMIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand approaches to syntax and semantics in NLP.	PO1
CO2	Understand approaches to discourse, generation, dialogue and summarization within NLP.	PO2
CO3	Understand current methods for statistical approaches to machine translation.	PO3
CO4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP	PO9

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 426A	Natural Language Processing	2	3	3	-	-	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS465A	**Natural Language Processing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.

The experiments in this lab are arranged in a logical sequence to inculcate a new concept at every step, starting from very basic ones to advanced ones.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.

CO2. Able to design, implement, and analyze NLP algorithms

CO3. Able to design different language modeling Techniques

CO4. Analyze large volume text data generated from a range of real-world applications.

Course Description

The lab complements ETCS426A.

List of Experiments (Indicative)

1	To learn about morphological features of a word by analysing it. (Word Analysis)	**2 lab hours**
2	To generate word forms from root and suffix information. (Word Generation)	**2 lab hours**
3	Understanding the morphology of a word by the use of Add-Delete table (Morpgology)	**2 lab hours**
4	To learn to calculate bigrams from a given corpus and calculate probability of a sentence. (N-Grams)	**2 lab hours**
5	To learn how to apply add-one smoothing on sparse bigram	**2 lab hours**

	table. (N-Gram Smoothing)	
6	To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model. (POS Tagging – Hidden Markov Model)	**2 lab hours**
7	To find POS tags of words in a sentence using Viterbi decoding. (POS Tagging – Viterbi Decoding).	**2 lab hours**
8	To know the importance of context and size of training corpus in learning Parts of Speech. (Building POS Tagger).	**2 lab hours**
9	To understand the concept of chunking and get familiar with the basic chunk tagset. (Chunking).	**2 lab hours**
10	To know the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking. (Building Chunker)	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.	**PO2, PO3, PO4**
CO2	Able to design, implement, and analyze NLP algorithms.	**PO2, PO3, PO4**
CO3	Able to design different language modeling techniques	**PO3, PO5**
CO 4	Analyze large volume text data generated from a range of real-world applications.	**PO2, PO3, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS465A	Natural Language Processing Lab	-	2	3	3	3	-	-	-	-	-	-	3	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 424A	**Data Warehouse And Data Mining**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component

CO2. Appreciate the strengths and limitations of various data mining and data warehousing models

CO3. Explain the analyzing techniques of various data

CO4. Describe different methodologies used in data mining and data ware housing

CO5. Compare different approaches of data ware housing and data mining with various technologies

<u>Catalog Description</u>

This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Content

<u>Unit I:</u> **10 lecture hours**

Introduction: Evolution Of Data Warehousing (Historical Context), The Data Warehouse - a Brief Overview, Characteristics, Operational Database Systems and Data Warehouse(OLTP & OLAP), Data Marts, Metadata.

Principles of Data Warehousing(Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

<u>Unit II:</u> **12 lecture hours**

Multidimensional Data Models: Types of Data and Their Uses, From Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Fact Tables, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas- STAR Schema, Snowflake Schema, OLAP, OLAP Operations**,** Hypercube**,** ROLAP, MOLAP, From Data warehousing to Data Mining, Data warehouse Usage

<u>Unit III:</u> **12 lecture hours**

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

Unit IV: **12 lecture hours**

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

Text Books

Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd

Reference Books/Materials

4. W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley.
5. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons.
6. Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the functionality of the various data mining and data warehousing component	**PO1**
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models	**PO1**
CO3	Explain the analyzing techniques of various data	**PO2**
CO4	Describe different methodologies used in data mining and data ware housing	**PO2**
CO5	Compare different approaches of data ware housing and data mining with various technologies	**PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO 2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
ETCS4 63A	Data warehouse and data mining	3	3	2	3	3	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS463A	**Data Warehousing And Data MiningLab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Able to get the acquaintance to WEKA tool

CO2. Competent to preprocess the data for mining

CO3. Proficient in generating association rules

CO4. Able to build various classification models

CO5. Able to realize clusters from the available data

Catalog Description

The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. At the end, the course provides a comparison of different conceptions of data mining.

List of Experiments (Indicative)

1	Demonstration of data pre-processing on datasets	**2 lab hours**
2	To list all the categorical (or nominal) attributes and the real valued attributes	**4 lab hours**
3	Create a data classification model using decision tree	**4 lab hours**
4	Create a data classification model using Naive Bayes	**2 lab hours**
5	Create a data classification model using rule based classifies	**2 lab hours**
6	Create a data classification model using statistical classifiers.	**4 lab hours**
7	Create a data classification model using neural networks.	**4 lab hours**
8	Create a data classification model	**4 lab hours**
9	Demonstrate the working of k-means algorithm for clustering the data.	**4 lab hours**
10	Create a clustering model using hierarchical clustering algorithm.	**2 lab hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to get **the** acquaintance to WEKA tool	**PO5**
CO2	Competent to preprocess the data for mining	**PO2**
CO3	Proficient in generating association rules	**PO4**
CO4	Able to build various classification models	**PO3**
CO5	Able to realize clusters from the available data	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 463A	Data wareho	2	2	3	3	3	-	-	-	-	-	-	-	3	3	3

	use and data mining Lab															

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS423A	**Neural Networks**	L	T	P	C
Version 1.0		4	-	0	4
Pre-requisites/Exposure	Artificial Intelligence and Machine learning				
Co-requisites	--				

Course Objectives

1. To be able to understand the analogy of biological and artificial neural networks.

2. To be able to use learning methods, optimization techniques, activation functions, variable transformations, pattern storage networks during the designing of Machine learning models.

3.To be able to understand the role of data mining and data analytics while designing the algorithms by using neural networks.

4.How neural networks can be used in prediction models and competitive leanings.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand all terminologies that are used in Neural network designing.

CO2. Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.

CO3. Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.

CO4.Write an algorithm for prediction modeling with the best performance.

Catalog Description

This course imparts the basic concepts of neural network algorithms. It enables them to write algorithms for solving problems with the help of supervised and unsupervised learning techniques. The course of neural networks helps to organize the historical data in a variety of ways to solve future problems. The course introduces the basic concepts about neural network activation functions, hyper parameter selection techniques, optimization techniques, it also discusses the pattern storage networks, competitive learning architecture, and applications.

Course Content

Unit I: 8 lecture hours

Introduction to ANN: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks, Trends in Computing Comparison of BNN and ANN

Basics of Artificial Neural Networks: characteristics of neural networks terminology, models of neuron Mc Culloch - Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

Unit II: 12 lecture hours

Backpropagation networks: Architecture of feed forward network, single layer ANN: Adaptive filtering problem, Unconstrained Organization Techniques, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Unit III: 12 lecture hours

Activation & Synaptic Dynamics: Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network, Feed forward neural networks – Linear responsibility X-OR problem and solution, Analysis of pattern mapping networks summary of basic gradient search methods, Feedback neural networks - Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning

Unit IV: 8 lecture hours

Competitive learning neural networks: Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

Applications of ANN: Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.

Text Books

2. Neural networks A comprehensive foundations, Simon Haykin, Pearson Education

Reference Books/Materials

1. Artificial neural networks, B. Vegnanarayana, Prentice Hall of India (P) Ltd

2. Neural networks, Fuzzy logic and Genetic Algorithms, S. Rajsekaran , Vijayalakshmi Pari, PHI

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand all terminologies that are used in Neural network designing.	**PO1**
CO2	Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.	**PO1, PO2, PO4**
CO3	Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.	**PO5, PSO1, PSO2**
CO4	Write an algorithm for prediction modeling with the best performance.	**PO5, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS423A	Neural Networks	2	3	-	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS460A	**Neural Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to

5. make students familiar with basic concepts and tool used in neural networks
6. teach students structure of a neuron including biological and artificial
7. teach learning in network (Supervised and Unsupervised)
8. teach concepts of learning rules.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems

CO2. Design single and multi-layer feed-forward neural networks

CO3. Understand supervised and unsupervised learning concepts & understand unsupervised learning

CO4. Apply convolution neural and recurrent neural net.

Course Description

The lab complements ETCS423A.

List of Experiments (Indicative)

1	To write a program to implement Perceptron	**2 lab hours**
2	To write a program to implement AND OR gates using Perceptron.	**2 lab hours**

3	To implement Crab Classification using pattern net	**2 lab hours**
4	To write a program to implement Wine Classification using Back propagation.	**2 lab hours**
5	To write a Script containing four functions Addition, Subtraction, Multiply and Divide functions	**2 lab hours**
6	Write a program to implement classification of linearly separable Data with a perceptron	**2 lab hours**
7	To study Long Short Term Memory for Time Series Prediction.	**2 lab hours**
8	To study Convolution Neural Network and Recurrent Neural Network.	**2 lab hours**
9	To study ImageNet, GoogleNet, ResNet convolutional Neural Networks	**2 lab hours**
10	To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems	**PO2, PO3,PO4**
CO2	Design single and multi-layer feed-forward neural	**PO2, PO3,**

	networks	**PO4, PO5**
CO3	Understand supervised and unsupervised learning concepts & understand unsupervised learning.	**PO2, PO3, PO4, PO5**
CO 4	Apply convolution neural and recurrent neural net.	**PO2, PO3, PO4, PO5, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS460A	Neural Networks Lab		3	3	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS422A	**Cloud Computing**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multi core operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMW are, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: 10 lecture hours

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: Open Stack.

Unit II: 6 lecture hours

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: 10 lecture hours

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

2. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS422A	Cloud Computing	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCA 362A	Cloud Computing Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. Define & implement Virtualization using different types of Hypervisors

2. Describe steps to perform on demand application delivery

3. Examine the installation and configuration of Open stack cloud

4. Analyze and understand the functioning of different components involved in Amazon web services cloud platform.

5. Describe the functioning of Platform as a Service

6. Design & Synthesize Storage as a service using own Cloud

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, concepts, principles and applications. This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). A variety of real case studies and existing in market cloud- based tools will be identified and studied in order to provide students with a close overview to Cloud Computing applications.

Course Content

1	Development of applications on Google app engine.	**4 lab hours**
2	Case study of private Cloud setup through Open Stack	**4 lab hours**
3	Case study of private Cloud setup through Cloud Stack	**4 lab hours**
4	Case study of XEN/VMware/KVM hypervisor	**4 lab hours**
5	Case study of Amazon ec2.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA362A	Cloud Computing Lab	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS421A	**Internet of Things**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O devices, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: 8 lecture hours

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit II: **9 lecture hours**

Network and Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit III: **10 lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12 lecture hours**

Developing IoT's: Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**

CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS421A	Internet of Things	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS457A	Internet of Things Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCS 418A. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

List of Experiments (Indicative)

1	Start Raspberry Pi and try various Linux commands in command terminal window	**2 lab hours**
2	Read your name and print Hello message with name.	**2 lab hours**
3	Read two numbers and print their sum, difference, product and division.	
4	Word and character count of a given string	
5	Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input	**2 lab hours**
6	Print a name 'n' times, where name and n are read from standard input, using for and while loops.	
7	Handle Divided by Zero Exception.	

8	Print current time for 10 times with an interval of 10 seconds.	**2 lab hours**
9	Read a file line by line and print the word count of each line.	
10	To inter face LED/Buzzer with Arduino/Raspberry Piandwriteaprogramtoturn ONLEDfor1 secafterevery2 seconds.	**2 lab hours**
11	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	**2 lab hours**
12	To install MySQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
13	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
14	WriteaprogramonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedat aandprint it.	**2 lab hours**
15	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumidity data to TCP client when requested..	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS457A	Internet of Things Lab	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS425A	Machine Learning	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	NIL				
Co-requisites					

Course Objectives

1. To develop an appreciation for what is involved in learning from data.
2. To understand a wide variety of learning algorithms.
3. To understand how to apply a variety of learning algorithms to data.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. To become familiar with Dimensionality reduction Techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge about basic concepts of Machine Learning

CO2. Identify machine learning techniques suitable for a given problem.

CO3. Solve the problems using various machine learning techniques.

CO4. Apply neural networks for suitable application.

CO5. Use a tool to implement typical clustering algorithms for different types of applications.

CO6. Apply Dimensionality reduction techniques.

Catalog Description

This course imparts comprehensive introduction to various topics in machine learning. It enables them to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content

UNIT I **8 Hours**

Machine learning: overview and survey of its applications. Problem of induction and statistical inference: Input-output functions, Boolean functions, Parametric and nonparametric inference, Probability, uncertainty and Bayes theorem, Introduction to typical learning tasks: regression, pattern recognition, feature selection, classification, clustering, rule induction (association). Model validation techniques: cross-validation, leave-one-out, majority, Measures of performance (sensitivity, specificity, ROC curves, etc.)

UNIT II **8 Hours**

Dimensionality Reduction: Subset Selection, Shrinkage Methods, Principle Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification

UNIT III **9 Hours**

Neural Networks: Non-linear Hypothesis, Biological Neurons, Model representation, Intuition for Neural Networks, Multiclass classification, Cost Function, Back Propagation Algorithm, Back Propagation Intuition, Weights initialization, Neural Network Training.

Support Vector Machines: Optimization Objective, Large Margin Classifiers, Kernels, SVM practical considerations

UNIT IV **10 Hours**

Supervised Learning: Additive model: logistic regression, Generative model: naïve Bayes classifier, Discriminative model: Decision trees, Neural networks.

Unsupervised Learning: Clustering: k-means, hierarchical, self-organizing map, EM algorithm, Feature selection principal component analysis.

Reinforcement Learning: Q-learning, Value function approximation, Policy search.

Text Books:

2. The Elements of Statistical Learning, T. Hastie, R. Tibshirani and J. H. Friedman, Springer.

Reference Books:

10. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
11. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
12. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
13. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
14. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
15. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
16. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
17. http://www.deeplearningbook.org
18. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publisher

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Gain knowledge about basic concepts of Machine Learning	**PO1**
CO2	Identify machine learning techniques suitable for a given problem.	**PO4**
CO3	Solve the problems using various machine learning techniques.	**PO5**
CO4	Apply neural networks for suitable application.	**PO2**

CO5	Use a tool to implement typical clustering algorithms for different types of applications.	**PO3**
CO6	Apply Dimensionality reduction techniques.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS425A	Machine Learning	2	3	3	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS455A	**Machine Learning Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Develop the technical and practical skills to apply machine learning to solve real-world problems.
2. Explore regression as a supervised machine learning technique to predict a continuous variable (response or target) from a set of other variables (features or predictors)
3. Discover how variable selection and shrinkage methods are used to improve the efficiency of a regression model when applied to complex data sets
4. Explore classification as a supervised machine learning technique to predict binary (or discrete) response variables from a set of features
5. Understand what neural networks are, its most successful applications, and how it can be used within a business context

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the implementation procedures for the machine learning algorithms .

CO2. Design Java/Python programs for various Learning algorithms.

CO3. Apply appropriate data sets to the Machine Learning algorithms.

CO4. Identify and apply Machine Learning algorithms to solve real world problems.

Note: The programs can be implemented in either JAVA or Python.

1.For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.

2.Datasetscan be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Catalog Description

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as FIND-S, Candidate Elimination Algorithm, Decision tree (ID3 Algorithm), Back propagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbor Algorithm, Locally Weighted Regression Algorithm.

List of Experiments (Indicative)

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	**2 lab hours**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**2 lab hours**
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**2 lab hours**
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	**2 lab hours**
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**2 lab hours**
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	**4 lab hours**

7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	**4 lab hours**
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	**4 lab hours**
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	**4 lab hours**
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the implementation procedures for the machine learning algorithms.	**PO2**
CO2	Design Java/Python programs for various Learning algorithms.	**PO3**

CO3	Apply appropriate data sets to the Machine Learning algorithms.	**PO5**
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS455A	Machine learning Lab	-	3	3	-	2	-	-	2	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.

C02. Write technical documentation for the project implement.

CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.

CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship	-	3	3	-	3	2	-	-	-	-	-	-	3	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

6.2.2 Syllabus of Courses specific to B.Tech - Computer Science & Engineering (CSE) with AI & ML with academic support of Samatrix and IBM

Scheme of studies:

SEMESTER I

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-I	3	1	0	4
2	ETPH109A	Engineering Physics	3	1	0	4
3	UCES125A	Environmental Studies	3	0	0	3
4	ETCS106A	Clean Coding with Python	3	0	0	3
5	ETCS105A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis	2	0	0	2
6	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	0	4
7	ETEC151A	Basics of Electrical & Electronics Engineering Lab	0	0	2	1
8	ETPH151A	Engineering Physics Lab	0	0	2	1
9	ETCS155A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis Lab	0	0	2	1
10	ETCS157A	Clean Coding with Python Lab	0	0	2	1
11		Open Elective	4	-	-	4
TOTAL			**21**	**3**	**6**	**28**

SEMESTER II

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-II	3	1	0	4
2	ETEC 215A	Embedded Robotics and IOT	4	0	0	4
3	ETCH119A	Engineering Chemistry	3	1	0	4
4	ETME 155A	Engineering Graphics Lab	0	0	3	1.5
5	ETCH159A	Engineering Chemistry Lab	0	0	2	1
6	ETCS107A	Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn	2	0	0	2
7	ETME 157A	Workshop Practices	-	-	3	1.5
8	ETCS154A	Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn Lab	0	0	2	1
9		Open Elective	4	-	-	4
TOTAL			**16**	**2**	**10**	**23**

SEMESTER III

SNo	Course Code	Course Title	L	T	P	C
1	ETMA215A	PROBABILITY AND STATISTICS	4	-	-	4
2	ETCS203A	Probabilistic Modelling and Reasoning with Python	2	-	-	2
3	ETCS231A	Discrete Mathematics	3	1	-	4
4	ETCS217A	Data Structures	3	1	-	4
5	UCDM301A	Disaster Management	3	-	-	3
6	ETCS208A	R Programming for Data Science and Data Analytics	2	-	-	2
7	ETCS257A	Data Structures Lab	-	-	2	1
8	ETCS259A	Probabilistic Modelling and Reasoning with Python Lab	-	-	2	1
9	ETCS261A	R Programming for Data Science and Data Analytics Lab	-	-	2	1
10		MOOC	1	-	-	2
TOTAL			**17**	**2**	**8**	**24**

SEMESTER IV

SNo	Course Code	Course Title	L	T	P	C
1	ETCS222A	Computer Organization & Architecture	3	1	-	4
2	ETCS220A	Analysis and Design of Algorithms	3	1	-	4
3	ETCS307A	Database Management Systems	3	1	-	4
4	ETCS205A	Machine Learning and Pattern Recognition	3	-	-	3
5	ETMC602A	Essentials of Organizational Behaviour	3	-	-	3
6	ETCS254A	Machine Learning Practical with Python, Scikit-learn, Matplotlib, TensorFlow	-	-	4	2
7	ETCS 355A	Database Management Systems Lab	-	-	2	1
8	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
9	ETCS228A	Employability and Analytical Skills-I	2	-	-	2
TOTAL			**15**	**3**	**8**	**24**

SEMESTER V

SNo	Course Code	Course Title	L	T	P	C
1	ETCS308A	Big Data Analytics	3	-	-	3
2	ETCS214A	Theory of Computation	3	1	-	4
3	ETCS211A	Operating Systems	3	1	-	4
4	ETCS304A	Computer Networks	3	1	-	4
5	ETCS365A	Computer Networks Lab	-	-	2	1
6	ETCS364A	Big Data Analytics Lab	-	-	2	1
7	ETCS367A	iOS Development Lab	-	-	2	1
8	ETCS255A	Operating System Lab	-	-	2	1
9	ETCS381A	Practical Training I	-	-	-	1
10	ETCS325A	Employability and Analytical Skills-II	2	-	-	2
TOTAL			**14**	**3**	**8**	**22**

SEMESTER VI

SNo	Course Code	Course Title	L	T	P	C
1	ETCS412A	Compiler Design	3	1	-	4
2	ETCS309A	Neural Networks and Deep Learning	3	-	-	3
3	ETCS354A	Deep Learning Practical with Python, TensorFlow and Keras	-	-	4	2
4	ETCS313A	Data Science - Tools and Techniques	2	-	-	2
5	ETCS311A	Natural Language Processing	2	-	-	2
6	ETCS330A	Employability and Analytical Skills-III	2	-	-	2
7	ETCS356A	Data Science - Tools and Techniques Lab	-	-	2	1
8	ETCS352A	Natural Language Processing Lab	-	-	2	1
9	**Elective**					
(i)	ETCS420A	Graph Theory	3	-	-	3
(ii)	ETCS320A	Distributed Computing Systems	3	-	-	3
(iii)	ETCS310A	Advanced Computer Architecture	3	-	-	3
TOTAL			**15**	**1**	**10**	**20**

SEMESTER VII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS422A	Computer Vision	2	-	-	2
2	ETCS464A	Major Project	-	-	-	6
3		Boot Camp (Training and Placement)	2	-	-	-
4	ETCS453A	Computer Vision Lab	-	-	2	1
5	ETCS481A	Practical Training II	-	-	-	2
6	ETCS314A	Data Visualization and Story Telling	2	-	-	2
7	ETCS461A	Data Visualization and Story Telling Lab	-	-	2	1
8	**Elective (with Lab)**					
(i)	ETCS422A	Cloud Computing	4	-	-	4
	ETCA362A	Cloud Computing Lab	-	-	2	1
(ii)	ETCS421A	Internet of Things	4	-	-	4
	ETCS457A	Internet of Things Lab	-	-	2	1
(iii)	ETCS424A	Data Warehousing and Data Mining	4	-	-	4
	ETCS463A	Data Warehousing and Data Mining Lab	-	-	2	1
TOTAL			**10**	**-**	**6**	**19**

SEMESTER VIII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS490A	**Industrial Internship**	-	-	-	12
TOTAL			**-**	**-**	**-**	**12**

Total Credits [C]	**172**

ETMA105A	Applied Mathematics-I	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of complex variable.

CO2. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO3. Applied the differential calculus method for curve tracing and radios of curvatures.

CO4. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO5. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO6. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices. The concepts of applied mathematics-I are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics. Important objectives of the linear algebra are to develop and strengthen the students’ problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor’s and Maclaurin’s theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

15. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.

16. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigen values and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**
CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA 105A	Applied Mathematics - I	3	3	3	3	-	-	-	1	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon of non dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations.

CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens 'Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young's double slit experiment, Newton's rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves
3. E. Hecht, Optics
4. A. Ghatak, Optics
5. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH109A	Engineering Physics	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.
2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

1. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. S.E. Manahan, Environmental Chemistry, CRC Press.
3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
4. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	**PO7**

CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	**PO8**
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Innovation and Industry Friendly	PSO3 Ethics and Communication Skills
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

ETCS106A	**Clean Coding with Python**	L	T	P	C
Version 1.0	--	3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to use lists, tuples, and dictionaries in Python programs.
4. To learn how to identify Python object types.
5. To learn how to use indexing and slicing to access data in Python programs.
6. To define the structure and components of a Python program.
7. To learn how to write loops and decision statements in Python.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn how to write functions and pass arguments in Python.

CO2. Learn how to build and package Python modules for reusability.

CO3. Learn how to read and write files in Python.

CO4. Learn how to design object-oriented programs with Python classes.

CO5. Learn data handling and use cases diagrams.

CO6. Learn how to use class inheritance in Python for reusability.

CO7. Learn how to use exception handling in Python applications for error.

Course Overview: Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming, and graphical user interface-driven applications. The examples and problems used in this course are drawn from diverse areas such as text processing, simple graphics creation and image manipulation, HTML and web programming, and genomics.

Course Content

Unit I: **8 lecture hours**

Introduction to Clean Code: What is Bad Code? Example 1: Avoid, Example 2: for each code, What is Clean Code? , Purpose of Clean Code, Thought of experienced programmers, Intention Revealing Names, Example 1: Poor Variable Names, Example 2: Poor Method Names, Example 3: Variable Name, Make Meaningful Distinctions, Example 1: Usage of Different Words, Example 2: Distinct Names, Use Pronounceable Names, Example 1: Vocal Names, Example 2: Short Form Names, Example 3: Non-Pronounceable Names, Example 4: Compare, Avoid Encodings and Mental Mappings, Difference between smart and professional programmer, Class and Method Names, Function Size Matters, Blocks and Indenting, Do only one thing within a function, One level of abstraction per function, Use Descriptive Name, Example 1: Verbal Names, Function Arguments, Advantages of Having Less Arguments, Command Query Separation, Prefer Exceptions to Returning Error Codes, Extract Try/Catch Blocks, Error Handling Is One Thing, Good Comments, Good Names Can Obviate Comments, Types of Good Comments, Legal Comment, Informative Comment, Explanation of Intent Comment, Clarification Comment, Warning of Consequences Comment, TODO Comments, Amplification Comment, Bad Comments , Mumbling Comments, Redundant Comments, Misleading Comments, Mandated Comments, Journal Comments, Noise Comments, Scary Noise, Commented-Out Code, Too Much Information, Test Your Knowledge, The Purpose of Formatting, Vertical Formatting, Horizontal Formatting, Team Rules, Exercise 1: Comments and Formatting, Test Your Knowledge, Data Abstraction, Example 1: Concrete Point, Example 2: Abstract Point, Data/Object Antisymmetry, Law of Demeter, Data Transfer Objects.

Unit II: **12 lecture hours**

Introduction to Python: What is Python?, Advantages and disadvantages, Downloading and installing, Which version of Python, Running Python Scripts, Using the interpreter interactively, Using variables, String types: normal, raw and Unicode String operators and expressions, Math operators and expressions, Writing to the screen, Reading from the keyboard, Indenting is significant, The if and elif statements, While Loops, Using List, Dictionaries, Using the for statement, Opening, reading and writing a text file, Using Pandas, the python data analysis library and data frames, Grouping, aggregating and applying, merging and joining, Dealing with syntax errors, Exceptions, Handling exceptions with try/exception.

Unit III: 12 lecture hours

Data Handling and Use Cases: re Pattern Matching, Parsing Data, Introduction to Regression, Types of Regression, Use Cases, Exploratory data analysis, Correlation Matrix, Visualization using Matplotlib, Implementing linear regression.

Unit IV: 8 lecture hours

Object Oriented Concepts: Class, Object, Functions, Inheritance, Types of Inheritance, Encapsulation, Polymorphism, Method Overloading and Method Overriding, Data Abstraction, Abstract Classes.

Text Books

1. IBM Material

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes

CO1	Learn how to write functions and pass arguments in Python.	**PO1**
CO2	Learn how to build and package Python modules for reusability.	**PO4**
CO3	Learn how to read and write files in Python.	**PO5**
CO4	Learn how to design object-oriented programs with Python classes.	**PO2**
CO5	Learn data handling and use cases diagrams.	**PO3**
CO6	Learn how to use class inheritance in Python for reusability.	**PO3**
CO7	Learn how to use exception handling in Python applications for error.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS306A	**Clean Coding with Python**	2	3	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS105A	**Overview of AI, Data Science, Ethics and Foundation of Data Analysis**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

<u>Course Objectives</u>

The objective of this course is to teach students the concepts of current main conceptual frameworks at use in AI

<u>Course Outcomes</u>

On completion of this course, the students will be able to learn:-

CO1. Uses of AI, Ethics present and future.

CO2. Introduction to Machine Learning.

CO3. Application of AI by domain, Role of AI in society.

<u>Catalog Description</u>

The course begins with the theoretical understanding of AIML and usage, Ethics present and future.

Course Content

<u>Unit I:</u> **06 lecture hours**

Introduction to Data Science: Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machine generated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, distributed file systems, Distributed programming framework, data integration framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments.

<u>Unit II:</u> **06 lecture hours**

Data Science Processes: Six steps of data science processes, define research goals, data retrieval, cleansing data, correct errors as early as possible, integrating – combine data from different s ources, transforming data, exploratory data analysis, Data modelling, model and variable selection, model execution, model diagnostic and model comparison, presentation and automation

Unit III: **06 lecture hours**

Introduction to Machine Learning: What is Machine Learning, Learning from Data, History of Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine learning systems.

Unit IV: **06 lecture hours**

Introduction to AI: What is AI, Turing test, cognitive modelling approach, law of thoughts, the relational agent approach, the underlying assumptions about intelligence, techniques required to solve AI problems, level of details required to model human intelligence, successfully building an intelligent problem, history of AI.

Unit V: **06 lecture hours**

Introduction to Data Analytics: Working with Formula and Functions, Introduction to Power BI & Charts, Logical functions using Excel, Analyzing Data with Excel.

Text Books

1.Stuart J Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach" 3rd edition. Pearson.

Reference Books/Materials

1. Kevin Knight, Elaine Rich, B. Nair, "Artificial Intelligence" 3rd edition. McGraw Hill.
O'Reilly Media.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Uses of AI, Ethics present and future.	**PO2**
CO2	Introduction to Machine Learning.	**PO1**
CO3	Application of AI by domain, Role of AI in society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 105A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis	3	3	-	-	-	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 101A	Basics Of Electrical & Electronics Engineering	L	T	P	C
		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
C02	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin’s, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT: CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.
2. B L Thareja – A text book of Electrical Technology
3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.
4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 151A	Basics Of Electrical & Electronics Engineering Lab	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the DC and AC circuit behavior by application of network theorems.
2. To elaborate complex signals over oscilloscope devices with reading.
3. To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.
4. To analyses the BJT in build circuits as per practical application point of view.
5. To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

Course Outcomes

On completion of this course, the students will be able to

CO1 Get an exposure to common electrical components and their ratings.

C02 Determines proper electrical connections as per wires of appropriate ratings.

CO3 Understand the usage of common electrical measuring instruments.

CO4 Ability to discover applications related to seven segment display type of devices

Catalog Description

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application in real time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:
   a) Cathode ray oscilloscope (CRO)
   b) Multimeter (Analog and Digital)
   c) Function generator
   d) Power supply
2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem
4. To Verify the Superposition theorem
5. To measure voltage, current and power in an A.C. circuit by LCR impedance method
6. To study the frequency response curve in series and parallel R-L-C circuit
7. a)Plot the forward and reverse V-I characteristics of P-N junction diode
   b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.

CO2. Better insight aboutwave nature of light.

CO3. Better understanding of data interpretation which enhances problem solving approach.

CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

1) To determine the value of acceleration due to gravity using Bar pendulum.
2) To determine the value of acceleration due to gravity using Kater's pendulum.
3) To determine the wavelength of sodium light using Newton`s ring apparatus.
4) To determine the wavelength of prominent lines of mercury by plane diffraction grating.
5) To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer.
6) To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
7) To determine the wavelength of He-Ne LASER using transmission diffraction grating.

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	PO1& PO2
CO2	Better insight aboutwave nature of light.	PO4

CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS155A	**Overview of AI, Data Science, Ethics and Foundation of Data Analysis Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of current main conceptual frameworks at use in AI

Course Outcomes

On completion of this course, the students will be able to implement:-

CO1. No SQL Database queries.

CO2. Basic machine learning algorithms such as regression, classification etc.

CO3. Unsupervised algorithms.

Catalog Description

This course complements ETCS105A. It enables them to write algorithms for solving basic machine learning algorithms. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS105A.

Text Books

1.Stuart J Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach" 3rd edition. Pearson.

Reference Books/Materials

1. Kevin Knight, Elaine Rich, B. Nair, "Artificial Intelligence" 3rd edition. McGraw Hill.
O'Reilly Media.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	No SQL Database queries.	**PO2**
CO2	Basic machine learning algorithms such as regression, classification etc.	**PO3**
CO3	Unsupervised algorithms.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 155A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS157A	Clean Coding with Python Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Be fluent in the use of procedural statements — assignments, conditional statements, loops, function calls — and sequences.
2. Be able to design, code, and test small Python programs.
3. Understand the concepts of object-oriented programming as used in Python: classes, subclasses, inheritance, and overriding.
4. Understand the basics of Object Oriented Design.
5. Implement the data structures and use the built-in libraries for efficient codes.

Course Outcomes

On completion of this course, the students will be able to

CO1. Develop solutions to simple computational problems using Python programs.

C02. Solve problems using conditionals and loops in Python. Develop Python programs by defining functions and calling them.

CO3. Use Python lists, tuples and dictionaries for representing compound data.

CO4. Develop Python programs using files.

Catalog Description

Clean coding with python emphasize on principles of software development, style, and testing. Topics include procedures and functions, iteration, recursion, arrays and vectors, strings, an operational model of procedure and function calls, algorithms, exceptions, object-oriented programming, and GUIs (graphical user interfaces). Weekly labs provide guided practice on the computer, with staff present to help. Assignments use graphics and GUIs to help develop fluency and understanding.

Course Content

LIST OF EXPERIMENTS

1. Develop programs to understand the control structures of python

2. Develop programs to implement list

3. Develop programs to implement Dictionary

4. Develop programs to implement tuples

5. Develop programs to implement function with stress on scoping

6. Develop programs to implement classes and objects

7. Develop programs to implement exception handling.

8. Develop programs to implement linear search and binary search.

9. Develop programs to implement insertion sort

10. Develop programs to implement bubble sort.

11. Develop programs to implement quick sort.

12. Develop programs to implement heap sort.

Text Books

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India.

Reference Books/Materials

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech
2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley
4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop solutions to simple computational problems using Python programs	**PO3**
CO2	Solve problems using conditionals and loops in Python.Develop Python programs by defining functions and calling them	**PO4**
CO3	Use Python lists, tuples and dictionaries for representing compound data	**PO2**
CO4	Develop Python programs using files	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

ETCS157A	Clean Coding with Python Lab	-	3	2	3	-	-	-	-	-	-	-	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA105A	**Applied Mathematics-II**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of Laplace transform.

CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: 09 lecture hours

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: 10 lecture hours

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: 10 lecture hours

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

17. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
18. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.	**PO8**
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**

CO4	Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.	**PO4**
CO5	Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about thefunctions.	**PO3**
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA105A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

ETEC 215A	EMBEDDED ROBOTICS & IOT	L	T	P	C
		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				
Course Teacher(s):	Dr. Bhavesh Vyas				

Course Objectives

1. To understand the basic of embedded system.
2. To analyse the complex circuits and build new designs of analog to digital conversion.
3. To be able to perform analysis of embedded C based circuits with robotics applications
4. To gain basic insight of semiconductors-based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

- CO1 Understand and apply Knowledge of Embedded Circuits in making real time projects to solve engineering difficulties.
- C02 Determine an understanding of logic gates and C language with electronic devices.
- CO3 Demonstrate the ability to identify digital circuits. Utilization of the knowledge gained to solve problems.
- CO4 Create an understanding of IOT & robotics devices application to existing setup.

Program Articulation Matrix: Mapping of Course Outcome (COs) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4
ETEC215A ER&I	CO1	1	-	-	-	-	-	-	-	-	-	1	-	1	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
	CO3	1	-	-	-	1	-	-	2	-	-	-	-	-	-

	CO4	-	2	3	3	-	-	-	-	-	-	-	1	-	-
	CO5	-	-	-	-		1	2	-	-	-	-	2	-	-
	CO6	-	-	-	-	1	-	-	-	-	2	3		-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Examination Scheme:

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	20	
2	Mid Term Examination (Written Examination)	90Minutes	20	
3	Attendance		10	
4	End Term Examination (Written Examination)	180 Minutes	50	
Total			**100**	

Course Content

UNIT I **14 HRS**

Introduction to Embedded Systems: Introduction to Basic Electronics Components, Introduction to Microprocessor and Microcontroller, Difference between Microcontroller and Microprocessor, Introduction to Embedded System, Introduction to Arduino, Types of Microcontrollers: 8051, PIC, AVR & ARM, parametric comparisons among all, Reading Datasheet & schematics, Advantages of Atmega328,

UNIT II **10 HRS**

Robotics: Introduction to robotics: Automation, Anatomy of Robots, Manipulators, Robot control, History of robots, Types of Main bodies, Tasks Planning for robots, Robot's mechanisms, Manipulators Mechanisms-I, Actuators for Robots-Part I, Stepper motor, Performance characteristic, Sensors and Controllers in robots, Incremental encoders and position, velocity sensors, external state sensors.

UNIT III **8 HRS**

Internet of Things: IOT Introduction and its Architecture (Why, What and How), Hardware in IOT, Future in IOT, Introduction to ESP8266 Wi-Fi Module, IOT Basics: IOT definition, applications in different domains, trends in IOT market. IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP).

UNIT IV **8 HRS**

Sensors For Robotic Applications: Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer. Recap of Embedded C: Datatypes, Array, Conditional Statements, Functions / Call-back function Structures, Pointers, Storage classes, Embedded Controllers, Interfaces, Operating System - Industrial Robots.

TEXT BOOKS:

1. Peter Marwedel, book**: Embedded System Design** 1st Edition, Kindle Edition
2. "Rise of the Robots: Technology and the Threat of a Jobless Future", by Author: Martin Ford
3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", by Author: Peter Mckinnon

REFERENCE BOOKS:

1. **"Making Simple Robots: Exploring Cutting-Edge Robotics with Everyday Stuff", by Author: Kathy Ceceri**
2. **"Real-Time C++: Efficient Object-Oriented and Template Microcontroller Programming", 14 May 2018 by Author Christopher Kormanyos.**

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12^{th} Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: 10 lecture hours

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: 10 lecture hours

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: **10 lecture hours**

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na_2SO_4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the understanding of Technology involved in improving qualityof water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze the qualityparameters of chemical fuels.	**PO1**
CO3	Develop the understanding of Chemical structure of polymers and itseffect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its propertiesand applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamicsand kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predictpotential applications of chemistry and practical utility in order to become goodengineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119A	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME155A	**Engineering Graphics Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.

CO2. Interpret engineering drawings using fundamental technical mathematics.

CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.

CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH159A	Engineering Chemistry Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

Course Outcomes

On completion of this course, the students will be able to

CO1: Analyze & generate experimental skills.
CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.
CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.
CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.
CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.
CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution, given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hypo solution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol formaldehyde resins.	**2 lab hours**
13	Determination of dissolved oxygen in the given sample of water.	**2 lab hours**
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Projects/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH159A	Engineering Chemistry Lab	3	3	2	-	2	-	-	-	3	-	-	3	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS107A	**Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of Python Programming Language with Libraries.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Theoretical and practical understanding of data analysis with Python package like NumPy and Pandas.

CO2. The knowledge of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.

CO3. To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview.

Catalog Description

Data Analysis with Python is for everyone who would like to create meaningful insight out of the data with the power of Numpy, Pandas, Matplotlib & Seaborn. The course has the right recipe to equip student with the right set of skill to ingest, clean, merge, manipulate, transform and finally visualize the data to create the meaning out of the data at hand.

Course Content

Unit I: **06 lecture hours**

Python programming Basic: Python interpreter, IPython Basics, Tab completion, Introspection, %run command, magic commands, matplotlib integration, python programming, language semantics, scalar types. Control flow.

<u>Unit II:</u> **06 lecture hours**

Data Structure, functions, files: tuple, list, built-in sequence function, dict, set, functions, namescape, scope, local function, returning multiple values, functions are objects, lambda functions, error and exception handling, file and operation systems.

<u>Unit III:</u> **06 lecture hours**

NumPy: Array and vectorized computation: Multidimensional array object. Creating ndarrays, arithmetic with numpy array, basic indexing and slicing, Boolean indexing, transposing array and swapping axes, universal functions, array-oriented programming with arrays, conditional logic as arrays operations, file input and output with array.

<u>Unit IV:</u> **06 lecture hours**

Pandas: Pandas data structure, series, DataFrame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format.

<u>Unit V:</u> **06 lecture hours**

Visualization with Matplotlib: Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration.

Plotting with pandas and seaborn: line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data.

<u>Text Books</u>

1.Fabio Nelli, Python Data Analytics 2nd Edition, Apress.

<u>Reference Books/Materials</u>

1. Python for Data Analysis: A Complete Beginner Guide for Python basics, Numpy, Pandas, Seaborn,

Bokeh and Matplotlib for Data Analysis, AI Publishing LLC.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Theoretical and practical understanding of data analysis with Python package like NumPy and Pandas.	**PO2**
CO2	The knowledge of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.	**PO5**
CO3	To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 107A	Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need
3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**

CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS154A	**Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of Python Programming Language with Libraries.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Practical understanding of data analysis with Python package like NumPy and Pandas.

CO2. Implementation of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.

CO3. To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview.

Catalog Description

This course complements ETCS107A. It enables them to write algorithms/programs for implementing python libraries such as NumPy, Pandas, Seaborn etc. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS107A.

Text Books

1.Fabio Nelli, Python Data Analytics 2nd Edition, Apress.

Reference Books/Materials

1. Python for Data Analysis: A Complete Beginner Guide for Python basics, Numpy, Pandas, Seaborn, Bokeh and Matplotlib for Data Analysis, AI Publishing LLC.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Practical understanding of data analysis with Python package like NumPy and Pandas.	**PO2**
CO2	Implementation of visualization tool (matplotlib and seaborn) so that one will be able to visualize and make correct decision based on the data.	**PO5**
CO3	To practice with real life data to feel confident of the topic and be able to ready to work on data analysis project or interview.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 154A	Data Analysis using Python, Numpy, Pandas, Matplotlib, and Seaborn Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1 To understand distributions in the study of the joint behaviour of two random variables.

2 To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.

3 To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
2. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
3. Jim Pitman (1993). Probability, Springer-Verlag.
4. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
5. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel

Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**
CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**
CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**

CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3	-	-	-	-	-	2	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS203A	**Probabilistic Modelling and Reasoning with Python**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Basics of Statistics and Probability distributions.

CO2. Sampling theory and Theory of Estimation.

CO3. Various tests of Hypothesis and Significance.

CO4. Correlation and Regression and fitting of different types of curves.

Catalog Description

The course begins with the theoretical study of statistics and probability distributions which is widely used in ML, AI and all engineering applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, and confidence intervals.

Course Content

Unit I: **08 lecture hours**

Introduction to Statistics: Introduction to Statistics. Role of statistics in scientific methods, current applications of statistics.

Scientific data gathering: Sampling techniques, scientific studies, observational studies, data management.

Data description: Displaying data on a single variable (graphical methods, measure of central tendency, measure of spread), displaying relationship between two or more variables, measure of association between two or more variables.

Unit II: **07 lecture hours**

Probability Theory: Sample space and events, probability, axioms of probability, independent events, conditional probability, Bayes' theorem.

Random Variables: Discrete and continuous random variables. Probability distribution of discrete random variables, binomial distribution, Poisson distribution. Probability distribution of continuous random variables, The uniform distribution, normal (Gaussian) distribution, exponential distribution, gamma distribution, beta distribution, t-distribution, χ'' distribution. Expectations, variance and covariance. Probability Inequalities. Bivariate distributions

Unit III: **08 lecture hours**

Point Estimations: Methods of finding estimators, method of moments, maximum likelihood estimators, bayes estimators. Methods of evaluating estimators mean squared error, best unbiased estimator, sufficiency and unbiasedness

Interval Estimations: Confidence interval of means and proportions, Distribution free confidence interval of percentiles.

Unit IV: **07 lecture hours**

Test of Statistical Hypothesis and p-values: Tests about one mean, tests of equality of two means, test about proportions, p-values, likelihood ratio test, Bayesian tests.

Bayesian Statistics: Bayesian inference of discrete random variable, Bayesian inference of binomial proportion, comparing Bayesian and frequentist inferences of proportion, comparing Bayesian and frequentist inferences of mean.

Univariate Statistics using Python: Mean, Mode. Median, Variance, Standard Deviation, Normal Distribution, t-distribution, interval estimation, Hypothesis Testing, Pearson correlation test, ANOVA F-test

Text Books

1.Achim Klenke, Probability Theory A Comprehensive Course Second Edition, Springer

Reference Books/Materials

1. •Christian Heumann, Michael Schomaker Shalabh (2016), Introduction to Statistics and DataAnalysis With Exercises, Solutions and Applications in R, Springer International Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Basics of Statistics and Probability distributions.	**PO1**
CO2	Sampling theory and Theory of Estimation.	**PO1**
CO3	Various tests of Hypothesis and Significance.	**PO2**
CO4	Correlation and Regression and fitting of different types of curves.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 203A	Probabilistic Modelling and Reasoning with Python	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS231A	**Discrete Mathematics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: 10 lecture hours

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions, Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: 12 lecture hours

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: 12 lecture hours

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: 10 lecture hours

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, “Discrete Mathematical Structures”, PHI.
2. NarsinghDeo, “Graph Theory with Application to Engineering and Computer Science”, PHI.
3. J. P. Trembly& P. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw Hill.
4. Vinay Kumar, “Discrete Mathematics”, BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS217A	**Data Structures**				
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: **8 lecture hours**

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: **12 lecture hours**

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: **12 lecture hours**

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: **8 lecture hours**

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

1. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.
2. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.
2. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
UCDM301	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: 8 lecture hours

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: 8 lecture hours

Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

Unit III: 6 lecture hours

Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment
- Post Disaster effects and Remedial Measures.

- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology,
- Long-term Counter Disaster Planning
- Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

- **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority
- **Liability for Mass Disaster**
  - Statutory liability
  - Contractual liability
  - Tortious liability
  - Criminal liability
  - Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

Project Work: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.

- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management			2			3						2			2

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS208A	**R Programming for Data Science and Data Analytics**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Open Source, Platform Independent, Machine Learning Operations.

CO2. Exemplary support for data wrangling.

CO3. Quality plotting and graphing.

CO4. The array of packages, Statistics.

Catalog Description

The course begins with the study of R Programming.

Course Content

Unit I: **08 lecture hours**

Getting Started with R and R Workspace: Introducing R, R as a programming Language, the need of R, Installing R, RStudio, RStudio's user interface, console, editor, environment pane, history pane, file pane, plots pane, package pane, help and viewer pane, R Workspace, R's working directory, R Project in R Studio, absolute and relative path, Inspecting an Environment, Inspect existing Symbols, View the structure of object, Removing symbols, Modifying Global Options, Modifying warning level, Library of Packages, Getting to know a package, Installing a Package from CRAN, Updating Package from CRAN, Installing package from online repository, Package Function, Masking and name conflicts.

Unit II: **07 lecture hours**

Basic Objects and Basic Expressions: Vectors, Numeric Vectors, Logical Vectors, Character Vectors, subset vectors, Named Vectors, extracting element, converting vector, Arithmetic operators, create Matrix, Naming row and columns, subsetting matrix, matrix operators, creating and subsetting an Array, Creating a List, extracting element from list, subsetting a list, setting value, creating a value of data frame, subsetting a data frame, setting values, factors, useful functions of a data frame, loading and writing data on disk, creating a function, calling a function, dynamic typing, generalizing a function. Assignment Operators, Conditional Expression, using if as expression and statement, using if with vectors, vectorized if: ifelse, using switch, using for loop, nested for loop, while loop.

Unit III: **08 lecture hours**

Working with Basic Objects and Strings: Working with object function, getting data dimensions, reshaping data structures, iterating over one dimension, logical operators, logical functions, dealing with missing values, logical coercion, math function, number rounding functions, trigonometric functions, hyperbolic functions, extreme functions, finding roots, derivatives and integration, Statistical function, sampling from a vector, Working with random distributions, computing summary statistics, covariance and correlation matrix, printing string, concatenating string, transforming text, Formatting text, formatting date and time, formatting date and time to string, finding string pattern, using group to extract data, reading data.

Unit IV: **07 lecture hours**

Working with Data – Visualize and Analyze Data: Reading and Writing Data, importing data using built-in-function, READR package, export a data frame to file, reading and writing Excel worksheets, reading and writing native data files, loading built-in data sets, create scatter plot, bar chart, pie chart, histogram and density plots, box plot, fitting linear model and regression tree.

Text Books

1.Garrett Grolemund, Hands-On Programming with R, O′Reilly.

Reference Books/Materials

1. Hadley Wickham & Garrett Grolemund, R for Data Science, O′Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Open Source, Platform Independent, Machine Learning Operations.	**PO1**
CO2	Exemplary support for data wrangling.	**PO1**
CO3	Quality plotting and graphing.	**PO2**
CO4	The array of packages, Statistics.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 208A	R Programming for Data Science and Data Analytics	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS257A	**Data Structures Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in

variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours
14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Analyze the algorithms to determine the time and computation complexity	PO1
CO2	Implement a given Search problem (Linear Search and Binary Search).	PO4
CO3	Write algorithms concerning various data structures	PO5
CO4	Write an algorithm for internal and external sorting	PO2

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS259A	Probabilistic Modelling and Reasoning with Python Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Applications of Sampling theory and Theory of Estimation.

CO2. Implementation of various tests of Hypothesis and Significance.

CO3. Implementation of Correlation and Regression and fitting of different types of curves.

Catalog Description

This course complements ETCS203A. It enables them to write algorithms/programs for solving various tests of Hypothesis and Significance and Correlation and Regression and fitting of different types of curves. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS203A.

Text Books

1.Achim Klenke, Probability Theory A Comprehensive Course Second Edition, Springer

Reference Books/Materials

1. Christian Heumann, Michael Schomaker Shalabh (2016), Introduction to Statistics and Data Analysis

With Exercises, Solutions and Applications in R, Springer International Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Applications of Sampling theory and Theory of Estimation	**PO3**
CO2	Implementation of various tests of Hypothesis and Significance.	**PO2**
CO3	Implementation of Correlation and Regression and fitting of different types of curves.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 259A	Probabilistic Modelling and Reasoning with Python Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS261A	**R Programming for Data Science and Data Analytics Lab**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Implement Open Source, Platform Independent, Machine Learning Operations.

CO2. Exemplary support for data wrangling.

CO3. Implement Quality plotting and graphing.

CO4. Implement the array of packages, Statistics.

Catalog Description

This course complements ETCS208A. It enables them to write algorithms/programs for Implementing Open Source, Platform Independent, Machine Learning Operations and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using R and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS208A.

Text Books

1.Garrett Grolemund, Hands-On Programming with R, O′Reilly.

<u>Reference Books/Materials</u>

1. Hadley Wickham & Garrett Grolemund, R for Data Science, O′Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement Open Source, Platform Independent, Machine Learning Operations.	**PO5**
CO2	Exemplary support for data wrangling.	**PO2**
CO3	Implement quality plotting and graphing.	**PO3**
CO4	Implement The array of packages, Statistics.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 261A	R Programming for Data Science and Data Analytics Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS222A	**Computer Organization and Architecture**				
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: **12 lecture hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: **10 lecture hours**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: **8lecture hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: **10lecture hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the concepts of microprocessors, their principles and practices.	**PO2**
CO2	Write efficient programs in assembly language of the	**PO3**

	8086 family of microprocessors.	
CO3	Organize a modern computer system and be able to relate it to real examples.	**PO4**
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO5	Implement embedded applications using Emulator.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-		3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS220A	Analysis and Design of Algorithms	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.

2. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS307A	**Database Management Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the database design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: 12 lecture hours

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: 8 lecture hours

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: 12 lecture hours

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: **8 lecture hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

1. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**
CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**

CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems	-	2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS205A	**Machine Learning and Pattern Recognition**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Basic Algorithms of Machine Learning.

CO2. Supervised and Unsupervised Learning.

CO3. Linear Regression, Classification, Tree, PCA, SVD, SVM.

CO4. Resampling Methods and Optimization Techniques.

Catalog Description

The course begins with the key concepts of Machine Learning. The student gets an opportunity to learn Machine learning algorithms, analyze the results, and techniques to optimize them.

Course Content

Unit I: **10 lecture hours**

Introduction: Learning systems, real world applications of machine learning, why machine learning, variable types and terminology, function approximation.

Types of machine learning: Supervised learning, unsupervised learning, reinforcement learning.

Unit II: **10 lecture hours**

Important concepts of machine learning: Parametric vs non-parametric models, the trade-off between prediction accuracy and model interpretability, the curse of dimensionality, measuring the quality of fit, bias-variance trade off, overfitting, model selection, no free lunch theorem.

Unit III: **10 lecture hours**

Linear Regression: Linear regression, estimating the coefficients, accessing the accuracy of coefficient estimates, accessing the accuracy of the model, multiple linear regression, qualitative predictors.

Unit IV: **07 lecture hours**

Classification: Logistic regression, estimating regression coefficients, making predictions, multiple logistic regressions, linear discriminant analysis, bayes' theorem of classification, LDA for p=1, LDA for p>1, quadratic discriminant analysis.

Text Books

1.Tom M. Mitchell, Machine Learning, First Edition, McGraw Hill Education.

Reference Books/Materials

1. Christopher M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer International Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Basic Algorithms of Machine Learning.	**PO2**
CO2	Supervised and Unsupervised Learning.	**PO2**
CO3	Linear Regression, Classification, Tree, PCA, SVD, SVM.	**PO3**
CO4	Resampling Methods and Optimization Techniques.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 205A	Machine Learni	-	3	3	2	-	-	-	-	-	-	-	-	3	-	-

	ng and Pattern Recognition															

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer's needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The

organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace.
This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception-concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

1. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
2. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
3. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning
4. McSchane, Organisation Behaviour, TMH, New Delhi
5. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
6. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi

Nelson, Debra L and James C Quick, Organizational Behavior, Thomson Learning

		L	T	P	C
ETCS254A	**Machine Learning Practical with Python, Scikit-learn, Matplotlib, TensorFlow**				
Version 1.0		-	-	4	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Basic Algorithms of Machine Learning.

CO2. Implementation of libraries such as Scilit-learn, matplotlib etc. on real life datasets.

CO3. Implementation of libraries tensorflow on real life datasets.

CO4. Resampling Methods and Optimization Techniques.

Catalog Description

This course complements ETCS205A. It enables them to write algorithms/programs for Implementing Scilit-learn, matplotlib, tensorflow and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS205A.

Text Books

1.Tom M. Mitchell, Machine Learning, First Edition, McGraw Hill Education.

Reference Books/Materials

1. Christopher M. Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer International Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Basic Algorithms of Machine Learning.	**PO2**
CO2	Implementation of libraries such as Scilit-learn, matplotlib etc. on real life datasets.	**PO3**
CO3	Implementation of libraries tensor flow on real life datasets.	**PO3**
CO4	Resampling Methods and Optimization Techniques.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 254A	Machine Learning Practical with Python, Scikit-learn, Matplotlib, Tensor Flow	-	3	3	2	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To facilitate students in Database design.
4. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

Text Books

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books/Materials

1. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.
2. "Fundamentals of Database Systems", R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 355A	Database Management Systems Lab	-	3	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	**Analysis and Design of Algorithms Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. To understand concept of different sorting algorithms.
2. To understand the concept of dynamic programming.
3. To understand concept of divide and conquer.
4. To understand Dictionary (ADT)
5. To understand concept of greedy algorithms.
6. To understand concept & features like max heap, min heap

Course Outcomes

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**
6	To Implement Matrix Chain Multiplication.	**2 lab hours**

7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS228A	**Employability and Analytical Skills-I**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

9. Analytical and Calculative skills
10. Technical Knowledge
11. Logic building
12. Communication skills
13. Grooming
14. Presentation skills
15. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

- Communication
- Introduction to Communication
- Types of communication
- Verbal & Nonverbal Communication
- Barriers to Communication
- Body language
- Listening Skills
- Activity

- Language

Quant

- Types of Numbers, HCF & LCM
- Divisibility, Unit Digit.
- Remainder Theorem
- Equations, Factorials.

UNITII

Objective: Vocabulary Building & general speaking

- Basic Grammar/Communicative Grammar
- Parts of speech
- Nouns
- Pronouns: Noun Pronoun Agreement, Types with special emphasis over relative pronouns
- Verbs: Introduction Principal verbs and auxiliary verbs, subject-verb agreement
- Adjectives: degrees of comparison
- Adverb: Types and its usage in sentences
- Conjunctions: Coordinating and Co-relative conjunctions
- Prepositions
- Articles: Definite and Indefinite articles
- Usage of Tenses
- Subject verb agreement
- Sentence Structure: Simple Complex and Compound sentences
- Clauses

Quant

- Progression, Probability
- Permutation & Combination, Average, Percentage, Ratio & Proportion, Partnership
- Profit & Loss

UNIT III

- Word formation
- Theory and exercise
- Synonyms and antonyms
- One-word substitutes
- Idioms
- Phrasal verbs
- Pair of words
- Homonyms, hyponyms, hypernyms
- Linking words: sequencing of sentences (to form a coherent paragraph

- Paragraph writing
- Supplying a suitable beginning/ending/middle sentence to make the paragraph coherent
- Idiomatic language (with emphasis on business communication),
- Punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices

Quant

- Problems on Ages.
- Mixture & Allegation
- Simple Interest & Compound Interest.

UNIT IV

- General Essay writing, Writing Issues and Arguments (with emphasis on creativity and analysis of a topic)
- Story writing
- Business letter writing: Guidance in framing a 'Statement of purpose',
- Letters of Recommendation
- Email writing, email and business letter writing etiquette,
- Letters of complaints/responses to complaint

Quant

- Time & Work.
- Time, Speed and Distance
- Data Interpretation.

ETCS308A	**Big Data Analytics**	L	T	P	C
Version 1.0	--	3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Understand analytics, what is leading to big data.
2. Understand Scientific techniques of analytics.
3. Develop an understanding of the complete open-source Hadoop ecosystem and its near term future directions.
4. Understand the major challenges of data.
5. Understand how the growth of interconnected devices helps big data.
6. Understand the functions and features of HDP.
7. Understand IBM value-add components.
8. Understand Explain IBM Watson Studio.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the brief description of the purpose of each of the value-add components.

CO2. Understand Hortonworks Data Platform (HDP)

CO3. Understand Apache Ambari

CO4. Understand Hadoop and the Hadoop Distributed File System, MapReduce and Yarn, Apache Spark.

CO5. Understand Zoo Keeper, Slider, and Knox

CO6. Loading data with Sqooq

Course Overview:

The course explains Dataplane Service , Stream Computing, Data Science essentials, Drew Conway's Venn Diagram - and that of others, The Scientific Process applied to Data Science, The steps in running a Data Science project , Languages used for Data Science (Python, R, Scala, Julia, ...), Survey of Data Science Notebooks, Markdown language with notebooks, Resources for Data Science, including GitHub, Jupyter Notebook, Essential packages: NumPy, SciPy, Pandas, Scikit-learn, NLTK, BeautifulSoup, Data visualizations: matplotlib, , PixieDust, Using Jupyter "Magic" commands, Using Big SQL to access HDFS data, Creating Big SQL schemas and tables, Querying Big SQL tables, Managing the Big SQL Server, Configuring Big SQL security, Data federation with Big SQL, IBM Watson Studio , Analyzing data with Watson Studio.

Course Content

Unit I: **10 lecture hours**

Introduction to Big Data and Analytics: Overview of Big Data 5 Vs of Big data, Realtime example of analytics with use cases ,Developing an understanding of the complete open-source Hadoop ecosystem and its nearterm future directions ,Comparing and evaluating the major Hadoop distributions and their ecosystem components, both their strengths and their limitations ,Gaining hands-on experience with key components of various big data ecosystem components and their roles in building a complete big data solution to common business problems, Learning the tools that will enable you to continue your big data education after the course, Describing the functions and features of HDP, Listing the IBM value-add components, Explaining what IBM Watson Studio is, Giving a brief description of the purpose of each of the value-add components, Exploring the lab environment, Launching Apache Ambari, Starting a variety of services using Apache GUI, Exploring some of the directory structure on the Linux system, Understanding the purpose of Apache Ambari in the HDP stack, Understanding the overall architecture of Ambari, and Ambari's relation to other services and components of a Hadoop cluster, Listing the functions of the main components of Ambari, Explaining how to start and stop services from Ambari Web Console, Managing Hadoop clusters with Apache Ambari, Start the Apache Ambari web console and perform basic start/stop services, Explore other aspects of the Ambari web server, Understanding the basic need for a big data strategy in terms of parallel reading of large data files and internode network speed in a cluster, Describing the nature of the Hadoop Distributed File System (HDFS), Explaining the function of the NameNode and DataNodes in an

Hadoop cluster, Explaining how files are stored and blocks ("splits") are replicated, Filing access and basic commands with HDFS, Describing the MapReduce model v1, Listing the limitations of Hadoop 1 and MapReduce 1, Reviewing the Java code required to handle the Mapper class, the Reducer class, and the program driver needed to access MapReduce , Describing the YARN model, Comparing Hadoop 2/YARN with Hadoop 1, Run MapResuce and YARN jobs, Creating and code a simple MapReduce job, Understanding the nature and purpose of Apache Spark in the Hadoop ecosystem, Listing and describing the architecture and components of the Spark unified stack , Describing the role of a Resilient Distributed Dataset (RDD), Understanding the principles of Spark programming, Listing and describing the Spark libraries, Launching and using Spark's Scala and Python shells, Working with Spark RDD with Scala, Listing the characteristics of representative data file formats, including flat/text files, CSV, XML, JSON, and YAML, Listing the characteristics of the four types of NoSQL datastores, Describing the storage used by HBase in some detail, Describing and compare the open source programming languages, Pig and Hive, Listing the characteristics of programming languages typically used by Data Scientists: R and Python, Understanding the challenges posed by distributed applications and how ZooKeeper is designed to handle them, Explaining the role of ZooKeeper within the Apache Hadoop infrastructure and the realm of Big Data management, Exploring generic use cases and some real-world scenarios for ZooKeeper, Defining the ZooKeeper services that are used to manage distributed systems, Exploring and use the ZooKeeper CLI to interact with ZooKeeper services, Understanding how Apache Slider works in conjunction with YARN to deploy distributed applications and to monitor them, Explaining how Apache Knox provides peripheral security services to an Hadoop cluster, Listing some of the load scenarios that are applicable to Hadoop, Understanding how to load data at rest, Understanding how to load data in motion, Understanding how to load data from common sources such as a data warehouse, relational database, web server, or database logs, Explaining what Sqoop is and how it works, Describing how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems, Briefing introduction to what Flume is and how it works, Moving data into HDFS with Sqoop, Explaining the need for data governance and the role of data security in this governance, Listing the Five Pillars of security and how they are implemented with HDP, Discussing the history of security with Hadoop, Identifying the need for and the methods used to secure Personal & Sensitive Information, Describing the function of the

Hortonworks DataPlane Service (DPS), Defining streaming data, Describing IBM as a pioneer in streaming data - with System S IBM Streams, Explaining streaming data - concepts & terminology, Comparing and contrasting batch data vs streaming data, Listing and explaining streaming components & Streaming Data Engines (SDEs)

Unit II: 10 lecture hours

Understanding Data Science and Notebooks: Working with Spark RDD with Scala, Listing the characteristics of representative data file formats, including flat/text files, CSV, XML, JSON, and YAML, Listing the characteristics of the four types of NoSQL datastores, Describing the storage used by HBase in some detail, Describing and compare the open source programming languages, Pig and Hive, Listing the characteristics of programming languages typically used by •Data Scientists: R and Python, Understanding the challenges posed by distributed applications and how ZooKeeper is designed to handle them, Explaining the role of ZooKeeper within the Apache Hadoop infrastructure and the realm of Big Data management, Exploring generic use cases and some real-world scenarios for ZooKeeper, Defining the ZooKeeper services that are used to manage distributed systems, Exploring and use the ZooKeeper CLI to interact with ZooKeeper services, Understanding how Apache Slider works in conjunction with YARN to deploy distributed applications and to monitor them, Explaining how Apache Knox provides peripheral security services to an Hadoop cluster, Listing some of the load scenarios that are applicable to Hadoop, Understanding how to load data at rest, Understanding how to load data in motion, Understanding how to load data from common sources such as a data warehouse, relational database, web server, or database logs, Explaining what Sqoop is and how it works, Describing how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems, Briefing introduction to what Flume is and how it works, Moving data into HDFS with Sqoop, Explaining the need for data governance and the role of data security in this governance, Listing the Five Pillars of security and how they are implemented with HDP, Discussing the history of security with Hadoop, Identifying the need for and the methods used to secure Personal & Sensitive Information, Describing the function of the Hortonworks DataPlane Service (DPS), Defining streaming data, Describing IBM as a pioneer in streaming data - with System, Streams, Explaining streaming data - concepts & terminology, Comparing and contrasting batch data vs streaming data, Listing and explaining streaming components & Streaming Data Engines (SDEs), Data visualizations: matplotlib, PixieDust, Using Jupyter "Magic" commands, Start Jupyter - it will open in a web browser, Importing the lab file (all Jupyter files have a.ipynb suffix) into your default workspace, This is now a copy of the provided lab file and you can do anything with it, If you mess it up, you can re-import again later, Exploring the component panels - some are markdown, some are code, some are results of running the code (output data, visualizations, …), Learning how to run single panels - and then the whole script oYou may need to adjust the provided script to locate the data files that accompany the Jupyter.ipynb file, Add some additional panels, as described in the lab script

Unit III: 10lecture hours

BigSQL and Watson Studio: Overview of Big SQL, Understanding how Big SQL fits in the Hadoop architecture, Start and stop Big SQL using Ambari and command line, Connecting to Big SQL using command line, Connecting to Big SQL using IBM Data Server Manager, Configuring images, Starting Hadoop components, Start up the Big SQL and DSM services, Connecting to Big SQL using JSqsh, Executing basic Big SQL statements, Exploring Big SQL through Ambari using DSM, Describing and creating Big SQL schemas and tables, Describing and listing the Big SQL data types, Working with various Big SQL DDLs ,Loading data into Big SQL tables using best practices, Creating and dropping simple Big SQL table, Creating sample tables, Moving data into HDFS, Loading data into Big SQL tables Creating and working with views, Creating external tables, Describing Big SQL supported file formats, Query Big SQL tables using various DMLs, Connecting to Big SQL, Query data with Big SQL, Working with the ARRAY type, Working with Big SQL functions, Storing data in an alternate file format (Parquet), Configuring the Big SQL Server, Configuring the Big SQL Scheduler, Listing the registries for compiler and runtime performance improvement •Backup and restore Big SQL, Updating the database resource percentage for the Big SQL database instance, Inspecting the Big SQL scheduler configuration file, Viewing the registries for the compiler and runtime performance improvement, Configuring authentication for Big SQL, Managing security with Apache Ranger, Enabling SSL encryption, Configuring authorization of Big SQL objects, Configuring impersonation in Big SQL, Understanding the concept of Big SQL federation, Listing the supported data sources, Set up and configure a federation server to use different data sources, Configuring Fluid Query with Big SQL, What is Watson Studio?, Setting up a project, Working with collaborators, Managing data assets, Sign up for a Watson Studio account, Creating a new project, Managing a project, Adding collaborators, Loading data, Managing the object storage, Overview of Jupyter notebooks, Creating notebooks, Coding and running notebooks, Sharing and publishing notebooks, Creating a notebook , Using notebooks, Working with external data.

Text Books

1. IBM Material

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the brief description of the purpose of each of the value-add components.	**PO1**
CO2	Understand Hortonworks Data Platform (HDP)	**PO4**
CO3	Understand Apache Ambari	**PO5**
CO4	Understand Hadoop and the Hadoop Distributed File System, MapReduce and Yarn, Apache Spark.	**PO2**
CO5	Understand Zoo Keeper, Slider, and Knox	**PO3**
CO6	Loading data with Sqooq	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS308A	Big Data Analytics	3	3	3	3	3								3		2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	**Theory of Computation**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: 12 lecture hours

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: 8 lecture hours

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: 12 lecture hours

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: 8 lecture hours

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education.
2. Thomas A. Sudkamp," An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education.
3. Raymond Greenlaw an H.James Hoover, "Fundamentals of Theory of Computation, Principles and Practice", Morgan Kaufmann Publishers.
4. MichealSipser, "Introduction of the Theory and Computation", Thomson Brokecole.
5. J. Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**

CO2	Design finite automata to accept a set of strings of a language	**PO3**
CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	**Operating Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: 6 lecture hours

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: 12 lecture hours

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessorscheduling: Real Time scheduling: RM and EDF.

Unit III: 12 lecture hours

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: **10 lecture hours**

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

1. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

1. Tannenbaum, "Operating Systems", PHI, 4th Edition.
2. William Stallings, "Operating Systems Internals and Design Principles", PHI
3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS304A	**Computer Networks**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
CO2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: **8 lecture hours**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization:

Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
2. Provides a practical approach to assemble Ethernet/Internet networking.
3. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.
CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.
CO3. Demonstrate and measure different network scenarios and their performance behavior.
CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra’s algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**
12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)	**4 lab hours**

14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**
CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**
CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS364A	**Big Data Analysis Lab**	L	T	P	C
Version 1.0	--	0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Big Data and Data Analytics
2. Hortonworks Data Platform (HDP)
3. Apache Ambari
4. Hadoop and the Hadoop Distributed File System
5. MapReduce and Yarn
6. Apache Spark

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn Storing and Quering data

CO2. Learn about ZooKeeper, Slider, and Knox

CO3. Loaddata with Sqooq

CO4. Learn Dataplane Service

CO5. Understand Stream Computing

CO6. Understand Data Science essentials

CO7. Understand Drew Conway's Venn Diagram - and that of others

CO8. Understand the Scientific Process applied to Data Science

Catalog Description

This course will expose the students to the data analytics practices executed in the business world. We will explore such key areas as the analytical process, how data is created, stored, accessed, and how the organization works with data and creates the environment in which analytics can flourish.

This course will give the students a strong foundation in all the areas that support analytics and will help them to better position themselves for success within the organization. Students will develop skills and a perspective that will make them more productive.

List of Experiments (Indicative)

1	Implement the following file management tasks in Hadoop: Adding files and directories • Retrieving files • Deleting file	**2 lab hours**
2	Install and Run Hive then use Hive to create,load, alter, and drop databases, tables, joins	**2 lab hours**
3	Implement Hive Partitioning and bucketing with data set.	**2 lab hours**
4	Install and Run Pig then write Pig Latin scripts to sort, group, join and filter your data.	**2 lab hours**
5	Implement sqoop commands.	**2 lab hours**
6	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm with data set.	**4 lab hours**
7	Working with Jupyter Notebooks. • Creating notebooks • Coding and running notebooks • Sharing and publishing notebooks • Creating a notebook • Using notebooks	**4 lab hours**
8	Create Big SQL table and load dataset into table.	**4 lab hours**
9	Implement Hbase commands with data set.	**4 lab hours**
10	Managing the Big SQL Server • Update the database resource percentage for the Big SQL	**4 lab hours**

	database instance • Inspect the Big SQL scheduler configuration file • View the registries for compiler and runtime performance Improvement	
11	Analyzing data with Watson Studio • Run through a sample notebook in Watson Studio • Use PixieDust for data visualization	**4 Lab Hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn Storing and Quering data	**PO2**
CO2	Learn about ZooKeeper, Slider, and Knox	**PO3**
CO3	Load data with Sqooq	**PO5**
CO4	Learn Dataplane Service	**PO4**
CO5	Understand Stream Computing	**PO1**
CO6	Understand Data Science essentials	**PO4**
CO7	Understand Drew Conway's Venn Diagram - and that of others	**PO4**
CO8	Understand the Scientific Process applied to Data Science	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS364A	Big Data Analysis Lab	2	3	3	3	2	-	-	-	-	-	-	-	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**iOS Development Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of MAC OS				
Co-requisites	--				

Course Objectives

1. To be able to Understand the basics of Swift Programming language
2. To Learn and practice the iOS App that commonly used in iPhone
3. Understand and able to differentiate between the concept of iOS and OS X
4. Apply necessary information to program for automation.
5. Apprehend the basic of MAC System and how to publish iOS app on AppStore.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.

CO2. Understand and know how to use properly UIKit, asynchronous code, Core Image, NSURL Session and JSON Map Kit and Core Location, Auto Layout, Source Control, Core Data, Animation, and the app submission process.

CO3. Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects

CO4. Organize their code professionally using objects and blocks, prototype several entry-level apps and try to publish on App store.

Catalog Description

The objective of the course is to provide skills to develop applications for OS X and iOS. It includes introduction to development framework Xcode. Objective-C is used as programming language to develop the applications. Objective-C is the superset of the C programming language and provides object-oriented capabilities and a dynamic runtime. Objective-C inherits the syntax, primitive types, and flow control statements of C and adds syntax for defining classes and methods. The list of experiments helps in making static and dynamic iOS App on based on real time systems.

List of Experiments (Indicative)

1	Case Study of Objective-C language.	2 lab hours
2	Case study of Windows and MAC systems	2 lab hours
3	Case Study of XCode based on MAC Systems	2 lab hours
4	Design an App for UISwitch based on Objective-C language	2 lab hours
5	Design an App for UISlider based on Objective-C language	2 lab hours
6	Design an App for UIStepper based on Objective-C language	2 lab hours
7	Write a program for creating Story Boards	2 lab hours
8	Design an App for UIAnimation based on Objective-C language	3 lab hours
9	Create a Simple Calculator using Objective-C Language	3 lab hours
10	Write an Objective-C program that displays the Phrase “Hello World”	1 lab hours
11	Write an Objective-C program for displaying the value of variables	2 lab hours
12	Write an Objective-C program for displaying the sum and subtraction of two variables	2 lab hours
13	Write an Objective-C program for displaying the multiplication and division of the two variables	2 lab hours
14	Write an Objective-C program that demonstrate control structure of Objective-C language	3 lab hours
15	Create a Button using Objective-C	2 lab hours
16	Make an interactive project based on iOS App using Objective-C Language	3 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.	**PO2**
CO2	Understand and know how to use properly UIKit, asynchronous code, CoreImage, NSURLSession and JSON MapKit and CoreLocation, AutoLayout, Source Control, Core Data, Animation, and the app submission process.	**PO3**
CO3	Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects	**PO5**
CO4	Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on Appstore.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS363A	Fundamentals of iOS Development Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 255A	Operating Systems Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

List of Experiments (Indicative)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**
8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical	**4 lab hours**
9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS381A	**Practical Training – I**	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enable students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS325A	**Employability and Analytical Skills-II**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

16. Analytical and Calculative skills
7. Technical Knowledge
8. Logic building
9. Communication skills
10. Grooming
11. Presentation skills
12. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	**Course Outcome**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- General speaking -Just a minute session,
- Reading news clippings in the class,
- Extempore speech, expressing opinions,
- Making requests/suggestions/complaints, telephone etiquette.
- Professional Speaking
- Elocutions
- Debate

Quant

- Mensuration.

Reasoning

- Number Series, Alpha-Numeric Series.

UNITII

- Describing incidents and developing positive nonverbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)
- Group discussion,
- Intricacies of a group discussion, topics for GD (with special focus on controversial topics),
- Structure of participation in a group discussion,
- Words often mis-used, words often mis-spelt,
- Multiple meanings of the same word (differentiating between meanings with the help of the given context),
- Business idioms and expressions foreign phrases, Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

Reasoning

- Seating Arrangement, Puzzle.
- Blood Relation, Coding & Decoding.

UNIT III

- Group discussion Advance
- Role Plays
- Video Showcasing
- Just a minute rounds
- Extempore
- Presentations – Team and Individual
- Team Lead activities
- Debates
- Free speech sessions

Reasoning

- Seating Arrangement, Puzzle.
- Data Sufficiency.
- Ranking Test, Venn-diagram, Statement and Conclusion, Statement and Inferences, Statement and Course of Action, Statement and Assumptions, Syllogism.

UNIT IV

- Professional grooming
- Inter personal skills,
- brushing up on general awareness,
- latest trends in their respective branches,
- resume preparation,
- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities, Importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

ETCS412A	**Compiler Design**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.

A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.

Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.

Type Checking: Type systems, Specification of a simple type checker.

Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.

Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.

Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, “Principles of Compiler Design”, Pearson Education.

Reference Books/Materials

1. Andrew L. Appel, “Modern Compiler Implementation in C”,Delhi, Foundation Books.
2. Dick Gruneet. Al., “Modern Compiler Design”, Wiley Dreamtech.
3. R. J. Schalkoff, “Artificial Intelligence – An Engineering Approach”, McGraw Hill Int. Ed. Singapore.
4. M. Sasikumar, S. Ramani, “Rule Based Expert Systems”, Narosa Publishing House.
5. Tim Johns, “Artificial Intelligence, Application Programming”, Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**
CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**

CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**
CO5	Distinguish between computability and non-computability and Decidability and undecidability.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS309A	**Neural Networks and Deep Learning**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Neural Network, Feed Forward and Backpropogation.

CO2. Tensorflow and Keras.

CO3. RNN, CNN, Autoencoders.

Catalog Description

The course begins with key concepts of neural networks, feed-forward neural network, and backpropogation. The student gets an opportunity to learn the programming languages (TensorFlow) to design the deep learning models. The student learns the concepts behind CNN, RNN, LSTM, Autoencoders, and GANs. The hands on learning will help build strong knowledge base for designing advanced deep learning models.

Course Content

Unit I: **10 lecture hours**

The neural network: The neuron, linear perceptron, feed-forward neural network, limitations of linear neurons, sigmoid, tanh, relu neurons, softmax output layer, information theory, cross entropy, Kullback-Leibler divergence.

Unit II: **10 lecture hours**

Training feed-forward neural network: Gradient Descent, delta rules and learning rates, gradient descent with sigmoidal neurons, the back propagation algorithms, stochastic and mini batch gradient descent, test sets, validation sets and over fitting, preventing over fitting.

Unit III: **10 lecture hours**

TensorFlow: Computation graphs, graphs, sessions and fetches, constructing and managing graph, flowing tensors, sessions, data types, tensor arrays and shapes, names, variables, placeholders and simple optimization, linear regression and logistic regression using tensorflow.

Unit IV: **07 lecture hours**

Implement Neural Network: Introduction to Keras, Build neural network using Keras, Evaluating models, data preprocessing, feature engineering, feature learning, over fitting, under fitting, weight regularization, dropout, universal workflow of deep learning.

Text Books

1.Francois Chollet, Deep Learning with Python, First Edition, Manning Publications.

Reference Books/Materials

1. Reza Zadeh, Bharath Ramsundar, Tensor Flow for Deep Learning, O'Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Neural Network, Feed Forward and Backpropogation.	**PO2**
CO2	Tensorflow and Keras.	**PO2**
CO3	RNN, CNN, Autoencoders.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Neural Networks and Deep Learning	-	3	-	2	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS354A	**Deep Learning Practical with Python, TensorFlow and Keras**	L	T	P	C
Version 1.0		-	-	4	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Implementation of Neural Network, Feed Forward and Backpropagation.

CO2. Implementation of Tensorflow and Keras.

CO3. Design RNN, CNN, Autoencoders.

Catalog Description

This course complements ETCS309A. It enables them to write algorithms/programs for Implementing Scilit-learn, matplotlib, tensorflow and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS309A.

Text Books

1.Francois Chollet, Deep Learning with Python, First Edition, Manning Publications.

<u>Reference Books/Materials</u>

1. Reza Zadeh, Bharath Ramsundar, Tensor Flow for Deep Learning, O'Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implementation of Neural Network, Feed Forward and Backpropagation.	**PO2**
CO2	Implementation of Tensorflow and Keras.	**PO2**
CO3	Design RNN, CNN, Autoencoders.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 354A	Deep Learning Practical with Python, Tensor Flow and Keras	-	3	-	2	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS313A	**Data Science - Tools and Techniques**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the conceptual framework of Big Data, Virtualization, MapReduce, HDFS, Pig, Hive, Spark, ZooKeeper, HBase.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Concepts of Hadoop and HDFS.

CO2. Concepts of MapReduce.

CO3. Big data tools Pig, Hive, Spark, Zookeeper, HBase.

Catalog Description

The student learns the architecture of HDFS and MapReduce along with other tools such as pig, hive, spark, Zookeeper, HBase.

Course Content

Unit I: **08 lecture hours**

Big Data: Fundamentals of Big Data, defining big data, building successful big data management architecture, big data journey.

Big Data Types: Structured and unstructured data types, real time and non-real time requirements.

Distributed Computing: History of distributed computing, basics of distributed computing.

Unit II: **07 lecture hours**

Big Data Technology Foundation: Big Data stack, redundant physical infrastructure, security infrastructure, operational databases, organising data services and tools, analytical data warehouse, big data analytics

Virtualization: Basics of virtualization, hypervisor, abstraction and virtualization, implementing virtualization with big data

Cloud and Big Data: Defining cloud, cloud deployment and delivery models, cloud as an imperative for big data, use the cloud for big data.

Unit III: **08 lecture hours**

Operational Databases: Relational database, nonrelational database, key-value pair databases, document databases, columnar databases, graph databases, spatial databases.

MapReduce Fundamentals: Origin of MapReduce, map function, reduce function, putting map and reduce together, optimizing map reduce.

Hadoop: Discovering Hadoop, Hadoop distributed file system, Hadoop MapReduce, Hadoop file system, dataflow, Hadoop I/O, data integrity, compression, serialization, file-based data structure.

Unit IV: **07 lecture hours**

Avro: Avro data types and schemas, in-memory serialization and deserialization, avro datafiles, schema resolution

Pig: Comparison with databases, pig latin, user defined functions, data processing operators

Hive: Running hive, comparison with traditional databases, HiveQL, tables, querying data, user-defined functions

Spark: Resilient distributed datasets, shared variables, anatomy of a spark job run, executors and cluster managers,

HBase: HBasics, concepts, clients, HBase vs RDBMS, Praxis

ZooKeeper: ZooKeeper services, building application with ZooKeeper.

Text Books

1.Tom White, Hadoop: The Definitive Guide, Fourth Edition, Shroff Publishers & Distributers Private Limited.

Reference Books/Materials

1. James Warren and Nathan Marz, Big Data: Principles and Best Practices of Scalable Real-time Data Systems, Manning Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Concepts of Hadoop and HDFS.	**PO2**
CO2	Concepts of MapReduce.	**PO3**
CO3	Big data tools Pig, Hive, Spark, Zookeeper, HBase.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 313A	Data Science - Tools and Techniques	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS311A	**Natural Language Processing**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The ultimate objective of NLP is to read, decipher, understand, and make sense of the human languages in a manner that is valuable.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Understand approaches to syntax and semantics in NLP.

CO2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Understand current methods for statistical approaches to machine translation.

CO4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

Catalog Description

This course is designed to teach the principles and methods of statistical natural language processing and provide hands-on experience of text analysis using Python. Processing text data is crucial in many domains such as computer science, journalism, social science, psychology, political science, etc. In this era of internet and social media, data is generated in such a huge volume and in such a high speed that it is practically impossible to process it and find insightful patterns out of it in traditional way. That is why students, instructors, and researchers of various domains are embracing computational tools to perform statistical textual content analysis. This course will enable students to perform large-scale statistical analysis of textual data in authoritative way and find useful patterns from the data. The expertise of natural language processing is also highly coveted in industries.

Course Content

Unit I: **08 lecture hours**

Introduction to NLP: Natural Language Processing in real world, What is language, Approached to NLP.

Build NLP model: Eights Steps for building NLP Model, Web Scrapping.

Unit II: **07 lecture hours**

Text Representation: Basic Vectorization, One-Hot Encoding, Bag of Words, Bag of N Grams, TF-IDF, Pre-trained Word Embedding, Custom Word Embeddings, Vector Representations via averaging, Doc2Vec Model, Visualizing Embeddings using TSNW and Tensorbaord.

Text Classification: Application of Text Classification, Steps for building text classification system, Text classification using Naïve Bayes Classifier, Logistic Regression, and Support Vector Machine, Neural embedding for Text Classification, text classification using deep learning, interpret text classification model.

Unit III: **08 lecture hours**

Information Extraction: Applications of Information Extraction, Processes for Information Extraction. Key phrase Extraction, Named Entity Recognition, Disambiguation and linking of named entity, Relationship extraction.

Chatbot: Real life applications of chatbot, Chatbot Taxonomy, Dialog Systems, Process of building a dialog, Components of Dialog System, End to End Approach, Rasa NLU.

Unit IV: **07 lecture hours**

NLP for social media: Application of NLP in social media, challenges with social media, Natural Language Processing for Social Data, Understanding Twitter Sentiments, Identifying memes and Fake News.

NLP for E-Commerce: E-commerce catalog, Search in E-Commerce, How to build an e-commerce catalog, Review and Sentiment Analysis, Recommendations for E-Commerce.

Text Books

1.Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, O'Reilly Media.

Reference Books/Materials

1. Christopher Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, The MIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand approaches to syntax and semantics in NLP.	**PO2**
CO2	Understand approaches to discourse, generation, dialogue and summarization within NLP.	**PO2**
CO3	Understand current methods for statistical approaches to machine translation.	**PO5**
CO4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Cours e Code	Course Title	PO1	PO2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 311A	Natural Langua ge Process ing	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS330A	**Communication & Analytical Skills 3**	**3**	**1**	**0**	**0**	**4**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	**Course Outcome**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- Answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities,
- importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

- handling stress,
- Suggestions for responding to tough/unknown questions, preparation on self and personality development

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNITII

- Profile Building On LinkedIn
- Resume Building
- Video CV building.
- Professional Grooming
- E mail Writing

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT III

- Interview Role Plays
- Individual Intro Video making
- Team Building sessions
- Self-analysis
- Telephone etiquettes

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT IV

- Industry readiness (Resume writing, grooming, GDPI etc.)
- Grooming
- Mock sessions
- FAQs discussions
- Multiple Test series
- Brush-up on GDPI and Industry readiness

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests

One to One Feedback sessions

ETCS356A	**Data Science - Tools and Techniques Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the conceptual framework of Big Data, Virtualization, MapReduce, HDFS, Pig, Hive, Spark, ZooKeeper, HBase.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Concepts and implementation of Hadoop and HDFS.

CO2. Concepts and implementation of MapReduce.

CO3. Usage of Big data tools Pig, Hive, Spark, Zookeeper, HBase.

Catalog Description

This course complements ETCS313A. It enables them to learn and implement Hadoop, HDFA, MapReduce algorithms/programs. It enables them the Usage of Big data tools Pig, Hive, Spark, Zookeeper, HBase for implementing database operations, machine learning algorithms.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS313A.

Text Books

1.Tom White, Hadoop: The Definitive Guide, Fourth Edition, Shroff Publishers & Distributers Private Limited.

Reference Books/Materials

1. James Warren and Nathan Marz, Big Data: Principles and Best Practices of Scalable Real-time Data Systems, Manning Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Concepts and implementation of Hadoop and HDFS.	**PO2**
CO2	Concepts and implementation of MapReduce.	**PO3**
CO3	Usage of Big data tools Pig, Hive, Spark, Zookeeper, HBase.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 356A	Data Science - Tools and Techniques Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS352A	Natural Language Processing Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The ultimate objective of NLP is to read, decipher, understand, and make sense of the human languages in a manner that is valuable.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Understand and implement approaches to syntax and semantics in NLP.

CO2. Understand and implement approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Analysis of current methods for statistical approaches to machine translation.

CO4. Usage of machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

Catalog Description

This course complements ETCS311A. It enables them to write algorithms/programs for Implementing Scilit-learn, matplotlib, tensorflow and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS311A.

Text Books

1.Steven Bird, Ewan Klein and Edward Loper, Natural Language Processing with Python, First Edition, O'Reilly Media.

Reference Books/Materials

1. Christopher Manning and Hinrich Schütze, Foundations of Statistical Natural Language Processing, The MIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and implement approaches to syntax and semantics in NLP.	**PO3**
CO2	Understand and implement approaches to discourse, generation, dialogue and summarization within NLP.	**PO3**
CO3	Analysis of current methods for statistical approaches to machine translation.	**PO2**
CO4	Usage machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 352A	Natural Language Processing Lab	-	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS420A	**Graph Theory**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **11lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on

Graph, The Travelling Salesman Problem, Sperner's Leema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley's Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: **11 lecture hours**

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski's Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: **12lecture hours**

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: **8 lecture hours**

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

1. Introduction to Graph Theory, R.J. Wilson, Pearson Education.

2. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
3. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3	-	1	-	-	-	-	-	2	3	1	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCS320A	**Distributed Computing Systems**	L	T	P	C
Version 1.0		3			3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

Unit I: **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

Unit II: **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

Unit III: **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

Unit IV: **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and

Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

1. Ajay D. Kshemkalyani and MukeshSinghal, "Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press.

Reference Books/Materials

1. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", Pearson Education, 4th Edition.
2. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	**PO1**
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	**PO1**
CO3	Design and implement distributed applications	**PO3**
CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 320A	Distributed Computing Systems	2	-	3	3	-	-	-	-	-	-	-	2	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

1. Understand the Concept of Parallel Processing and its applications.
2. Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. Develop the Pipelining Concept for a given set of Instructions.
5. Distinguish the performance of pipelining and non-pipelining environment in a processor.
6. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein's Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl's law, Gustafson'slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

Unit III: **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Unit IV: **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

5. Advanced computer architecture, Kai Hwang, McGraw Hills.
6. Computer Organization and Design, D. A. Patterson and J. L. Hennessey,Morgan Kaufmann.

REFERENCE BOOKS:

15. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
16. Memory System and Pipelined Processors,HarveyG.Cragon,Narosa Publication.
17. Parallel Computer, V.Rajaranam&C.S.R.Murthy, PHI.
18. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
19. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
20. Computer Organization & Architecture, Stalling W, PHI.
21. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**

CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 422A	**Computer Vision**	L	T	P	C
Version 1.0		2	0	0	2
Pre-requisites/Exposure	Basics of image processing				
Co-requisites	--				

Course Objectives

Upon completion of the course the students will be able to:-

1. To introduce students the fundamentals of image formation;

2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;

3. To develop an appreciation for various issues in the design of computer vision and object recognition systems; and

4. To provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcomes

On completion of this course, the students will be able to:-

CO1.Understand and master basic knowledge, theories and methods in image processing and computer vision.

CO2. Identify, formulate and solve problems in image processing and computer vision.

CO3.Implement and test some fundamental computer vision algorithms e.g. image filtering, restoration, image segmentation, camera calibration.

CO4. Design and demonstrate a working computer vision system through team research project, and project report, presentation.

CO5.Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.

Catalog Description

This course introduces students to fundamental problems in image processing and computer vision, as well as their state-of-the-art solutions. Topics covered in detail include: image formation, image filtering, camera geometry, thresholding and image segmentation, edge, point and feature detection, geometric frameworks for vision, 3D visual reconstruction etc. The course features extensive practical components including computer labs and Term Research projects that provide students with the opportunity to practice and refine their skills in image processing and computer vision.

Course Content

Unit I: 8 lecture hours

Overview, computer imaging systems, lenses, Image formation and sensing,Image analysis, pre-processing and Binary image analysis. Edge detection, Edge detection performance, Hough transform, corner detection

Unit II: 12 lecture hours

Segmentation, Morphological filtering, Fourier transform. Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools,Feature analysis, feature vectors, distance /similarity measures, data pre-processing.

Unit III: 12 lecture hours

Pattern Analysis:Clustering: K-Means, K-Medoids, Mixture of GaussiansClassification: Discriminant Function, Supervised, Un-supervised, SemisupervisedClassifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA,ICA, and Non-parametric methods.

Unit IV: 8 lecture hours

Recent trends inActivity Recognition, computational photography, Biometrics.

Text Books

1. Computer Vision: Algorithms and Applications by Richard Szeliski.

Reference Books/Materials

1. Deep Learning, by Goodfellow, Bengio, and Courville.
2. Dictionary of Computer Vision and Image Processing, by Fisher et al.
3. Haralick& Shapiro, "Computer and Robot Vision", Vol II
4. EmanueleTrucco and AlessandroVerri "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998.
5. Olivier Faugeras, "Three-Dimensional Computer Vision", The MIT Press, 1993.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Explain in detail DBMS architecture.	**PO1**
CO2	Explain in detail query processing and techniques involved in query optimization	**PO4**
CO3	Explain the principles of concurrency control.	**PO5**
CO4	Explain the principles of recovery management.	**PO2**
CO5	Know recent developments and active research topics in database.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS610A	COMPUTER VISION	2	-	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS464A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**

CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 464A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS453A	Computer Vision Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning of Image Processing & Computer Vision				
Co-requisites	--				

Course Objectives

The students will be able to get an idea on:

1. To introduce students the fundamentals of image formation;
2. To introduce students the major ideas, methods, and techniques of computer vision and pattern recognition;
3. To develop an appreciation for various issues in the design of computer vision and object recognition systems; and
4. To provide the student with programming experience from implementing computer vision and object recognition applications.

Course Outcomes

Upon completion of the course the students will be able to:

CO1.Understand and master basic knowledge, theories and methods in image processing and computer vision.

CO2. Identify, formulate and solve problems in image processing and computer vision.

CO3.Implement and test some fundamental computer vision algorithms e.g. image filtering, restoration, image segmentation, camera calibration.
CO4. Design and demonstrate a working computer vision system through team research project, and project report, presentation.
CO5.Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition.

Catalog Description

This course introduces students to fundamental problems in image processing and computer vision, as well as their state-of-the-art solutions. Topics covered in detail include: image formation, image filtering, camera geometry, thresholding and image segmentation, edge, point and feature detection, 3D visual reconstruction etc. The course features extensive practical components including computer labs and term Research projects that provide students with the opportunity to practice and refine their skills in image processing.

Course Content

1	Write a program for image enhancement.	**2 lab hours**
2	Write a program for image compression.	**2 lab hours**
3	Write a program for color image processing.	**2 lab hours**
4	Write a program for image segmentation.	**2 lab hours**
5	Write a program for image morphology.	**2 lab hours**
6	Write a program for Image Restoration.	**4 lab hours**
7	Write a program for Edge detection.	**4 lab hours**
8	Write a program for Blurring 8 bit color versus monochrome.	**4 lab hours**
9	Write a Program with illustration of Line Detection Using	**4 lab hours**

	Hough Lines.	
10	Write a program for Image Restoration.	**4 lab hours**
11	To create a program for segmentation of an image using watershed transforms.	

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and master basic knowledge, theories and methods in image processing and computer vision.	**PO1**
CO2	Identify, formulate and solve problems in image processing and computer vision.	**PO4**
CO3	Implement and test some fundamental computer vision algorithms e.g. image filtering, restoration, image segmentation, camera calibration.	**PO5, PSO3, PO9**
CO4	Design and demonstrate a working computer vision	**PO2**

	system through team research project, and project report, presentation.	

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS453A	Computer Vision Lab	2	2	-	3	3	-	-		3	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS481A	**Practical Training – II**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Completion of sixth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS481A	Practical Training – II	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS314A	**Data Visualization and Story Telling**	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Design and create data visualizations.

CO2. Conduct exploratory data analysis using visualization.

CO3. Craft visual presentations of data for effective communication.

Catalog Description

Designed to help you become a successful Data Analyst, this Subject is for those just starting their career in Analytics. It will teach you how to understand data fundamental, analyse the data methodology, techniques, powerful dashboards, Power BI & Visualization power of data along with a strong focus on case studies to ensure hands on learning. Once armed with analytics, you will also learn the powerful data visualization tool like Advanced version of Excel, Power Map, Power BI, Business Intelligence software, Tableau desktop version & other open source tools etc to present your analysis.

Course Content

Unit I: **12 lecture hours**

INTRODUCTION TO DATA HANDLING Overview of Data analysis, Introduction to Data visualization, Working with statistical formulas - Logical and financial functions , Data Validation & data models, Power Map for visualize data , Power BI-Business Intelligence , Data Analysis using statistical methods, Dashboard designing.

Unit II: **12 lecture hours**

INTRODUCTION TO DATA MANIPULATION USING FUNCTION: Heat Map, Tree Map, Smart Chart, Azure Machine learning , Column Chart, Line Chart , Pie,Bar, Area, Scatter Chart, Data Series, Axes, Chart Sheet , Trendline , Error Bars, Sparklines, Combination Chart, Gauge, Thermometer Chart, Gantt Chart , Pareto Chart etc , Frequency Distribution, Pivot Chart, Slicers , Tables: Structured References, Table Styles , What-If Analysis: Data Tables| Correlation model |Regression model.

Unit III: **10 lecture hours**

Data Strategy & Consumer behaviour Analytics: Understanding Product & Category, Competitive Analysis, Market Share understanding- Market potential Index, Seasonality-Sales Trending, Consumer behaviour Analytics-MIND AND MARKET FACTORS, Budget planning & Execution- MIMI, Regression & Correlation Analysis for Sales trending, Forecasting method with predictive investment modelling, Cohort Analysis, Google Analytics(GA), Case Studies-Assignments.

Unit IV: **12 lecture hours**

TABLEAU SOFTWARE: GETTING STARTED WITH TABLEAU SOFTWARE: What is Tableau? What does the Tableau product suite comprise of? How Does Tableau Work? Tableau Architecture, What is My Tableau Repository? Connecting to Data & Introduction to data source concepts, Understanding the Tableau workspace, Dimensions and Measures, Data Types & Default Properties, Building basic views, Saving and Sharing your work-overview.

Text Books

1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

Reference Books/Materials

1. Julie Steele, Noah Iliinsky, Beautiful Visualization, Looking at Data Through the Eyes of Experts, O′Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and create data visualizations.	**PO3**
CO2	Conduct exploratory data analysis using visualization.	**PO4**
CO3	Craft visual presentations of data for effective communication.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 314A	Data Visualization and Story Telling	-	-	3	3	-	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS461A	**Data Visualization and Story Telling Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

Course Outcomes

On completion of this course, the students will be able to learn:-

CO1. Design and implement data visualizations on real life datasets.

CO2. Conduct exploratory data analysis using visualization.

CO3. Prepare visual presentations of data for effective communication.

Catalog Description

This course complements ETCS314A. It enables them to write algorithms/programs for Implementing Open Source, Platform Independent, Machine Learning Operations and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using R and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS314A.

Text Books

1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

Reference Books/Materials

1. Julie Steele, Noah Iliinsky, Beautiful Visualization, Looking at Data Through the Eyes of Experts, O′Reilly.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and implement data visualizations on real life datasets.	**PO3**
CO2	Conduct exploratory data analysis using visualization.	**PO4**
CO3	Prepare visual presentations of data for effective communication.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Cours e Code	Course Title	PO1	PO2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 461A	Data Visuali zation and Story Telling Lab	-	-	3	3	-	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS422A	**Cloud Computing**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: **10 lecture hours**

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: OpenStack.

Unit II: **6 lecture hours**

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: **10 lecture hours**

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, BigTable, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

1. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS422A	Cloud Computing	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCA 362A	**Cloud Computing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. Define & implement Virtualization using different types of Hypervisors
2. Describe steps to perform on demand application delivery
3. Examine the installation and configuration of Open stack cloud
4. Analyze and understand the functioning of different components involved in Amazon web services cloud platform.
5. Describe the functioning of Platform as a Service
6. Design & Synthesize Storage as a service using own Cloud

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, concepts, principles and applications. This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). A variety of real case studies and existing in market cloud- based tools will be identified and studied in order to provide students with a close overview to Cloud Computing applications.

Course Content

1	Development of applications on Google app engine.	**4 lab hours**
2	Case study of private Cloud setup through OpenStack	**4 lab hours**
3	Case study of private Cloud setup through CloudStack	**4 lab hours**
4	Case study of XEN/VMware/KVM hypervisor	**4 lab hours**
5	Case study of Amazon ec2.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA362A	Cloud Computing Lab	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS418A	**Internet of Things**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O devices, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: **8 lecture hours**

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit II: **9 lecture hours**

Network and Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit III: **10 lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12 lecture hours**

Developing IoT's: Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. WaltenegusDargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS418A	Internet of Things	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS457A	**Internet of Things Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCS 418A. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

List of Experiments (Indicative)

1	Start Raspberry Pi and try various Linux commands in command terminal window	**2 lab hours**
2	Read your name and print Hello message with name.	**2 lab hours**
3	Read two numbers and print their sum, difference, product and division.	
4	Word and character count of a given string	
5	Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input	**2 lab hours**

6	Print a name 'n' times, where name and n are read from standard input, using for and while loops.	
7	Handle Divided by Zero Exception.	
8	Print current time for 10 times with an interval of 10 seconds.	**2 lab hours**
9	Read a file line by line and print the word count of each line.	
10	To inter face LED/Buzzer with Arduino/Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.	**2 lab hours**
11	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	**2 lab hours**
12	To install MySQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
13	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
14	Write a programonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedataandprint it.	**2 lab hours**
15	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumidity data to TCP client when requested..	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**

CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS457A	Internet of Things Lab	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 424A	**Data Warehouse And Data Mining**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component

CO2. Appreciate the strengths and limitations of various data mining and data warehousing models

CO3. Explain the analyzing techniques of various data

CO4. Describe different methodologies used in data mining and data ware housing

CO5. Compare different approaches of data ware housing and data mining with various technologies

Catalog Description

This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Content

Unit I: **10 lecture hours**

Introduction: Evolution Of Data Warehousing (Historical Context), The Data Warehouse - a Brief Overview, Characteristics, Operational Database Systems and Data Warehouse(OLTP & OLAP), Data Marts, Metadata.

Principles of Data Warehousing(Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

Unit II: **08 lecture hours**

Multidimensional Data Models: Types of Data and Their Uses, From Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Fact Tables, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas- STAR Schema, Snowflake Schema, OLAP, OLAP Operations**,** Hypercube**,** ROLAP, MOLAP, From Data warehousing to Data Mining, Data warehouse Usage

Unit III: **12 lecture hours**

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

Unit IV: **10 lecture hours**

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

Text Books

Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd

Reference Books/Materials

1. W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley.
2. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons.
3. Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the functionality of the various data mining and data warehousing component	**PO1**
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models	**PO1**
CO3	Explain the analyzing techniques of various data	**PO2**
CO4	Describe different methodologies used in data mining and data ware housing	**PO2**
CO5	Compare different approaches of data ware housing and data mining with various technologies	**PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS463A	Data warehouse and data mining	3	3	2	3	3	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS463A	**Data Warehousing And Data Mining Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Able to get the acquaintance to WEKA tool

CO2. Competent to preprocess the data for mining

CO3. Proficient in generating association rules

CO4. Able to build various classification models

CO5. Able to realize clusters from the available data

Catalog Description

The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. At the end, the course provides a comparison of different conceptions of data mining.

List of Experiments (Indicative)

1	Demonstration of data pre-processing on datasets	**2 lab hours**
2	To list all the categorical (or nominal) attributes and the real valued attributes	**4 lab hours**
3	Create a data classification model using decision tree	**4 lab hours**
4	Create a data classification model using Naive Bayes	**2 lab hours**
5	Create a data classification model using rule based classifies	**2 lab hours**
6	Create a data classification model using statistical classifiers.	**4 lab hours**
7	Create a data classification model using neural networks.	**4 lab hours**
8	Create a data classification model	**4 lab hours**
9	Demonstrate the working of k-means algorithm for clustering the data.	**4 lab hours**
10	Create a clustering model using hierarchical clustering algorithm.	**2 lab hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to get **the** acquaintance to WEKA tool	**PO5**
CO2	Competent to preprocess the data for mining	**PO2**
CO3	Proficient in generating association rules	**PO4**
CO4	Able to build various classification models	**PO3**
CO5	Able to realize clusters from the available data	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 463A	Data warehouse and data mining Lab	2	2	3	3	3	-	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.

CO2. Write technical documentation for the project implement.

CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.

CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship	-	3	3	-	3	2	-	-	-	-	-	-	3	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

6.2.3 Syllabus of Courses specific to B.Tech - Computer Science Engineering with specialization in Full Stack Development in Association with Xebia

SEMESTER I

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-I	3	1	0	4
2	ETPH109A	Engineering Physics	3	1	0	4
3	UCES125A	Environmental Studies	3	0	0	3
4	ETME101A	Basics of Mechanical Engineering	3	1	-	4
5	ETME151A	Basics of Mechanical Engineering Lab	0	0	2	1
6	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	0	4
7	ETEC151A	Basics of Electrical & Electronics Engineering Lab	0	0	2	1
8	ETPH151A	Engineering Physics Lab	0	0	2	1
9		Open Elective	4	-	-	4
TOTAL			**19**	**4**	**6**	**26**

SEMESTER II

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-II	3	1	0	4
2	ETEC 215A	Embedded Robotics and IOT	4	0	0	4
3	ETCH119A	Engineering Chemistry	3	1	0	4
4	ETME 155A	Engineering Graphics Lab	0	0	3	1.5
5	ETCH159A	Engineering Chemistry Lab	0	0	2	1
6	ETCS120A	Software Craftsmanship	3	0	0	3
7	ETME 157A	Workshop Practices	-	-	3	1.5
8	ETCS162A	Software Craftsmanship Using Python	0	0	2	1
9		Open Elective	4	-	-	4
TOTAL			**17**	**2**	**10**	**24**

SEMESTER III

SNo	Course Code	Course Title	L	T	P	C
1	ETMA215A	PROBABILITY AND STATISTICS	4	-	-	4
2	ETCS225A	Front End Development with ReactJS	3	-	-	3
3	ETCS231A	Discrete Mathematics	3	1	-	4
4	ETCS217A	Data Structures	3	1	-	4
5	UCDM301A	Disaster Management	3	-	-	3
6	ETCS227A	Backend Development using NodeJS	3	-	-	3
7	ETCS257A	Data Structures Lab	-	-	2	1
8	ETCS267A	Front End Development with ReactJS Lab Lab	-	-	2	1
9	ETCS269A	Backend Development using NodeJS Lab	-	-	2	1
10		MOOC	1	-	-	2
TOTAL			**20**	**2**	**6**	**26**

SEMESTER IV

SNo	Course Code	Course Title	L	T	P	C
1	ETCS222A	Computer Organization & Architecture	3	1	-	4
2	ETCS220A	Analysis and Design of Algorithms	3	1	-	4
3	ETCS307A	Database Management Systems	3	1	-	4
4	ETCS224A	Database Engineering with MongoDB	3	-	-	3
5	ETMC602A	Essentials of Organizational Behaviour	3	-	-	3
6	ETCS270A	Database Engineering with MongoDB Lab	-	-	2	1
7	ETCS 355A	Database Management Systems Lab	-	-	2	1
8	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
9	ETCS228A	Employability and Analytical Skills-I	2	-	-	2
10	ETCS226A	Test Automation	3	-	-	3
11	ETCS272A	Test Automation Lab	-	-	2	1
TOTAL			**20**	**3**	**8**	**27**

SEMESTER V

SNo	Course Code	Course Title	L	T	P	C
1	ETCS321A	Mobile Application Development	3	-	-	3
2	ETCS 214A	Theory of Computation	3	1	-	4
3	ETCS211A	Operating Systems	3	1	-	4
4	ETCS304A	Computer Networks	3	1	-	4
5	ETCS365A	Computer Networks Lab	-	-	2	1
6	ETCS371A	Mobile Application Development Lab	-	-	2	1
7	ETCS367A	iOS Development Lab	-	-	2	1
8	ETCS255A	Operating System Lab	-	-	2	1
9	ETCS381A	Practical Training I	-	-	-	1
10	ETCS325A	Employability and Analytical Skills-II	2	-	-	2
TOTAL			**14**	**3**	**8**	**22**

SEMESTER VI

SNo	Course Code	Course Title	L	T	P	C
1	ETCS412A	Compiler Design	3	1	-	4
2	ETCS309A	CI/CD & Microservice	3	-	-	3
3	ETCS354A	DevOps & Automation	3	-	-	3
4	ETCS401A	Artificial Intelligence	3	1	-	4
5	ETCS451A	Artificial Intelligence Lab	-	-	2	1
6	ETCS330A	Employability and Analytical Skills-III	2	-	-	2
7	ETCS356A	CI/CD & Microservice Lab	-	-	2	1
8	ETCS352A	DevOps & Automation Lab	-	-	2	1
9	**Elective**					
(i)	ETCS420A	Graph Theory	3	-	-	3
(ii)	ETCS320A	Distributed Computing Systems	3	-	-	3
(iii)	ETCS310A	Advanced Computer Architecture	3	-	-	3
TOTAL			**17**	**2**	**6**	**22**

SEMESTER VII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS422A	Computer Vision	2	-	-	2
2	ETCS475A	Major Project(Xebia)	-	-	-	6
3		Boot Camp (Training and Placement)	2	-	-	-
4	ETCS453A	Computer Vision Lab	-	-	2	1
5	ETCS481A	Practical Training II	-	-	-	2
6	ETCS314A	Data Visualization and Story Telling	2	-	-	2
7	ETCS461A	Data Visualization and Story Telling Lab	-	-	2	1
8	**Elective (with Lab)**					
(i)	ETCS422A	Cloud Computing	4	-	-	4
	ETCA362A	Cloud Computing Lab	-	-	2	1
(ii)	ETCS418A	Internet of Things	4	-	-	4
	ETCS457A	Internet of Things Lab	-	-	2	1
(iii)	ETCS424A	Data Warehousing and Data Mining	4	-	-	4
	ETCS463A	Data Warehousing and Data Mining Lab	-	-	2	1
TOTAL			**10**	**-**	**6**	**19**

SEMESTER VIII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS490A	**Industrial Internship**	-	-	-	12
TOTAL			-	-	-	**12**

Total Credits [C]	**178**

ETMA105A	**Applied Mathematics-I**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO7. Understand and able to apply the basic concept of complex variable.

CO8. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO9. Applied the differential calculus method for curve tracing and radios of curvatures.

CO10. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO11. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO12. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices.The concepts of applied mathematics-Iare extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10 lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, “ Higher Engineering Mathematics”, Khanna Publishers.
2. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**
CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA 105A	Applied Mathematics - I	3	3	3	3	-	-	-	1	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon of non dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations.

CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens 'Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young's double slit experiment, Newton's rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

11. Ian G. Main, Oscillations and waves in physics
12. H.J. Pain, The physics of vibrations and waves
13. E. Hecht, Optics

14. A. Ghatak, Optics
15. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETPH109A	Engineering Physics	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.
2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

1. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

1. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
2. S.E. Manahan, Environmental Chemistry, CRC Press.
3. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
4. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	**PO7**

CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	**PO8**
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

ETEC 101A	**Basics Of Electrical & Electronics Engineering**	L	T	P	C
		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.

2. B L Thareja – A text book of Electrical Technology

3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10th Edition.

4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27th Edition.

REFERENCE BOOKS:

5. Electrical Engineering Fundamentals, V.Del Toro

6. Problems in Electrical Engineering – Parker Smith.S.

3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.

4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.

5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME 101A	**Basics of Mechanical Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

1. Understanding Basic Materials and Manufacturing Processes.
2. Have an understanding of laws of thermodynamics and Thermodynamic processes.
3. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
4. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.

CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.

CO3. Get the knowledge about power transmission method and device with mechanical properties.

CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: **10 lecture hours**

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: **12 lecture hours**

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison's ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: 6 lecture hours

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

15. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
16. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
17. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
18. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
19. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
20. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
21. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

7. Strength of Materials – Popov, Pub. PHI, New Delhi.
8. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
9. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics and workshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**
CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 101A	Basics of Mechanical Engineering	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.
CO2. Better insight aboutwave nature of light.
CO3. Better understanding of data interpretation which enhances problem solving approach.
CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

1	To determine the value of acceleration due to gravity using Bar pendulum	2 lab hours
2	To determine the value of acceleration due to gravity using Kater's pendulum	2 lab hours
3	To determine the wavelength of sodium light using Newton`s ring apparatus	2 lab hours
4	To determine the wavelength of prominent lines of mercury by plane diffraction grating	2 lab hours
5	To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer	2 lab hours
6	To determine the specific rotation of cane sugar solution with the help of half shade polarimeter	2 lab hours
7	To determine the wavelength of He-Ne LASER using transmission diffraction grating	2 lab hours

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	**PO1& PO2**
CO2	Better insight aboutwave nature of light.	**PO4**
CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETEC 151A	**Basics Of Electrical & Electronics Engineering Lab**	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1.To understand the DC and AC circuit behavior by application of network theorems.

2.To elaborate complex signals over oscilloscope devices with reading.

3.To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.

4.To analyses the BJT in build circuits as per practical application point of view.

5.To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

Course Outcomes

On completion of this course, the students will be able to

CO1 Get an exposure to common electrical components and their ratings.

C02 Determines proper electrical connections as per wires of appropriate ratings.

CO3 Understand the usage of common electrical measuring instruments.

CO4 Ability to discover applications related to seven segment display type of devices

Catalog Description

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application inreal time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:
   i) Cathode ray oscilloscope (CRO)
   j) Multimeter (Analog and Digital)
   k) Function generator
   l) Power supply
2. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
3. To Verify the Thevenin' s and Norton's theorem
4. To Verify the Superposition theorem
5. To measure voltage, current and power in an A.C. circuit by LCR impedance method
6. To study the frequency response curve in series and parallel R-L-C circuit
7. a)Plot the forward and reverse V-I characteristics of P-N junction diode
   b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME151A	**Basics of Mechanical Engineering Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

1. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
2. To study simple screw jack and compound screw jack and determine their efficiency.
3. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)
4. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
5. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
6. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.

CO2 Understand concepts of screw jack, friction, law of moments.

CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.

CO4 Get the knowledge of various Refrigeration and Air- Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**
CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**
CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air-Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA105A	**Applied Mathematics-II**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of Laplace transform.

CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters,

Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field,	**PO8**

	gradient, divergence and curl.	
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**
CO4	Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.	**PO4**
CO5	Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.	**PO3**
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
ETMA105A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

ETCS104A	**Introduction To Computer Science And Programming In Python**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS104A	Introduction to Computer Science and Programming in Python	2	2	2	2	-	-	-	-	-	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12^{th} Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to

become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **8 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **12 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: **10 lecture hours**

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na2SO4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the understanding of Technology involved in improving quality of water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.	**PO1**
CO3	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its properties and applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 215A	EMBEDDED ROBOTICS & IOT	L	T	P	C
		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				
Course Teacher(s):	Dr. Bhavesh Vyas				

Course Objectives

1. To understand the basic of embedded system.
2. To analyse the complex circuits and build new designs of analog to digital conversion.
3. To be able to perform analysis of embedded C based circuits with robotics applications
4. To gain basic insight of semiconductors-based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

- CO1 Understand and apply Knowledge of Embedded Circuits in making real time projects to solve engineering difficulties.
- C02 Determine an understanding of logic gates and C language with electronic devices.
- CO3 Demonstrate the ability to identify digital circuits. Utilization of the knowledge gained to solve problems.
- CO4 Create an understanding of IOT & robotics devices application to existing setup.

Program Articulation Matrix: Mapping of Course Outcome (COs) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4

ETEC215 A ER&I	CO1	1	-	-	-	-	-	-	-	-	-	1	-	1	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
	CO3	1	-	-	-	1	-	-	2	-	-	-	-	-	-
	CO4	-	2	3	3	-	-	-	-	-	-	-	1	-	-
	CO5	-	-	-	-		1	2	-	-	-	-	2	-	-
	CO6	-	-	-	-	1	-	-	-	-	2	3	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Examination Scheme:

Evaluation Scheme:

	Evaluation Component	Duration	Weightage (%)	Date
1	**Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	20	
2	Mid Term Examination (Written Examination)	90Minutes	20	
3	Attendance		10	
4	End Term Examination (Written Examination)	180 Minutes	50	
Total			**100**	

Course Content

UNIT I **14 HRS**

Introduction to Embedded Systems: Introduction to Basic Electronics Components, Introduction to Microprocessor and Microcontroller, Difference between Microcontroller and Microprocessor, Introduction to Embedded System, Introduction to Arduino, Types of

Microcontrollers: 8051, PIC, AVR & ARM, parametric comparisons among all, Reading Datasheet & schematics, Advantages of Atmega328,

UNIT II **10 HRS**

Robotics: Introduction to robotics: Automation, Anatomy of Robots, Manipulators, Robot control, History of robots, Types of Main bodies, Tasks Planning for robots, Robot's mechanisms, Manipulators Mechanisms-I, Actuators for Robots-Part I, Stepper motor, Performance characteristic, Sensors and Controllers in robots, Incremental encoders and position, velocity sensors, external state sensors.

UNIT III **8 HRS**

Internet of Things: IOT Introduction and its Architecture (Why, What and How), Hardware in IOT, Future in IOT, Introduction to ESP8266 Wi-Fi Module, IOT Basics: IOT definition, applications in different domains, trends in IOT market. IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP).

UNIT IV **8 HRS**

Sensors For Robotic Applications: Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer. Recap of Embedded C: Datatypes, Array, Conditional Statements, Functions / Call-back function Structures, Pointers, Storage classes, Embedded Controllers, Interfaces, Operating System - Industrial Robots.

TEXT BOOKS:

1. Peter Marwedel, book: Embedded System Design 1st Edition, Kindle Edition
2. "Rise of the Robots: Technology and the Threat of a Jobless Future", by Author: Martin Ford
3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", by Author: Peter Mckinnon

REFERENCE BOOKS:

1. "Making Simple Robots: Exploring Cutting-Edge Robotics with Everyday Stuff", by Author: Kathy Ceceri
2. "Real-Time C++: Efficient Object-Oriented and Template Microcontroller Programming", 14 May 2018 by Author Christopher Kormanyos.

Teacher(s) Contact: Students can contact the Course Teacher(s) in his/her chamber for consultation in the hour specified.				
Name	**Room**	**Ext.No.**	**e-mail**	**Consultation Hr.**
Dr. Bhavesh Vyas	B212	-	Bhavesh.vyas@krmangalam.edu.in	Lunch Hours

****Weekly Evaluation**			
Week	**Topic(s)**	****Mode of Evaluation**	**Marks/Grade**

ETME155A	Engineering Graphics Lab	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.
CO2. Interpret engineering drawings using fundamental technical mathematics.
CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.
CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS150A	**Introduction To Computers And Programming In Python Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**
4	Develop programs to understand the control structures of python	**2 lab hours**

5	Develop programs to implement function with stress on scoping	**2 lab hours**
6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**
8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS150A	Introduction to computers and programming in python Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH159A	**Engineering Chemistry Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

Course Outcomes

On completion of this course, the students will be able to

CO1: Analyze & generate experimental skills.
CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.
CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.
CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.
CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.
CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution, given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hyposolution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol	**2 lab hours**

	formaldehyde resins.	
13	Determination of dissolved oxygen in the given sample of water.	**2 lab hours**
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH159	Engineering Chemistry Lab	3	3	2	-	2	-	-	-	3	-	-	3	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need
3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**

CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1 To understand distributions in the study of the joint behaviour of two random variables.

2 To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.

3 To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least

squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

1. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
2. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
3. Jim Pitman (1993). Probability, Springer-Verlag.
4. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
5. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel

Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**

CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**
CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**
CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3	-	-	-	-	-	2	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 321A	Java Programming	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	NIL				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn the syntax of Java Programming Language and implement applications using it.

CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.

CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.

CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.

CO5. Understand multithreading and evaluate exception handing to create new applications.

CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

Course Content

Unit I: **10 lecture hours**

Introduction to Java: Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping: if..else, switch,?: operator, while, do, for statements, labeled loops, jump statements: break, continue return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.

Unit II: **9 lecture hours**

Arrays and Strings: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy, abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Unit III: **9 lecture hours**

Exceptional Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Run able interface, inter thread Communication, suspending, resuming and stopping threads.

Unit IV: **12 lecture hours**

Input/output Programming: Basics Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (Lang, util, io, net).

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes.

Text Books

1. Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

Reference Books/Materials

1. Herbert Schildt, “Java – The Complete Reference”, Oracle Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**

CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS321A	Java Programming	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS231A	**Discrete Mathematics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: **10 lecture hours**

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: **12 lecture hours**

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: **12 lecture hours**

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: **10 lecture hours**

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI.

2. NarsinghDeo, "Graph Theory with Application to Engineering and Computer Science", PHI.

3. J. P. Trembly& P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill.

4. Vinay Kumar, "Discrete Mathematics", BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS217A	**Data Structures**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course

introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: **8 lecture hours**

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: **12 lecture hours**

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: **12 lecture hours**

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: **8 lecture hours**

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

5. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.
6. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books/Materials

5. Schaum's outline series, "Data Structure", McGraw Hills.
6. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
UCDM301A	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: **8 lecture hours**

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: **8 lecture hours**

Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

Unit III: **6 lecture hours**

Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment
- Post Disaster effects and Remedial Measures.
- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology,
- Long-term Counter Disaster Planning
- Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

- **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

- **Liability for Mass Disaster**

  - Statutory liability
  - Contractual liability
  - Tortiousliability
  - Criminal liability
  - Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

- **Project Work**: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	**20**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non-governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management	-	-	2	-	-	3	-	-	-	-	-	2	-	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**Java Programming Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn to the syntax of Java Programming Language and implement applications in it.
CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.
CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.
CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.
CO5. Understand multithreading and evaluate exception handing to create new applications.
CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

This course complements ETCS 323A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments help organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**
3	Write a java program to implement various shapes using Abstract class	**2 lab hours**
4	Write a java program to demonstrate interfaces.	**2 lab hours**
5	Write a java program to show multithreaded producer and consumer application.	**2 lab hours**
6	Create a java programs that make use of all the 5 exception keywords.	**4 lab hours**
7	Convert the content of a given file into the uppercase content of the same file.	**4 lab hours**
8	Develop a scientific calculator using swings.	**4 lab hours**
9	Create a servlet that uses Cookies to store the number of times a user has visited your servlet.	**4 lab hours**
10	Create a simple java bean having bound and constrained properties.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS361A	Java Programming Lab	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS257A	Data Structures Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in

variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours
14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS222A	Computer Organization and Architecture	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: **12 lecture hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: **10 lecture hours**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions.

Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: **8 lecture hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: **10 lecture hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

5. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

6. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the concepts of microprocessors, their principles and practices.	**PO2**
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors.	**PO3**
CO3	Organize a modern computer system and be able to relate it to real examples.	**PO4**
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO5	Implement embedded applications using Emulator.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS220A	**Analysis And Design Of Algorithms**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

5. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
6. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.

2. Y. Langsamet. al., “Data Structures using C and C++”, PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS307A	Database Management Systems	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the data base design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: **12 lecture hours**

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: **8 lecture hours**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: **12 lecture hours**

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: **8 lecture hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

1. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs

	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**
CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**
CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems	-	2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer's needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The

organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace.
This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception- concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

2. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

7. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
8. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
9. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning

10. McSchane, Organisation Behaviour, TMH, New Delhi
11. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
12. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi
13. Nelson, Debra L and James C Quick, Organisational Behaviour, Thomson Learning

Course Code	Course Title	L	T	P	S	C
ETCS228A	**Employability and Analytical Skills-I**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

- Communication
- Introduction to Communication
- Types of communication
- Verbal & Nonverbal Communication
- Barriers to Communication
- Body language
- Listening Skills
- Activity

- Language

Quant

- Types of Numbers, HCF & LCM
- Divisibility, Unit Digit.
- Remainder Theorem
- Equations, Factorials.

UNITII

Objective: Vocabulary Building & general speaking

- Basic Grammar/Communicative Grammar
- Parts of speech
- Nouns
- Pronouns: Noun Pronoun Agreement, Types with special emphasis over relative pronouns
- Verbs: Introduction Principal verbs and auxiliary verbs, subject-verb agreement
- Adjectives: degrees of comparison
- Adverb: Types and its usage in sentences
- Conjunctions: Coordinating and Co-relative conjunctions
- Prepositions
- Articles: Definite and Indefinite articles
- Usage of Tenses
- Subject verb agreement
- Sentence Structure: Simple Complex and Compound sentences
- Clauses

Quant

- Progression, Probability
- Permutation & Combination, Average, Percentage, Ratio & Proportion, Partnership
- Profit & Loss

UNIT III

- Word formation
- Theory and exercise
- Synonyms and antonyms
- One-word substitutes
- Idioms
- Phrasal verbs
- Pair of words
- Homonyms, hyponyms, hypernyms
- Linking words: sequencing of sentences (to form a coherent paragraph

- Paragraph writing
- Supplying a suitable beginning/ending/middle sentence to make the paragraph coherent
- Idiomatic language (with emphasis on business communication),
- Punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices

Quant

- Problems on Ages.
- Mixture & Allegation
- Simple Interest & Compound Interest.

UNIT IV

- General Essay writing, Writing Issues and Arguments (with emphasis on creativity and analysis of a topic)
- Story writing
- Business letter writing: Guidance in framing a 'Statement of purpose',
- Letters of Recommendation
- Email writing, email and business letter writing etiquette,
- Letters of complaints/responses to complaint

Quant

- Time & Work.
- Time, Speed and Distance
- Data Interpretation.

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To facilitate students in Database design.
4. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the

system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

Text Books

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books/Materials

1. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.
2. "Fundamentals of Database Systems", R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS	Database		3	3		2								3		

355A	Management Systems Lab															

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	**Analysisand Design of Algorithms Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. To understand concept of different sorting algorithms.
2. To understand the concept of dynamic programming.
3. To understand concept of divide and conquer.
4. To understand Dictionary (ADT)
5. To understand concept of greedy algorithms.
6. To understand concept & features like max heap, min heap

Course Outcomes

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**
6	To Implement Matrix Chain Multiplication.	**2 lab hours**

7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	Theory of Computation	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: **12 lecture hours**

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: **8 lecture hours**

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: **12 lecture hours**

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: **8 lecture hours**

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

3. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education.

2. Thomas A. Sudkamp,” An Introduction to the Theory of Computer Science, Languages and Machines”, Third Edition, Pearson Education.

3. Raymond Greenlaw an H.James Hoover, “Fundamentals of Theory of Computation, Principles and Practice”, Morgan Kaufmann Publishers.

4. MichealSipser, “Introduction of the Theory and Computation”, Thomson Brokecole.

5. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**
CO2	Design finite automata to accept a set of strings of a language	**PO3**
CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	**Operating Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit III: **12 lecture hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: **10 lecture hours**

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

3. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

9. Tannenbaum, "Operating Systems", PHI, 4th Edition.
10. William Stallings, "Operating Systems Internals and Design Principles", PHI
11. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
12. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS304A	**Computer Networks**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
C02. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: **8 lecture hours**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired

LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**iOS Development Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of MAC OS				
Co-requisites	--				

Course Objectives

1. To be able to Understand the basics of Swift Programming language
2. To Learn and practice the iOS App that commonly used in iPhone
3. Understand and able to differentiate between the concept of iOS and OS X
4. Apply necessary information to program for automation.
5. Apprehend the basic of MAC System and how to publish iOS app on AppStore.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.

C02. Understand and know how to use properly UIKit, asynchronous code, Core Image, NSURL Session and JSON Map Kit and Core Location, Auto Layout, Source Control, Core Data, Animation, and the app submission process.

CO3. Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects

CO4. Organize their code professionally using objects and blocks, prototype several entry-level apps and try to publish on App store.

Catalog Description

The objective of the course is to provide skills to develop applications for OS X and iOS. It includes introduction to development framework Xcode. Objective-C is used as programming language to develop the applications. Objective-C is the superset of the C programming language and provides object-oriented capabilities and a dynamic runtime. Objective-C inherits the syntax, primitive types, and flow control statements of C and adds syntax for defining classes and methods. The list of experiments helps in making static and dynamic iOS App on based on real time systems.

List of Experiments (Indicative)

1	Case Study of Objective-C language.	2 lab hours
2	Case study of Windows and MAC systems	2 lab hours
3	Case Study of XCode based on MAC Systems	2 lab hours
4	Design an App for UISwitch based on Objective-C language	2 lab hours
5	Design an App for UISlider based on Objective-C language	2 lab hours
6	Design an App for UIStepper based on Objective-C language	2 lab hours
7	Write a program for creating Story Boards	2 lab hours
8	Design an App for UIAnimation based on Objective-C language	3 lab hours
9	Create a Simple Calculator using Objective-C Language	3 lab hours
10	Write an Objective-C program that displays the Phrase “Hello World”	1 lab hours
11	Write an Objective-C program for displaying the value of variables	2 lab hours
12	Write an Objective-C program for displaying the sum and subtraction of two variables	2 lab hours
13	Write an Objective-C program for displaying the multiplication and division of the two variables	2 lab hours
14	Write an Objective-C program that demonstrate control structure of Objective-C language	3 lab hours
15	Create a Button using Objective-C	2 lab hours

16	Make an interactive project based on iOS App using Objective-C Language	3 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.	**PO2**
CO2	Understand and know how to use properly UIKit, asynchronous code, CoreImage, NSURLSession and JSON MapKit and CoreLocation, AutoLayout, Source Control, Core Data, Animation, and the app submission process.	**PO3**
CO3	Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects	**PO5**
CO4	Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on Appstore.	**PO9**

Course Code	Course Title	Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS367A	iOS Development Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
2. Provides a practical approach to assemble Ethernet/Internet networking.
3. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.
CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.
CO3. Demonstrate and measure different network scenarios and their performance behavior.
CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra's algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**
12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)	**4 lab hours**

14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**
CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**

CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 255A	**Operating Systems Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

List of Experiments (Indicative)

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**
8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c)	**4 lab hours**

	Hierarchical	
9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS381A	Practical Training – I	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enable students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I			3		3		2			3					

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS325A	**Employability and Analytical Skills-II**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- General speaking -Just a minute session,
- Reading news clippings in the class,
- Extempore speech, expressing opinions,
- Making requests/suggestions/complaints, telephone etiquette.
- Professional Speaking
- Elocutions
- Debate

Quant

- Mensuration.

Reasoning

- Number Series, Alpha-Numeric Series.

UNITII

- Describing incidents and developing positive nonverbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)
- Group discussion,
- Intricacies of a group discussion, topics for GD (with special focus on controversial topics),
- Structure of participation in a group discussion,
- Words often mis-used, words often mis-spelt,
- Multiple meanings of the same word (differentiating between meanings with the help of the given context),
- Business idioms and expressions foreign phrases, Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

Reasoning

- Seating Arrangement, Puzzle.
- Blood Relation, Coding & Decoding.

UNIT III

- Group discussion Advance
- Role Plays
- Video Showcasing
- Just a minute rounds
- Extempore
- Presentations – Team and Individual
- Team Lead activities
- Debates
- Free speech sessions

Reasoning

- Seating Arrangement, Puzzle.
- Data Sufficiency.
- Ranking Test, Venn-diagram, Statement and Conclusion, Statement and Inferences, Statement and Course of Action, Statement and Assumptions, Syllogism.

UNIT IV

- Professional grooming
- Inter personal skills,
- brushing up on general awareness,
- latest trends in their respective branches,
- resume preparation,
- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities, Importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

ETCS375A	**Mini Project**	L	T	P	C
Version 1.0		-	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 375A	Mini Project Lab	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS412A	**Compiler Design**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.
A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.
Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.
Type Checking: Type systems, Specification of a simple type checker.
Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.
Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.
Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, "Principles of Compiler Design", Pearson Education.

Reference Books/Materials

1. Andrew L. Appel, "Modern Compiler Implementation in C",Delhi, Foundation Books.
2. Dick Gruneet. Al., "Modern Compiler Design", Wiley Dreamtech.
5. R. J. Schalkoff, "Artificial Intelligence – An Engineering Approach", McGraw Hill Int. Ed. Singapore.
6. M. Sasikumar, S. Ramani, "Rule Based Expert Systems", Narosa Publishing House.
7. Tim Johns, "Artificial Intelligence, Application Programming", Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**
CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**
CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**
CO5	Distinguish between computability and non-computability and Decidability and undecidability.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS401A	**Artifical Intelligence**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO2. Apply these techniques in applications which involve perception, reasoning and learning.
CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO4. Acquire the knowledge of real world Knowledge representation.
CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: **8 lecture hours**

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: **12 lecture hours**

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: **12 lecture hours**

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: **8 lecture hours**

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

1. Artificial Intelligence, P. H. Winston,Pearson Education.
2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
3. Principles of AI, N. J. Nilsson, Narosa Publishing House

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	**PO1**
CO2	Apply these techniques in applications which involve perception, reasoning and learning.	**PO4**

CO3	Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.	**PO5**
CO4	Acquire the knowledge of real world Knowledge representation.	**PO2**
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.	**PO3**
CO6	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.	**PO3**
CO7	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS401A	ARTIFICAL INTELLIGENCE	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 202A	**Software Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

<u>Course Objectives</u>

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

<u>Course Outcomes</u>

On completion of this course, the students will be able to:

CO1. To learn and understand the Concepts of Software Engineering

CO2. To Learn and understand Software Development Life Cycle

CO3. To apply the project management and analysis principles to software project development.

CO4. To apply the design & testing principles to software project development.

CO5. Ability to execute tests, design test cases, use test tools, etc.

CO6. To Study about Software maintenance tools

<u>Catalog Description</u>

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

<u>Unit I:</u> **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

Unit II: **12 lecture hours**

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO,COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding:TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

Unit III: **8 lecture hours**

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

Unit IV: **12 lecture hours**

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International.
2. R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
3. W.S. Jawadekar, "Software Engineering – Principles and Practices", McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, TMH.
2. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
3. I. Sommerville, "Software Engineering", Addison Wesley.
4. K. Chandrasehakhar, "Software Engineering & Quality Assurance", BPB.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 202A	Software Engineering	3	3	3	3	3	-	-	-	-	-	2	-	3	3	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS451A	**Artificial Intelligence Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs

CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving

CO4. Know how to build simple knowledge-based systems

CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**
2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	**PO1**
CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	**PO4**
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	**PO5**
CO4	Know how to build simple knowledge-based systems	**PO2**
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS451A	ARTIFICIAL INTELLIGENCE LAB	2	3	-	3	3	-	-	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS330A	**Communication & Analytical Skills 3**	**3**	**1**	**0**	**0**	**4**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	**Course Outcome**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PSO 1**	**PSO 2**	**PSO 3**
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- Answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities,
- importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

- handling stress,
- Suggestions for responding to tough/unknown questions, preparation on self and personality development

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNITII

- Profile Building On LinkedIn
- Resume Building
- Video CV building.
- Professional Grooming
- E mail Writing

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT III (Lectures-)

- Interview Role Plays
- Individual Intro Video making
- Team Building sessions
- Self-analysis
- Telephone etiquettes

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT IV

- Industry readiness (Resume writing, grooming, GDPI etc.)
- Grooming
- Mock sessions
- FAQs discussions
- Multiple Test series
- Brush-up on GDPI and Industry readiness

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

ETCS420A	**Graph Theory**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **10 lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on

Graph, The Travelling Salesman Problem, Sperner'sLeema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley's Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: **10 lecture hours**

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski's Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: **12lecture hours**

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: **8 lecture hours**

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

7. Introduction to Graph Theory, R.J. Wilson, Pearson Education.

8. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
9. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3	-	1	-	-	-	-	-	2	3	1	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS309A	**Distributed Computing Systems**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

Unit I: **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

Unit II: **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

Unit III: **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

Unit IV: **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and

Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

3. Ajay D. Kshemkalyani and MukeshSinghal, "Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press.

Reference Books/Materials

5. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", Pearson Education, 4^{th} Edition.
6. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	**PO1**
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	**PO1**
CO3	Design and implement distributed applications	**PO3**

CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Distributed Computing Systems	2	-	3	3	-	-	-	-	-	-	-	2	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

1. Understand the Concept of Parallel Processing and its applications.
2. .Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. .Develop the Pipelining Concept for a given set of Instructions.
5. .Distinguish the performance of pipelining and non-pipelining environment in a processor.
6. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein’s Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl’s law, Gustafson’slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

<u>Unit III:</u> **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

<u>Unit IV:</u> **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

7. Advanced computer architecture, Kai Hwang, McGraw Hills.
8. Computer Organization and Design, D. A. Patterson and J. L. Hennessey, Morgan Kaufmann.

REFERENCE BOOKS:

22. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
23. Memory System and Pipelined Processors, HarveyG.Cragon, Narosa Publication.
24. Parallel Computer, V.Rajaranam & C.S.R. Murthy, PHI.

25. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
26. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
27. Computer Organization & Architecture, Stalling W, PHI.
28. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**
CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS462A	Major Project	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS464A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS481A	**Practical Training – II**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Completion of sixth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS481A	Practical Training – II	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 426A	**Natural Language Processing**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Explain the concepts of artificial intelligence to solve problems.
2. Appraise the concept of natural languages processing components using NLP tools.
3. Create scalable applications that can robustly handle errors in runtime applications.
4. Designing applications using pre-built NLP processor.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand approaches to syntax and semantics in NLP.

CO2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Understand current methods for statistical approaches to machine translation.

CO4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Catalog Description

The intent of the course is to present a fairly broad graduate-level introduction to Natural Language Processing, the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical and neural-network learning algorithms that train on (annotated) text corpora to automatically acquire the knowledge needed to perform the task. Class lectures will discuss general issues as well as present abstract algorithms. Implemented versions of some of the algorithms will be provided in order to give a feel for how

the systems discussed in class "really work" and allow for extensions and experimentation as part of the course projects.

Course Content

Unit I: **10 lecture hours**

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

Unit II: **7 lecture hours**

Introduction to semantics and knowledge representation, Some applications like machine translation, database interface. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

Unit III: **7 lecture hours**

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

Unit IV: **10 lecture hours**

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Text Books

3. Natural Language Understanding, Allen, Pearson Education.

Reference Books/Materials

5. Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, D. Jurafsky & J. H. Martin, Pearson Education.
6. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich SchutzeMIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand approaches to syntax and semantics in NLP.	**PO1**
CO2	Understand approaches to discourse, generation, dialogue and summarization within NLP.	**PO2**
CO3	Understand current methods for statistical approaches to machine translation.	**PO3**
CO4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 426A	Natural Language Processing	2	3	3	-	-	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS465A	**Natural Language Processing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.

The experiments in this lab are arranged in a logical sequence to inculcate a new concept at every step, starting from very basic ones to advanced ones.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.

CO2. Able to design, implement, and analyze NLP algorithms

CO3. Able to design different language modeling Techniques

CO4. Analyze large volume text data generated from a range of real-world applications.

Course Description

The lab complements ETCS426A.

List of Experiments (Indicative)

1	To learn about morphological features of a word by analysing it. (Word Analysis)	**2 lab hours**
2	To generate word forms from root and suffix information. (Word Generation)	**2 lab hours**
3	Understanding the morphology of a word by the use of Add-Delete table (Morpgology)	**2 lab hours**
4	To learn to calculate bigrams from a given corpus and calculate probability of a sentence. (N-Grams)	**2 lab hours**

5	To learn how to apply add-one smoothing on sparse bigram table. (N-Gram Smoothing)	**2 lab hours**
6	To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model. (POS Tagging – Hidden Markov Model)	**2 lab hours**
7	To find POS tags of words in a sentence using Viterbi decoding. (POS Tagging – Viterbi Decoding).	**2 lab hours**
8	To know the importance of context and size of training corpus in learning Parts of Speech. (Building POS Tagger).	**2 lab hours**
9	To understand the concept of chunking and get familiar with the basic chunk tagset. (Chunking).	**2 lab hours**
10	To know the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking. (Building Chunker)	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.	**PO2, PO3, PO4**
CO2	Able to design, implement, and analyze NLP algorithms.	**PO2, PO3, PO4**
CO3	Able to design different language modeling techniques	**PO3, PO5**
CO 4	Analyze large volume text data generated from a range of real-world applications.	**PO2, PO3, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS465A	Natural Language Processing Lab	-	2	3	3	3	-	-	-	-	-	-	3	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS 424A	**Data Warehouse And Data Mining**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component

CO2. Appreciate the strengths and limitations of various data mining and data warehousing models

CO3. Explain the analyzing techniques of various data

CO4. Describe different methodologies used in data mining and data ware housing

CO5. Compare different approaches of data ware housing and data mining with various technologies

Catalog Description

This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Content

Unit I: **10 lecture hours**

Introduction: Evolution Of Data Warehousing (Historical Context), The Data Warehouse - a Brief Overview, Characteristics, Operational Database Systems and Data Warehouse(OLTP & OLAP), Data Marts, Metadata.

Principles of Data Warehousing(Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

Unit II: **12 lecture hours**

Multidimensional Data Models: Types of Data and Their Uses, From Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Fact Tables, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas- STAR Schema, Snowflake Schema, OLAP, OLAP Operations**,** Hypercube**,** ROLAP, MOLAP, From Data warehousing to Data Mining, Data warehouse Usage

Unit III: **12 lecture hours**

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

Unit IV: 12 lecture hours

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

Text Books

Kamber and Han, “Data Mining Concepts and Techniques”, Hartcourt India P. Ltd

Reference Books/Materials

7. W. H. Inmon, “Building the operational data store”, 2nd Ed., John Wiley.
8. Paul Raj Poonia, “Fundamentals of Data Warehousing”, John Wiley & Sons.
9. Sam Anahony, “Data Warehousing in the real world: A practical guide for building decision support systems”, John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the functionality of the various data mining and data warehousing component	**PO1**
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models	**PO1**
CO3	Explain the analyzing techniques of various data	**PO2**
CO4	Describe different methodologies used in data mining and data ware housing	**PO2**
CO5	Compare different approaches of data ware housing and data mining with various technologies	**PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO 2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3

ETCS463A	Data warehouse and data mining	3	3	2	3	3	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS463A	**Data Warehousing And Data MiningLab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Able to get the acquaintance to WEKA tool

CO2. Competent to preprocess the data for mining

CO3. Proficient in generating association rules

CO4. Able to build various classification models

CO5. Able to realize clusters from the available data

Catalog Description

The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. At the end, the course provides a comparison of different conceptions of data mining.

List of Experiments (Indicative)

1	Demonstration of data pre-processing on datasets	**2 lab hours**
2	To list all the categorical (or nominal) attributes and the real valued attributes	**4 lab hours**
3	Create a data classification model using decision tree	**4 lab hours**
4	Create a data classification model using Naive Bayes	**2 lab hours**
5	Create a data classification model using rule based classifies	**2 lab hours**
6	Create a data classification model using statistical classifiers.	**4 lab hours**
7	Create a data classification model using neural networks.	**4 lab hours**
8	Create a data classification model	**4 lab hours**
9	Demonstrate the working of k-means algorithm for clustering the data.	**4 lab hours**
10	Create a clustering model using hierarchical clustering algorithm.	**2 lab hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to get **the** acquaintance to WEKA tool	**PO5**
CO2	Competent to preprocess the data for mining	**PO2**
CO3	Proficient in generating association rules	**PO4**
CO4	Able to build various classification models	**PO3**
CO5	Able to realize clusters from the available data	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 463A	Data warehouse and data mining Lab	2	2	3	3	3	-	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS423A	**Neural Networks**	L	T	P	C
Version 1.0		4	-	0	4
Pre-requisites/Exposure	Artificial Intelligence and Machine learning				
Co-requisites	--				

Course Objectives

1. To be able to understand the analogy of biological and artificial neural networks.

2. To be able to use learning methods, optimization techniques, activation functions, variable transformations, pattern storage networks during the designing of Machine learning models.

3.To be able to understand the role of data mining and data analytics while designing the algorithms by using neural networks.

4.How neural networks can be used in prediction models and competitive leanings.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand all terminologies that are used in Neural network designing.

CO2. Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.

CO3. Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.

CO4.Write an algorithm for prediction modeling with the best performance.

Catalog Description

This course imparts the basic concepts of neural network algorithms. It enables them to write algorithms for solving problems with the help of supervised and unsupervised learning techniques. The course of neural networks helps to organize the historical data in a variety of ways to solve future problems. The course introduces the basic concepts about neural network activation functions, hyper parameter selection techniques, optimization techniques, it also discusses the pattern storage networks, competitive learning architecture, and applications.

Course Content

Unit I: 8 lecture hours

Introduction to ANN: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks, Trends in Computing Comparison of BNN and ANN

Basics of Artificial Neural Networks: characteristics of neural networks terminology, models of neuron Mc Culloch - Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

Unit II: 12 lecture hours

Backpropagation networks: Architecture of feed forward network, single layer ANN: Adaptive filtering problem, Unconstrained Organization Techniques, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Unit III: 12 lecture hours

Activation & Synaptic Dynamics: Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network, Feed forward neural networks – Linear responsibility X-OR problem and solution, Analysis of pattern mapping networks summary of basic gradient search methods, Feedback neural networks - Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning

Unit IV: 8 lecture hours

Competitive learning neural networks: Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

Applications of ANN: Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.

Text Books

3. Neural networks A comprehensive foundations, Simon Haykin, Pearson Education

Reference Books/Materials

1. Artificial neural networks, B. Vegnanarayana, Prentice Hall of India (P) Ltd

2. Neural networks, Fuzzy logic and Genetic Algorithms, S. Rajsekaran , Vijayalakshmi Pari, PHI

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand all terminologies that are used in Neural network designing.	**PO1**
CO2	Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.	**PO1, PO2, PO4**

CO3	Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.	**PO5, PSO1, PSO2**
CO4	Write an algorithm for prediction modelingwith the best performance.	**PO5, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS423A	Neural Networks	2	3	-	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS460A	**Neural Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to

1. make students familiar with basic concepts and tool used in neural networks
2. teach students structure of a neuron including biological and artificial
3. teach learning in network (Supervised and Unsupervised)
4. teach concepts of learning rules.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems

CO2. Design single and multi-layer feed-forward neural networks

CO3. Understand supervised and unsupervised learning concepts & understand unsupervised learning

CO4. Apply convolution neural and recurrent neural net.

Course Description

The lab complements ETCS423A.

List of Experiments (Indicative)

1	To write a program to implement Perceptron	**2 lab hours**
2	To write a program to implement AND OR gates using Perceptron.	**2 lab hours**

3	To implement Crab Classification using pattern net	**2 lab hours**
4	To write a program to implement Wine Classification using Back propagation.	**2 lab hours**
5	To write a Script containing four functions Addition, Subtraction, Multiply and Divide functions	**2 lab hours**
6	Write a program to implement classification of linearly separable Data with a perceptron	**2 lab hours**
7	To study Long Short Term Memory for Time Series Prediction.	**2 lab hours**
8	To study Convolution Neural Network and Recurrent Neural Network.	**2 lab hours**
9	To study ImageNet, GoogleNet, ResNet convolutional Neural Networks	**2 lab hours**
10	To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems	**PO2, PO3,PO4**
CO2	Design single and multi-layer feed-forward neural	**PO2, PO3,**

	networks	**PO4, PO5**
CO3	Understand supervised and unsupervised learning concepts & understand unsupervised learning.	**PO2, PO3, PO4, PO5**
CO 4	Apply convolution neural and recurrent neural net.	**PO2, PO3, PO4, PO5, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS460A	Neural Networks Lab	-	3	3	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS422A	**Cloud Computing**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multi core operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMW are, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: 10 lecture hours

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: Open Stack.

Unit II: 6 lecture hours

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: 10 lecture hours

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

3. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS422A	Cloud Computing	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

<table>
<tr><td>ETCA 362A</td><td>Cloud Computing Lab</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Version 1.0</td><td></td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>Pre-requisites/Exposure</td><td colspan="5">Practical learning</td></tr>
<tr><td>Co-requisites</td><td colspan="5">--</td></tr>
</table>

Course Objectives

1. Define & implement Virtualization using different types of Hypervisors

2. Describe steps to perform on demand application delivery

3. Examine the installation and configuration of Open stack cloud

4. Analyze and understand the functioning of different components involved in Amazon web services cloud platform.

5. Describe the functioning of Platform as a Service

6. Design & Synthesize Storage as a service using own Cloud

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, concepts, principles and applications. This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). A variety of real case studies and existing in market cloud- based tools will be identified and studied in order to provide students with a close overview to Cloud Computing applications.

Course Content

1	Development of applications on Google app engine.	**4 lab hours**
2	Case study of private Cloud setup through Open Stack	**4 lab hours**
3	Case study of private Cloud setup through Cloud Stack	**4 lab hours**
4	Case study of XEN/VMware/KVM hypervisor	**4 lab hours**
5	Case study of Amazon ec2.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA362A	Cloud Computing Lab	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS421A	**Internet of Things**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O devices, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: **8 lecture hours**

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit II: **9 lecture hours**

Network and Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit III: **10 lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12 lecture hours**

Developing IoT's: Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS421A	Internet of Things	2	3	3	3	-	-	-	-	-	-	-	-	3	3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS457A	**Internet of Things Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCS 418A. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

List of Experiments (Indicative)

1	Start Raspberry Pi and try various Linux commands in command terminal window	**2 lab hours**
2	Read your name and print Hello message with name.	**2 lab hours**
3	Read two numbers and print their sum, difference, product and division.	
4	Word and character count of a given string	
5	Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input	**2 lab hours**
6	Print a name 'n' times, where name and n are read from standard input, using for and while loops.	

7	Handle Divided by Zero Exception.	
8	Print current time for 10 times with an interval of 10 seconds.	**2 lab hours**
9	Read a file line by line and print the word count of each line.	
10	To inter face LED/Buzzer with Arduino/Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.	**2 lab hours**
11	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	**2 lab hours**
12	To install MySQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
13	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
14	WriteaprogramonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedat aandprint it.	**2 lab hours**
15	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumidity data to TCP client when requested..	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS457A	Internet of Things Lab	2	3	3	3	-	-	-	-	-	-	-	-	3	3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS425A	Machine Learning	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	NIL				
Co-requisites					

Course Objectives

1. To develop an appreciation for what is involved in learning from data.
2. To understand a wide variety of learning algorithms.
3. To understand how to apply a variety of learning algorithms to data.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. To become familiar with Dimensionality reduction Techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge about basic concepts of Machine Learning

CO2. Identify machine learning techniques suitable for a given problem.

CO3. Solve the problems using various machine learning techniques.

CO4. Apply neural networks for suitable application.

CO5. Use a tool to implement typical clustering algorithms for different types of applications.

CO6. Apply Dimensionality reduction techniques.

Catalog Description

This course imparts comprehensive introduction to various topics in machine learning. It enables them to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content

UNIT I **8 Hours**

Machine learning: overview and survey of its applications. Problem of induction and statistical inference: Input-output functions, Boolean functions, Parametric and nonparametric inference, Probability, uncertainty and Bayes theorem, Introduction to typical learning tasks: regression, pattern recognition, feature selection, classification, clustering, rule induction (association). Model validation techniques: cross-validation, leave-one-out, majority, Measures of performance (sensitivity, specificity, ROC curves, etc.)

UNIT II **8 Hours**

Dimensionality Reduction: Subset Selection, Shrinkage Methods, Principle Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification

UNIT III **9 Hours**

Neural Networks: Non-linear Hypothesis, Biological Neurons, Model representation, Intuition for Neural Networks, Multiclass classification, Cost Function, Back Propagation Algorithm, Back Propagation Intuition, Weights initialization, Neural Network Training.

Support Vector Machines: Optimization Objective, Large Margin Classifiers, Kernels, SVM practical considerations

UNIT IV **10 Hours**

Supervised Learning: Additive model: logistic regression, Generative model: naïve Bayes classifier, Discriminative model: Decision trees, Neural networks.

Unsupervised Learning: Clustering: k-means, hierarchical, self-organizing map, EM algorithm, Feature selection principal component analysis.

Reinforcement Learning: Q-learning, Value function approximation, Policy search.

Text Books:

3. The Elements of Statistical Learning, T. Hastie, R. Tibshirani and J. H. Friedman, Springer.

Reference Books:

19. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
20. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
21. Jain V.K., "Data Sciences", Khanna Publishing House, Delhi.
22. Jain V.K., "Big Data and Hadoop", Khanna Publishing House, Delhi.
23. Jeeva Jose, "Machine Learning", Khanna Publishing House, Delhi.
24. Chopra Rajiv, "Machine Learning", Khanna Publishing House, Delhi.
25. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
26. http://www.deeplearningbook.org
27. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publisher

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Gain knowledge about basic concepts of Machine Learning	**PO1**
CO2	Identify machine learning techniques suitable for a given problem.	**PO4**
CO3	Solve the problems using various machine learning techniques.	**PO5**
CO4	Apply neural networks for suitable application.	**PO2**
CO5	Use a tool to implement typical clustering algorithms for different types of applications.	**PO3**
CO6	Apply Dimensionality reduction techniques.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS425A	Machine Learning	2	3	3	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS455A	**Machine Learning Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Develop the technical and practical skills to apply machine learning to solve real-world problems.
2. Explore regression as a supervised machine learning technique to predict a continuous variable (response or target) from a set of other variables (features or predictors)
3. Discover how variable selection and shrinkage methods are used to improve the efficiency of a regression model when applied to complex data sets
4. Explore classification as a supervised machine learning technique to predict binary (or discrete) response variables from a set of features
5. Understand what neural networks are, its most successful applications, and how it can be used within a business context

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the implementation procedures for the machine learning algorithms .

CO2. Design Java/Python programs for various Learning algorithms.

CO3. Apply appropriate data sets to the Machine Learning algorithms.

CO4. Identify and apply Machine Learning algorithms to solve real world problems.

Note: The programs can be implemented in either JAVA or Python.

1.For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.

2.Datasetscan be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Catalog Description

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as FIND-S, Candidate Elimination Algorithm, Decision tree (ID3 Algorithm), Back propagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbor Algorithm, Locally Weighted Regression Algorithm.

List of Experiments (Indicative)

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	**2 lab hours**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**2 lab hours**
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**2 lab hours**
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	**2 lab hours**
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**2 lab hours**

6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	**4 lab hours**
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	**4 lab hours**
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	**4 lab hours**
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	**4 lab hours**
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program**

		Outcomes
CO1	Understand the implementation procedures for the machine learning algorithms.	**PO2**
CO2	Design Java/Python programs for various Learning algorithms.	**PO3**
CO3	Apply appropriate data sets to the Machine Learning algorithms.	**PO5**
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS455A	Machine learning Lab	-	3	3	-	2	-	-	2	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.

C02. Write technical documentation for the project implement.

CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.

CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship		3	3		3	2							3		2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS120A	**Software Craftsmanship**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic Programming Skills				
Co-requisites	--				

Course Objectives

1. Be familiar with craftsmanship foundations

2. Understand the fundamental characteristics of good design

3. Characterize the code smells and identify the symptoms of poorly designed code

4. Master techniques of choosing the programming strategy

5. Develop skill in using framework and tools

6. Understand the concept of Testing, Debugging and refactoring

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the emergence of software craftsmanship, development model and paradigms

CO2. Understand Clean coding and its fundamental concepts

CO3. Explain the code structure with Classes, packages, and methods:

CO4. Describe code formatting and documentation

CO5. Describe the techniques and methods of Testing and Debugging

Catalog Description

This course gives learners a detailed overview of Software Craftsmanship and its associated concepts. It covers the essentials of craftsmanship and code design. The basics of code structure, code formatting and documentation are detailed out. The course also introduces testing and debugging. The learners will be able to explolre how to refactor the code and improving code structure, code base, useful software frameworks and tools, and the programming processes.

Course Content

Unit I: **8 lecture hours**

Introduction: Definition, History of the emergence of software craftsmanship, Software craftsmanship, Process versus paradigm, Software development processes, Software development models, Software design paradigms, Software development paradigms, Major programming paradigms Procedural programming paradigm, Object-oriented programming paradigm, Functional programming paradigm, Dimensions of craftsmanship, Craftsmanship - Mastery of the paradigm Describing and defining well-crafted code, Becoming a craftsman, The programming process

Unit II: **6 lecture hours**

Code Design: Clean code and its fundamental concepts, Code Design, Software design considerations, Kent Beck's principle of simple design, Fundamental characteristics of good design, Design Patterns: Reusing best practices, SOLID design principles, Programming Principles

Unit III: **8 lecture hours**

Code Structure: Classes, packages and methods: building blocks of code, organizing code: the size of methods and classes, what makes methods and classes "good", Software metaphors, Objects and data structures, data transfer objects, Using libraries, Overview of the best practices in structure: Law of Demeter and open close principle,

Unit IV: **6 lecture hours**

Code Formatting & Documentation: Introduction, Variants, Vertical Openness, Vertical Density, Distance and Ordering, Naming Best Practices, Intention-Revealing Names, Avoid Mental Mappings, Naming Classes, Methods and Functions, Comments, Writing Code Documentation

Unit V: **8 lecture hours**

Testing Debugging & Refactoring: Testing and Debugging, Basic Test-driven Development (TDD), Categories of TDD and Unit tests, Unit Testing Techniques, Automating Testing Using Junit, Refactoring: Improving Structure, Refactoring: Changing Code Structure without

Changing Functionality, The need for Refactoring, The Refactoring Process and the Different Levels of Refactoring, Refactoring Strategies, Code Smells: Symptoms of Poorly Designed Code, Categories of Code Smells, Code Base, Using Frameworks & Tools

Text Books

Robert C Martin, "Clean Code: A Handbook of Agile Software Craftsmanship", O'Reilly

Reference Books/Materials

1. Brian Allbee, "Hands on Software engineering with Python", O'Reilly
2. Pride Sandro Mancuso, "The Software Craftsman: Professionalism, Pragmatism", O'Reilly
3. Robert Martin, "Clean Architecture: A Craftsman's Guide to Software Structure and Design" Robert Martin Paperback
4. Pete McBreen, "Software Craftsmanship: The New Imperative", Addison-Wesley Professional

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the emergence of software craftsmanship, development model and paradigms.	**PO1**
CO2	Understand Clean coding and its fundamental concepts	**PO1, PO 2, PO 3, PO4**
CO3	Explain the code structure with Classes, packages, and methods:	**PO1, PO 3, PO4**
CO4	Describe code formatting and documentation	**PO1, PO 3, PO4, PO8**
CO5	Describe the techniques and methods of Testing and Debugging	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS120A	Software Craftsmanship	3	3	2	3	-	1	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS225A	**Front End Development with ReactJS**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic Programming Skills, Web Fundamentals HTML, CSS, JavaScript				
Co-requisites	--				

Course Objectives

- Discover how a Single Page React application differs from traditional web development frameworks.
- Use the new ES6 language features to write code. Create a React application from the ground up.
- Explain what React is and why it's useful.
- Investigate the fundamental architecture of a React application.
- Learn how forms can be created and validated using controlled components.

Course Outcomes

On completion of this course, the students will be able to:

CO1: Understand Specifications and Features of ES6

CO2: Explain the need of React and methods of how React Works

CO3: Discuss the essentials of working with JSX

CO4: Describe how elements are rendered

CO5: Explain Redux Concepts and Principles

Catalog Description

The course covers the essentials of React programming with details on fundamental architecture of a react application. The learning journey showcase the discovery of how a Single Page React application differs from traditional web development frameworks. The learners will be able to use the new ES6 language features to write code. Create a React application from the ground up.

Course Content

Unit I: **8 lecture hours**

ES6: Specifications and Features, Introduction, The let and const, The arrow functions, New Literal Syntax, Classes, Inheritance using extends, Default Parameter Values, Spread Operator (...), Iterators and Generators, Introduction to React, Features of React, Why we Need React

Unit II: **6 lecture hours**

ECMA, E6: ECMA Script, ES6 let and const, the arrow functions, New Literal Syntax, Classes, Inheritance using extends, Default Parameter Values, Spread Operator (...), Iterators and Generators, Features of React, Practical Application, Why need React, How React Works, Leveraging Virtual DOM, Setting up React

Unit III: **8 lecture hours**

JSX: Why JSX, Embedding JavaScript, Expression in JSX, JSX as an Expression, Nested elements in JSX, JSX Attributes, JSX Comments, JSX Styling and representation as object, The State of the Component, Defining State, Changing the State, Props, Validation, Validators

Unit IV: **6 lecture hours**

Elements: Rendering Element, about render (), Creating React Element, Updating Element, components, Introducing Components, Types of Components, Functional Component, Functional Components as Stateless, Using Functional Component

Unit V: **8 lecture hours**

Redux: Redux Concepts, Redux Principles, Data Flow, Actions, Functions, Reduces, Testing , DevTools, React & Redux Integrate

Text Books

- Anthony Accomazzo, "Fullstack React: The Complete Guide to React JS and Friends" , fullstack.io

Reference Books/Materials

1. Robin Wieruch, "The Road to Learn React: Your journey to master plain yet pragmatic React.js", Independent Publisher
2. Adam Boduch and Roy Derks, "React and React Native", Packt
3. Andrea Chiarelli, "Beginning React", Packt

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand Specifications and Features of ES6	**PO1, PO 2**
CO2	Explain the need of React and methods of how React Works	**PO1, PO 2, PO 3, PO4**
CO3	Discuss the essentials of working with JSX	**PO1, PO 3, PO4, PO 5**
CO4	Describe how elements are rendered	**PO1, PO 3, PO4, PO5, PO8**
CO5	Explain Redux Concepts and Principles	**PO1, PO 2, PO3, PO 8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS225A	Front End Development with ReactJS	3	3	3	3	2	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS227A	**Backend Development using NodeJS**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic Programming Skills, Web Fundamentals HTML, CSS, JavaScript, React				
Co-requisites	--				

Course Objectives

- Understand the Nodejs framework
- Learn asynchronous programming
- Learn about non-blocking, event-driven servers
- Understand reusable modules and distributable packages
- Understand the techniques and working of express

Course Outcomes

On completion of this course, the students will be able to:

- Explain the Node.js architecture
- Understand the concept of Modules, file system and events
- Explain the operations and buffers
- Explain REST API and Express

Catalog Description

The course on Node JS teaches you how to use JavaScript to create network applications quickly and efficiently. The training is intended to assist developers in understanding and developing web applications using JavaScript.

Course Content

Unit I: **8 lecture hours**

Introduction to Node.js: What is Node.js, History of Node.js, Why Node.js, Node.js Architecture, Working and Features, Installation and Setup, Installing Node.js, Launching REPL, Environment, Installing Visual Studio, Code Editor, Components of Node.js

Unit II: **10 lecture hours**

Modules: Module Exports, Export Object, Export Functions, Export Functions as Class, Loading module from, Separate Folder, Modules, File System Module, Reading and Writing into, Files, Appending and Opening Files, Events and Event Emitters, Handling Events, Customized Class for Handling Events, In-built Modules File Systems, Operating System

Unit III: **8 lecture hours**

Buffers: Writing to Buffers, Reading from Buffers, Concatenating Buffers, Copying Buffers, Slicing Buffers, The Stream Module, Reading From Stream, Writing to Stream, Pipes, Pipe Chaining

Unit IV: **8 lecture hours**

REST API: Explain REST API, Describe Node.js express, Discuss the importance of express, Explain the installing process of express, Learn express request and response, Describe routing, REST API : Intro to API, History of API Development, Development of AJAX, CRUD

Text Books

- Manuel Kiessling, 'The Node Beginner Book', Leanpub
- Griggs Bethany, 'Node Codebook', Packt

Reference Books/Materials

1. Ethan Brown, 'Web Development with Node and Express', O Reilly
2. David Herron, 'Node.JS Web Development', Packt

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Nodejs framework	**PO1, PO6**
CO2	Learn asynchronous programming	**PO1, PO 2, PO 3, PO4**
CO3	Learn about non-blocking, event-driven servers	**PO1, PO 3, PO4**
CO4	Understand reusable modules and distributable packages	**PO1, PO 3**
CO5	Understand the techniques and working of express	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3
ETCS2 27A	Backend Development using NodeJS	3	3	2	3	-	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS270A	**Database Engineering with MongoDB**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Fundamentals				
Co-requisites	--				

Course Objectives

- Explain Traditional File system and its components.
- Explain the fundamental concepts of NoSQL database
- Understand the way Sharding works and the different approaches to sharding.
- Describe the CRUD operations in MongoDB
- Discuss arrays and nested Arrays in MongoDB
- Learn projections operations
- Explain the Aggregation facets in MongoDB
- Explore the data modelling concepts

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the Traditional File System and its components with detailing on NoSQL Database

CO2. Explain NoSQL Database Approach and sharding approaches

CO3. Explain the essentials of MongoDB with CRUD operations

CO4. Discuss the Read and Write Query Operations

CO5. Discuss the concepts of modelling database, Array Updates and Aggregation,

Catalog Description

This course material includes theory and lab. The course comprises six modules. The main objective of this course is to impart knowledge on Database Engineering Concepts and Working with MongoDB.

Course Content

Unit I:
6 **lecture hours**

The File System Namespace
Introduction to Data Storage, Types of Data Storage Media, Traditional Storage Devices, The File System Namespace – an Introduction, File Systems, File System Terminologies, Extents and Attributes, File Metadata, Directories, Some Basic Filesystem Operations, File System Hierarchy, Common File Systems, Limitations of Traditional File Systems

Unit II: **6 Lecture Hours**

NoSQL Database Approach
What is the NoSQL approach? Why Use the NoSQL Approach? Benefits of NoSQL, Types of Databases, Key-Value Stores, Wide-column Stores/ Columnar Databases, Document/Document-store/Documentoriented Databases, Graph-based Databases

Unit III: **6 Lecture Hours**

Sharding in NoSQL
Managing Database for Availability and Performance, Database Scaling, Database Distribution Models, Database Replication, Types of Database Replication, Master-Slave Replication, Peer-to-Peer Replication, Advantages and Disadvantages of Peer-to-Peer Replication, Introduction to Sharding, Why Sharding, The Lookup Strategy, The Range Strategy, The Hash Strategy, When to Shard?, Sharding Challenges, Combining Sharding and Replication, Scaling of NoSQL Databases with Sharding, Algorithmic Sharding, Dynamic Sharding, Entity Groups, Hierarchical keys and Column-Oriented Databases

Unit IV: **6 Lecture Hours**

Introduction to MongoDB & Its Operations
Introduction to MongoDB, CAP Theorem, Collections & documents, understanding data types in MongoDB, Features of MongoDB Module, Overview of MongoDB, Principles & Design Goals for MongoDB Server and Database, MongoDB tools, MongoDB Installation on Windows, and Cloud, CRUD operations, Basic MongoDB Commands

Unit V: **6 Lecture Hours**

Read and Query Operations
Importing data, Nested documents, Arrays in MongoDB, Sorting Documents, Mongo Shell / Driver, Query Comparison Operators, Nested Documents, Matching an embedded document, Query on Nested Field, Setting up filters using query operators, Arrays in MongoDB, Querying

on Array, Querying the array for an Element, Querying for an Element, using operator, Querying to meet multiple criteria. Nested Arrays in MongoDB, Querying on Nested Arrays, Querying on Array of Embedded Documents, querying with multiple conditions on nested Fields, Projections Operations, Working with Indexes

Unit VI: **6 Lecture Hours**

Data Modeling

Discuss the concepts of modelling database, Array Updates ($push and $pull) Aggregation, The aggregation pipeline, The map-reduce function 12 The single purpose aggregation methods 13 3 Introduction to Data Modeling, Flexible Schema, Document Structure, Atomicity of Writing Operations, Data Use & Performance, Concepts in Data Modeling, Embedded Data Models (Denormalized Models), Using References (Normalized Models) Joining Collections using $lookup, Modeling Relationship, Transactions in MongoDB

Text Books

- Kristina Chodorow, "MongoDB: The Definitive Guide", O Reilly
- Eelco Plugge, Peter Membrey, Tim Hawkins, DUPTim Hawkins, "The Definitive Guide to MongoDB

Reference Books

1. NoSQL Database for Cloud and Desktop Computing", Apress
2. Kyle Banker, Douglas Garrett, Peter Bakkum, Shaun Verch, "MongoDB in Action Manning"
3. Alex Giamas, "Mastering MongoDB 3.x", Packt

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the essentials of Android OS Architecture	**PO1**
CO2	Explain Activity state and lifecycle	**PO1, PO 2, PO 3, PO4**
CO3	Explain the Fragment Events and Communication	**PO1, PO 3, PO4**
CO4	Learn to explore action bar	**PO1, PO 3, PO4, PO8**
CO5	Describe Broadcast and services facet.	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS270A	Database Engineering with MongoDB	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS224A	**Mobile App Development**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	HTML, CSS , JavaScript, Basic Programming				
Co-requisites	--				

Course Objectives

1. Describe the fundamentals and flow of mobile application development on multiple devices and online publishing.
2. Create a mobile application with basic functionality using the assets provided.
3. Create a mobile application that makes use of hardware and software resources
4. Create a mobile application that makes use of hardware and software resources
5. Learn to test the functionality of mobile applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the essentials of Android OS Architecture

CO2. Explain Activity state and lifecycle

CO3. Explain the Fragment Events and Communication

CO4. Learn to explore action bar

CO5. Describe Broadcast and services facet.

Catalog Description

This course on mobile app development is based on Android acting as a mobile device software stack that includes an operating system, middleware, and key applications. This rich source of software is used in Mobile Technology via the Android Software Development Kit's innovation module (SDK). As basics you learn to create new interface for the app and perform different interactive operations

Course Content

Unit I: **8 lecture hours**

Introduction to Android: Android Introduction, Android Flavors, Android OS Architecture, Gradle Build System, Setting up Android Development Environment, System Requirements, Android Studio Installation, Create FirstAndroid Application, Understand Project Hierarchy, Layouts & Views, Resources, User Input Control, List View and Scrolling Views, Recycler View & Card View, Themes & Styles, Material Design, Providing Resources for adaptive layouts, Dialogs – Alert, Progress, and Custom, Floating Action Button, Localization

Unit II: **6 lecture hours**

Activities & Intents: Activity Lifecycle, Activity State, Explicit Intent, Implicit Intent, Intent resolution, Detail Activity, Menu and Icons, Passing data between activities with intents, Activity Navigation, Data Back from Activity

Unit III: **8 lecture hours**

Fragments: What is Fragment? Creating a Fragment, Fragment Lifecycle, Handling Fragment Events, Fragment Communication, fragment manager, Transactions, Saving State, Communication between fragments and activities, Debug and Test

Unit IV: **6 lecture hours**

Exploring Action Bar: Getting Access to Action Bar, Option Menus, Context Menus, Popup Menus, Navigation Drawer, Tab Navigation, Swipe View with View Pager, Advantages and Disadvantages of Action Bar, Action Bar Components, Menu with Action Bar, Example simplified,

Unit V: **8 lecture hours**

Broadcast & Services: Broadcast Receivers & Notification, Broadcast Receiver, Sending a Broadcast, Classes of Broadcasts, Context-registered receivers, Manifest Declared Receivers, Permissions in Broadcasts, Sending & Receiving with Permissions, Creating Receiver ,Registering broadcast receiver, Notification, Integrating notification with a broadcast receiver, Service, Types of Service, Service Declaration, Creating a Service, Extending Service Class, Start a Service, Stop a Service, Creating a Bound Service, The life cycle of Service

Text Books

- Arnon Axelrod, “Complete Guide to Test Automation”,Apress

Reference Books

- Elfriede Dustin, Thom Garrett, Bernie Gauf, "Implementing Automated Software Testing: How to Save Time and Lower Costs While Raising Quality", Addison Wesley
- Matsinopoulos, Practical Test Automation, Apress
- Dorothy Graham, Mark Fewster, 'Experiences of Test Automation: Case Studies of Software Test Automation', Addison Wesley

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

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	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the essentials of Android OS Architecture	**PO1**
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CO3	Explain the Fragment Events and Communication	**PO1, PO 3, PO4**
CO4	Learn to explore action bar	**PO1, PO 3, PO4, PO8**
CO5	Describe Broadcast and services facet.	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS224A	Mobile App Development	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 424A	CICD and Microservices	L	T	P	C
Version 1.0		3	0	1	
Pre-requisites/Exposure					
Co-requisites	--DevOps				

Course Objectives

- Identify the practices associated with CI and the working mechanism
- Explain the core CI process and advanced CI process
- Explore about releasing an application to production
- Discuss the Continuous Deployment engineering practices
- Describe continuous development and integration
- Define continuous deployment to successive environments until before production
- Explain continuous monitoring for the delivery pipeline

Course Outcomes

On completion of this course, the students will be able to:

- CO1. Learn the essentials of practices associated with CI and the working mechanism
- CO2. Explain the Stages of Continuous Integration and Continuous Delivery
- CO3. Understand Jenkins Dashboard & UI understanding
- CO4. Discuss the anatomy of CICD
- CO5. Discuss Deploying, Promoting, and monitoring your Application

Catalog Description

This course gives learners a detailed overview of continuous integration and continuous delivery and its associated concepts. This course has 6 modules. The first section covers an introduction to continuous integration, continuous delivery, and continuous deployment. The second section will cover the stages of a continuous integration process. The third section will cover the continuous delivery model. The course then introduces the key CI/CD concepts and stages of a continuous integration process. You will also learn about how to automate builds, automated unit testing, Static code analysis, code coverage analysis, deploying application to a production environment and monitoring delivery pipeline.

Course Content

UNIT I: Overview

Introduction to CI, Continuous Integration Workflow, Benefits of Continuous Integration, How CI Benefits Distributed Teams, Continuous Delivery, Steps Involved in CICD, Pipelines, Prerequisites, Checklist, Business Drivers for Continuous Deployment, Benefits of Continuous Deployment, CD – The HP Laserjet Case Study

UNIT II: Stages of Continuous Integration and Continuous Delivery

Core CI Process, VCS, Merging Local Changes to Integration Branch, Fork & Pull, Code Review, Automated code builds – Key metrics, Static Code Analysis, Snapshot, Sample Bug Report, Automated Unit Testing- JUNIT, Test Frameworks, Automated Unit Testing Process, Code Coverage analysis, Code Coverage Methods, Condition Coverage, Line Coverage, Publishing Code Coverage reports to Jenkins, Uploading build artifact to a repository, Advanced CI process, Automated Functional Testing, Publish Report to the Development Team, Google Canary release Case study

UNIT III: Jenkins

CICD Jenkins Installation, Jenkins Dashboard & UI understanding, Jenkins Job, Jenkins Triggers, Jenkins Plugins, Multi Node cluster setup with architecture, Installing/Configuring Nexus, Use Jenkins as a Continuous Integration server, Deploying the application to staging/prod environment, Docker integration with Jenkins, Static Pipeline

UNIT IV: Anatomy of a Continuous Delivery

Pipeline Simple Delivery Pipeline, Continuous Deployment Pipeline, Releasing an application to Production, Zero-Downtime Releases, Rolling back deployments, Blue-Green Deployments, Canary Releasing, Emergency Fixes, Continuous Delivery engineering practices, Continuous Development/Integration

UNIT V: Continuous Testing

Deploying and Promoting your Application, Modeling Your Release Process and Promoting Builds, Continuous Deployment to successive environments until before Production, Continuous monitoring for the delivery pipeline, Nagios sampler report, Continuous Feedback rules

Unit VI: System Monitoring

Introduction to monitoring, Goals of monitoring, DevOps approach to monitoring, Network operations center, Role of NOC in DevOps world, Telemetry and metrics, Types of monitoring: end user, infrastructure, application, log monitoring and analysis

Text Books

Rafal Leszko, "Continuous Delivery with Docker and Jenkins", Packt

Reference Books

1. Anuj Kumar, "Microservices with Clojure", O'Reilly
2. Ronnie Mitra, Irakli Nadareishvili, "Microservices Up and Running", O'Reilly
3. Mohamed Labouardy, "Pipeline as Code: Continuous Delivery with Jenkins, Kubernetes, and Terraform", Manning
4. Murat Karslioglu, "Kubernetes: A Complete DevOps Cookbook", Packt
5. Bob Aiello, "Hands-On DevOps for Architects", Packt

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the essentials of Android OS Architecture	**PO1**
CO2	Explain Activity state and lifecycle	**PO1, PO 2, PO 3, PO4**
CO3	Explain the Fragment Events and Communication	**PO1, PO 3, PO4**
CO4	Learn to explore action bar	**PO1, PO 3, PO4, PO8**
CO5	Describe Broadcast and services facet.	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS463A	CICD and Microservices	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS378A	**DevOps and Automation**	L	T		P	C
Version 1.0		3	0		1	
Pre-requisites/Exposure	Software Engineering					
Co-requisites	--					

Course Objectives

1. Describe Challenges of Traditional IT systems
2. Discuss about the emergence of DevOps
3. Lean the essentials of DevOps Automation
4. Learn about the basic operations in a VCS, Examples of version control systems, Subversion (SVN)
5. Discuss the features and Limitations of DevOps and Agile

Course Outcomes

On completion of this course, the students will be able to:

CO1. Describe the challenges of Traditional IT Systems

CO2. Explain the emergence of Development and Operations

CO3. Learn about the basic operations in a VCS, Examples of version control systems, Subversion (SVN)

CO4. Learn the concepts of containers and virtualization

CO5. Describe the Docker Architecture and Kubernetes

Catalog Description

DevOps (a blend word for Development & Operations) has an intrinsic association with digital transformation. DevOps empowers developers to own, run, and manage the end-to-end delivery of an application. It is a collaborative approach to building and delivering software. You will learn about the pitfalls of the Traditional IT LIfe Cycle and the emergence of Agile Methodology. This program will introduce the tools and technologies of DevOps. You will also learn about Linux Basics & Admin.

Course Content

UNIT I: Introduction to DevOps

Definition of DevOps: Challenges of traditional IT systems & processes,History and emergence of DevOps, DevOps definition and principles governing DevOps, DevOps and Agile,The need for building a business use case for DevOps, Purpose of DevOps, Application Deployment, Automated Application Deployment, Application Release Automation (ARA), Components of Application Release Automation (ARA), Best Practices of CI, Benefits of CI, CAMS

UNIT II: Introduction to DevOps Tools & Technologies

Introduction to Linux (OS) & why it is important to know Linux while working with DevOps, Git & GitHub (SCM), Docker (Containerization), Jenkins (CI/CD Pipelines), Terraform (Provisioning), Maven (Build & Release Management), Ansible (Configuration Management), Selenium (Test Automation), AWS (Cloud Computing), SonarQube (Code Quality Checking), Prometheus/Nagios (Monitoring)

UNIT III: Source Code Management

History of Version Control Systems (VCS), Basic operations in a VCS, Examples of version control systems, Subversion (SVN), Features and Limitations, Mercurial, Git, Overview, History - Linux and Git by Linus Torvalds, Advantages of Git, Explain how local version control works, Centralized Version Control Systems (CVCS), Distributed Version Control Systems (DVCS), advantages of DVCS, Private Workspace

Unit IV: Application Containerization

Understanding Containers: Transporting Goods Analogy, Problems in Shipping Industry before Containers, Shipping Industry Challenges, Container: Virtualization Introduction, Hypervisor, Scope of Virtualisation, Containers vs Virtual Machines, Understanding Containers, Containerization Platform, Runtime and Images, Container Platform, Container Runtime, The Chroot System, FreeBSD Jails, LinuX Containers (LXC), Docker

UNIT V: Introduction to Containerization

Docker architecture, Docker Daemon (Container Platform), Docker Rest API , CLI Different environments: (Dev, QA and Prod), Overcoming issues with different environments, Development Environment Docker Swarm and Kubernetes, Architecture, AWS (ECS,EKS), 10 AWS Elastic Container Services Architecture, Azure Kubernetes Services, Openshift, KUBERNETES ON CLOUD, Monitoring of container Jenkins Installation, Jenkins Dashboard

& UI understanding, Jenkins Job, Jenkins Triggers, Jenkins Plugins, Multi Node cluster setup with architecture, Installing/Configuring Nexus, Use Jenkins as a Continuous Integration server, Deploying the application to staging/prod environment, Docker integration with Jenkins, Static Pipeline

Textbooks

- Murat Karslioglu, 'Kubernetes: A Complete DevOps Cookbook', Packt

Reference Books

1. Bob Aiello, 'Hands-On DevOps for Architects', Packt

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the challenges of Traditional IT Systems	**PO1**
CO2	Explain the emergence of Development and Operations	**PO1, PO 2, PO 3, PO4**
CO3	Learn about the basic operations in a VCS, Examples of version control systems, Subversion (SVN)	**PO1, PO 3, PO4**

CO4	Learn the concepts of containers and virtualization	**PO1, PO 3, PO4, PO8**
CO5	Describe the Docker Architecture and Kubernetes	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS378A	DevOps and Automation	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

6.2.4 Syllabus of Courses specific to B.Tech - Computer Science & Engineering with specialization in Cloud Computing in association with Xebia

SEMESTER I

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-I	3	1	-	4
2	ETPH109A	Engineering Physics	3	1	-	4
3	UCES125A	Environmental Studies	3	-	-	3
4	ETME101A	Basics of Mechanical Engineering	3	1	-	4
5	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	-	4
6	ETPH151A	Engineering Physics Lab	-	-	2	1
7	ETEC151A	Basics of Electrical & Electronics Engineering Lab	-	-	2	1
8	ETME151A	Basics of Mechanical Engineering Lab	-	-	2	1
9		Open Elective	4	-	-	4
TOTAL			**19**	**4**	**6**	**26**

SEMESTER II

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-II	3	1	-	4
2	ETCS104A	Introduction to Computer Science and Programming in Python	3	1	-	4
3	ETCH119A	Engineering Chemistry	3	1	-	4
4	ETCS116A	Introduction to Cloud Computing	3	-	-	3
5	ETME 155A	Engineering Graphics Lab	-	-	3	1.5
6	ETCS160A	Introduction to Cloud Computing Lab	-	-	2	1
7	ETCS150A	Introduction to Computer Science and Programming in Python Lab	-	-	2	1
8	ETCH159A	Engineering Chemistry Lab	-	-	2	1
9		Open Elective	4	-	-	4
	ETME 157A	Workshop Practices	-	-	3	1.5
TOTAL			**1**	**3**	**1**	**25**

		6		**2**	

SEMESTER III

SNo	Course Code	Course Title	L	T	P	C
1	ETMA215A	PROBABILITY AND STATISTICS	4	-	-	4
2	ETCS221A	Cloud Computing Tools and Techniques	3	-	-	3
3	ETCS231A	Discrete Mathematics	3	1	-	4
4	ETCS217A	Data Structures	3	1	-	4
5	UCDM301A	Disaster Management	3	-	-	3
6	ETCS223A	Foundational Linux & Scripting	3	-	-	3
7	ETCS253A	Cloud Computing Tools and Techniques Lab	-	-	2	1
8	ETCS265A	Foundational Linux & Scripting Lab	-	-	2	1
9		MOOC	1	-	-	3
10	ETCS257A	Data Structures Lab	-	-	2	1
TOTAL			**20**	**2**	**6**	**27**

SEMESTER IV

SNo	Course Code	Course Title	L	T	P	C
1	ETCS222A	Computer Organization & Architecture	3	1	-	4
2	ETCS218A	Computational Services In The Cloud	3	-	-	3
3	ETCS220A	Analysis and Design of Algorithms	3	1	-	4
4	ETCS307A	Database Management Systems	3	1	-	4
5	ETCS216A	High Performance Computing	3	-	-	3
6	ETCS228A	Employability and Analytical Skills-I	2	-	-	2
7	ETCS 355A	Database Management Systems Lab	-	-	2	1
8	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
9	ETCS268A	Computational Services In The Cloud Lab	-	-	2	1
10	ETMC602A	Essentials of Organizational Behaviour	3	-	-	3

TOTAL	**20**	**3**	**6**	**26**

SEMESTER V

SNo	Course Code	Course Title	L	T	P	C
1	ETCS305A	Storage and Databases on Cloud	3	-	-	3
2	ETCS321A	Java Programming	3	1	-	4
3	ETCS 214A	Theory of Computation	3	1	-	4
4	ETCS319A	Application Development and DevOps on Cloud	3	-	-	3
5	ETCS367A	Application Development and DevOps on Cloud Lab	-	-	2	1
6	ETCS361A	Java Programming Lab	-	-	2	1
7	ETCS381A	Practical Training I	-	-	-	1
8	ETCS325A	Employability and Analytical Skills-II	2	-	-	2
9	ETCS375A	Mini Project	-	-	-	3
10	ETCS353A	Storage and Databases on Cloud Lab	-	-	2	1
11	ETCS305A	Storage and Databases on Cloud	3	-	-	3
TOTAL			**14**	**2**	**6**	**23**

SEMESTER VI

SNo	Course Code	Course Title	L	T	P	C
1	ETCS412A	Compiler Design	3	1	-	4
2	ETCS322A	Messaging & Monitoring	3	-	-	3
3	ETCS324A	Migration and Cloud Security	3	-	-	3
4	ETCS366A	Migration and Cloud Security Lab	-	-	2	1
5	ETCS330A	Employability and Analytical Skills-III	2	-	-	2
6	ETCS360A	Messaging & Monitoring Lab	-	-	2	1
7	ETCS401A	Artificial Intelligence	3	1	-	4
8	ETCS451A	Artificial Intelligence Lab	-	-	2	1
9	**Elective I**					
(i)	ETCS310A	Advanced Computer Architecture	3	-	-	3
(ii)	ETCS420A	Graph Theory	3	-	-	3
(iii)	ETCS320A	Distributed Computing Systems	3	-	-	3
10	ETCS462A	Minor Project	-	-	-	5
TOTAL			**17**	**2**	**6**	**27**

SEMESTER VII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS464A	Major Project(XEBIA)	-	-	-	6
2	ETCS481A	Practical Training II	-	-	-	2
3		Boot Camp (Training and Placement)	2	-	-	-
4	**Elective - II**					
(i)	ETCS426A	Natural Language Processing	4	-	-	4
	ETCS465A	Natural Language Processing Lab	-	-	2	1
(ii)	ETCS424A	Data Warehousing and Data Mining	4	-	-	4
	ETCS463A					
(iii)	ETCS423A	Neural Network	4	-	-	4
	ETCS460A	Neural Network Lab	-	-	2	1
5	**Elective - III**					
	ETCS422A	Cloud Computing	4	-	-	4
	ETCA362A	Cloud Computing Lab	-	-	2	1
	ETCS421A	Internet of Things	4	-	-	4
	ETCS457A	Internet of Things Lab	-	-	2	1
	ETCS425A	Machine Learning	4	-	-	4
	ETCS455A	Machine Learning Lab	-	-	2	1
TOTAL			**10**	**-**	**4**	**18**

SEMESTER VIII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS490A	**Industrial Internship**	-	-	-	12
TOTAL			-	-	-	**12**

Total Credits [C]	**184**

ETMA105A	**Applied Mathematics-I**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO13. Understand and able to apply the basic concept of complex variable.

CO14. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO15. Applied the differential calculus method for curve tracing and radios of curvatures.

CO16. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO17. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO18. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices.The concepts of applied mathematics-Iare extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10 lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.

2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

8. B.S.Grewal, “ Higher Engineering Mathematics”, Khanna Publishers.
9. H.K. Dass, “Advanced Engineering Mathematics”, S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**
CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**

CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA 105A	Applied Mathematics - I	3	3	3	3	-	-	-	1	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon of non dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.
CO2. Solve non-dispersive transverse and longitudinal waves equations.
CO3. Analyze propagation of light, geometric and wave optics.
CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens 'Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young's double slit experiment, Newton's rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

1. Ian G. Main, Oscillations and waves in physics
2. H.J. Pain, The physics of vibrations and waves
3. E. Hecht, Optics

4. A. Ghatak, Optics
5. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH109A	Engineering Physics	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.
2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation;

Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

6. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

5. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
6. S.E. Manahan, Environmental Chemistry, CRC Press.
7. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
8. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	The learners will be able to comprehend and	**PO7**

	become responsive regarding environmental issues.	
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	**PO8**
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

ETEC 101A	**Basics Of Electrical & Electronics Engineering**	L	T	P	C
		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
CO2	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin's, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT:CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.
2. B L Thareja – A text book of Electrical Technology
3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10^{th} Edition.
4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27^{th} Edition.

REFERENCE BOOKS:

7. Electrical Engineering Fundamentals, V.Del Toro
8. Problems in Electrical Engineering – Parker Smith.S.

3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.

4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.

5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME 101A	**Basics of Mechanical Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

1. Understanding Basic Materials and Manufacturing Processes.
2. Have an understanding of laws of thermodynamics and Thermodynamic processes.
3. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
4. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.

CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.

CO3. Get the knowledge about power transmission method and device with mechanical properties.

CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: 10 lecture hours

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: 12 lecture hours

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison’s ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: 6 lecture hours

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

8. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
9. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons

10. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
11. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
12. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
13. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
14. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

10. Strength of Materials – Popov, Pub. PHI, New Delhi.
11. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.
12. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics and workshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**
CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 101A	Basics of Mechanical Engineering	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.
CO2. Better insight aboutwave nature of light.
CO3. Better understanding of data interpretation which enhances problem solving approach.
CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

1	To determine the value of acceleration due to gravity using Bar pendulum	2 lab hours
2	To determine the value of acceleration due to gravity using Kater's pendulum	2 lab hours
3	To determine the wavelength of sodium light using Newton`s ring apparatus	2 lab hours
4	To determine the wavelength of prominent lines of mercury by plane diffraction grating	2 lab hours
5	To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer	2 lab hours
6	To determine the specific rotation of cane sugar solution with the help of half shade polarimeter	2 lab hours
7	To determine the wavelength of He-Ne LASER using transmission diffraction grating	2 lab hours

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Reference Books/Materials

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	**PO1& PO2**

CO2	Better insight aboutwave nature of light.	**PO4**
CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 151A	Basics Of Electrical & Electronics Engineering Lab	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1.To understand the DC and AC circuit behavior by application of network theorems.

2.To elaborate complex signals over oscilloscope devices with reading.

3.To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.

4.To analyses the BJT in build circuits as per practical application point of view.

5.To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

Course Outcomes

On completion of this course, the students will be able to

CO1 Get an exposure to common electrical components and their ratings.

C02 Determines proper electrical connections as per wires of appropriate ratings.

CO3 Understand the usage of common electrical measuring instruments.

CO4 Ability to discover applications related to seven segment display type of devices

Catalog Description

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application inreal time situations.

Course Content

7. To get familiar with the working knowledge of the following instruments:
    m) Cathode ray oscilloscope (CRO)
    n) Multimeter (Analog and Digital)
    o) Function generator
    p) Power supply
8. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO
9. To Verify the Thevenin' s and Norton’s theorem
10. To Verify the Superposition theorem
11. To measure voltage, current and power in an A.C. circuit by LCR impedance method
12. To study the frequency response curve in series and parallel R-L-C circuit

7. a)Plot the forward and reverse V-I characteristics of P-N junction diode
b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region
8. To plot and study the input and output characteristics of BJT in common-emitter configuration.
9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).
10. To get familiar with the working and use of seven-segment display.

Reference Books for Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, “Microelectronic Circuits” 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, “Digital Systems – Principles and Applications”, 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, “A course in Electrical & Electronics Measurements & Instrumentation”, Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME151A	Basics of Mechanical Engineering Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

1. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
2. To study simple screw jack and compound screw jack and determine their efficiency.
3. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)
4. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
5. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
6. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.

CO2 Understand concepts of screw jack, friction, law of moments.

CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.

CO4 Get the knowledge of various Refrigeration and Air- Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**
CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**
CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air-Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA105A	**Applied Mathematics-II**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand and able to apply the basic concept of Laplace transform.

CO2. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO3. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO4. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO5. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO6. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters,

Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

1. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
2. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient,	**PO8**

	divergence and curl.	
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**
CO4	Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.	**PO4**
CO5	Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.	**PO3**
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
ETMA105A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

		L	T	P	C
ETCS104A	**Introduction To Computer Science And Programming In Python**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India

Reference Books

1. R. Nageswara Rao, "Core Python Programming", Dreamtech

2. Wesley J. Chun. "Core Python Programming, Second Edition", Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley

4. Kenneth A. Lambert, "Fundamentals of Python,First Programs", CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS104A	Introduction to Computer Science and Programming in Python	2	2	2	2	-	-	-	-	-	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12^{th} Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to

become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **8 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **12 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: 10 lecture hours

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na2SO4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

4. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
5. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
6. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs

	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Develop the understanding of Technology involved in improving quality of water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.	**PO1**
CO3	Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its properties and applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predict potential applications of chemistry and practical utility in order to become good engineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 215A	EMBEDDED ROBOTICS & IOT	L	T	P	C
		3	0	0	3

Pre-requisites/Exposure	--
Co-requisites	--
<u>Course Teacher(s)</u>:	Dr. Bhavesh Vyas

Course Objectives

1. To understand the basic of embedded system.
2. To analyse the complex circuits and build new designs of analog to digital conversion.
3. To be able to perform analysis of embedded C based circuits with robotics applications
4. To gain basic insight of semiconductors-based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

- CO1 Understand and apply Knowledge of Embedded Circuits in making real time projects to solve engineering difficulties.
- C02 Determine an understanding of logic gates and C language with electronic devices.
- CO3 Demonstrate the ability to identify digital circuits. Utilization of the knowledge gained to solve problems.
- CO4 Create an understanding of IOT & robotics devices application to existing setup.

<u>Program Articulation Matrix: Mapping of Course Outcome (COs) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)</u>

Course Code	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
ETEC215A ER&I	CO1	1	-	-	-	-	-	-	-	-	-	1	-	1	-
	CO2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
	CO3	1	-	-	-	1	-	-	2	-	-	-	-	-	-
	CO4	-	2	3	3	-	-	-	-	-	-	-	1	-	-
	CO5	-	-	-	-		1	2	-	-	-	-	2	-	-
	CO6	-	-	-	-	1	-	-	-	-	2	3	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

<u>Examination Scheme:</u>

<u>Evaluation Scheme:</u>				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date**
1	******Continuous Assessment (Quiz/Assignment/ Presentation/ Extempore)	-	20	
2	Mid Term Examination (Written Examination)	90Minutes	20	
3	Attendance		10	
4	End Term Examination (Written Examination)	180 Minutes	50	
Total			**100**	

Course Content

UNIT I **14 HRS**

Introduction to Embedded Systems: Introduction to Basic Electronics Components, Introduction to Microprocessor and Microcontroller, Difference between Microcontroller and Microprocessor, Introduction to Embedded System, Introduction to Arduino, Types of Microcontrollers: 8051, PIC, AVR & ARM, parametric comparisons among all, Reading Datasheet & schematics, Advantages of Atmega328,

UNIT II **10 HRS**

Robotics: Introduction to robotics: Automation, Anatomy of Robots, Manipulators, Robot control, History of robots, Types of Main bodies, Tasks Planning for robots, Robot's mechanisms, Manipulators Mechanisms-I, Actuators for Robots-Part I, Stepper motor, Performance characteristic, Sensors and Controllers in robots, Incremental encoders and position, velocity sensors, external state sensors.

UNIT III **8 HRS**

Internet of Things: IOT Introduction and its Architecture (Why, What and How), Hardware in IOT, Future in IOT, Introduction to ESP8266 Wi-Fi Module, IOT Basics: IOT definition, applications in different domains, trends in IOT market. IOT Architecture, Protocols Introduction (MQTT, AMQP, CoAP).

UNIT IV **8 HRS**

Sensors For Robotic Applications: Sensor Categories, Binary Sensor, Analog versus Digital Sensors, Shaft Encoder; A/D Converter, Position Sensitive Device; Compass, Gyroscope, Accelerometer, Inclinometer. Recap of Embedded C: Datatypes, Array, Conditional Statements, Functions / Call-back function Structures, Pointers, Storage classes, Embedded Controllers, Interfaces, Operating System - Industrial Robots.

TEXT BOOKS:

1. Peter Marwedel, book: Embedded System Design 1st Edition, Kindle Edition
2. "Rise of the Robots: Technology and the Threat of a Jobless Future", by Author: Martin Ford
3. "Robotics: Everything You Need to Know About Robotics from Beginner to Expert", by Author: Peter Mckinnon

REFERENCE BOOKS:

1. "Making Simple Robots: Exploring Cutting-Edge Robotics with Everyday Stuff", by Author: Kathy Ceceri
2. "Real-Time C++: Efficient Object-Oriented and Template Microcontroller Programming", 14 May 2018 by Author Christopher Kormanyos.

Teacher(s) Contact: Students can contact the Course Teacher(s) in his/her chamber for consultation in the hour specified.				
Name	**Room**	**Ext.No.**	**e-mail**	**Consultation Hr.**
Dr. Bhavesh Vyas	B212	-	Bhavesh.vyas@krmangalam.edu.in	Lunch Hours

****Weekly Evaluation**			
Week	**Topic(s)**	****Mode of Evaluation**	**Marks/Grade**

ETME155A	**Engineering Graphics Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.
CO2. Interpret engineering drawings using fundamental technical mathematics.
CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.
CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing of orthographic, isometric, and auxiliary projections. Other topics include scaling, sectioning, dimensioning, and drawing documentation. This course uses the latest release of computer-aided design (CAD) software commonly used in industry to introduce students to CAD interface, structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS150A	**Introduction To Computers And Programming In Python Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**

4	Develop programs to understand the control structures of python	**2 lab hours**
5	Develop programs to implement function with stress on scoping	**2 lab hours**
6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**
8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS150A	Introduction to computers and programming in python Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH159A	**Engineering Chemistry Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Chemistry				
Co-requisites	--				

Course Objectives

- To acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field.
- To understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.
- To enable the learners to get hands-on experience on the principles discussed in theory sessions and to understand the applications of these concepts in engineering.

Course Outcomes

On completion of this course, the students will be able to

CO1: Analyze & generate experimental skills.
CO2: Enhance the thinking capabilities in the modern trends in Engineering & Technology.
CO3: Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.
CO4: Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.
CO5: Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.
CO6: Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.

Catalog Description

This course covers the simple synthesis method of resin using polymers. The course gives introduction and hand on experience of analysis of alkalinity/ dissolved oxygen/ hardness of water in an analytical way. An overview of volumetric titration and conductometric titration has been introduced.

List of Experiments (Indicative)

1	Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.	**2 lab hours**
2	Determine the amount of Oxalic acid and Sulphuric acid in one liter of solution, given standard sodium hydroxide and Potassium Permanganate.	**2 lab hours**
3	Determine the amount of copper in the copper ore solution, provided hyposolution.	**2 lab hours**
4	Argent metric titration one each by Vohlard's method and by Mohr's method.	**2 lab hours**
5	Complexometric titrations.	**2 lab hours**
6	Determine the heat of neutralization of strong acid with strong base.	**2 lab hours**
7	Determine the surface tension of a liquid using drop weight method.	**2 lab hours**
8	Determine viscosity of a given liquid (density to be determined).	**2 lab hours**
9	Determine the reaction rate constant for the Ist order reaction.	**2 lab hours**
10	Determine the cell constant of a conductivity cell.	**2 lab hours**
11	Find out strength of given solution of HClconductometric ally.	**2 lab hours**
12	Preparation of urea formaldehyde and phenol	**2 lab hours**

	formaldehyde resins.	
13	Determination of dissolved oxygen in the given sample of water.	**2 lab hours**
14	Determination of alkalinity in the given sample of water.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze & generate experimental skills.	**PO12**
CO2	Enhance the thinking capabilities in the modern trends in Engineering & Technology.	**PO1**
CO3	Learn and apply basic techniques used in chemistry laboratory for small/large scale water analyses/purification.	**PO3**
CO4	Utilize the fundamental laboratory techniques for analyses hardness/ alkalinity of water.	**PO2**
CO5	Employ the basic techniques used in chemistry laboratory for analyses such as volumetric titrations, conductometric, and stalagmometer.	**PO5**
CO6	Learn to design and carry out scientific experiments as well as accurately record and analyze the results of such experiments.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH159	Engineering Chemistry Lab	3	3	2	-	2	-	-	-	3	-	-	3	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need
3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**

CO3	Creation of simple components using different materials	**PO5**
CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1 To understand distributions in the study of the joint behaviour of two random variables.

2 To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.

3 To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least

squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

6. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
7. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
8. Jim Pitman (1993). Probability, Springer-Verlag.
9. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
10. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**

CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**
CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**
CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3						2		2		3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 321A	**Java Programming**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	NIL				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn the syntax of Java Programming Language and implement applications using it.
CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.
CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.
CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.
CO5. Understand multithreading and evaluate exception handing to create new applications.
CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

Java's unique architecture enables programmers to develop applications that can run across multiple platforms seamlessly and reliably. In this hands-on course, students gain extensive experience with Java and its object-oriented features. Students learn to create robust console and GUI applications and store and retrieve data from relational databases.

Course Content

Unit I: **10 lecture hours**

Introduction to Java: Introduction to Java: Importance and features of Java, Keywords, constants, variables and Data Types, Operators and Expressions, Decision Making, Branching and Looping: if..else, switch,?: operator, while, do, for statements, labeled loops, jump statements: break, continue return. Introducing classes, objects and methods: defining a class, adding variables and methods, creating objects, constructors, class inheritance.

Unit II: **9 lecture hours**

Arrays and Strings: Creating an array, one and two dimensional arrays, string array and methods, Classes: String and String Buffer classes, Wrapper classes: Basics types, using super, Multilevel hierarchy, abstract and final classes, Object class, Packages and interfaces, Access protection, Extending Interfaces, packages.

Unit III: **9 lecture hours**

Exceptional Handling: Fundamentals exception types, uncaught exceptions, throw, throw, final, built in exception, creating your own exceptions, Multithreaded Programming: Fundamentals, Java thread model: priorities, synchronization, messaging, thread classes, Run able interface, inter thread Communication, suspending, resuming and stopping threads.

Unit IV: **12 lecture hours**

Input/output Programming: Basics Streams, Byte and Character Stream, predefined streams, Reading and writing from console and files. Using Standard Java Packages (Lang, util, io, net).

Event Handling: Different Mechanism, the Delegation Event Model, Event Classes, Event Listener Interfaces, Adapter and Inner Classes.

Text Books

2. Cay S. Horstmann, “Core Java Volume – I Fundamentals”, Pearson.

Reference Books/Materials

2. Herbert Schildt, “Java – The Complete Reference”, Oracle Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and implement applications in it.	**PO2**
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS321A	Java Programming	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS231A	Discrete Mathematics	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: **10 lecture hours**

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: **12 lecture hours**

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: **12 lecture hours**

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: **10 lecture hours**

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.
2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, "Discrete Mathematical Structures", PHI.

2. NarsinghDeo, "Graph Theory with Application to Engineering and Computer Science", PHI.
3. J. P. Trembly& P. Manohar, "Discrete Mathematical Structures with Applications to Computer Science", McGraw Hill.
4. Vinay Kumar, "Discrete Mathematics", BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS217A	Data Structures	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course

introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: **8 lecture hours**

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: **12 lecture hours**

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: **12 lecture hours**

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: **8 lecture hours**

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

7. E. Horowitz and S. Sahani, "Fundamentals of Data Structures", Galgotia Book source Pvt. Ltd.
8. R. L. Kruse, B. P. Leung, C. L. Tondo, "Data Structures and program design in C", PHI

Reference Books/Materials

7. Schaum's outline series, "Data Structure", McGraw Hills.
8. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program**

		Outcomes
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCDM301A	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO1. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO2. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO3. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people’s responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: **8 lecture hours**

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: **8 lecture hours**

Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

Unit III: **6 lecture hours**

Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development.
- Damage Assessment
- Post Disaster effects and Remedial Measures.
- Creation of Long-term Job Opportunities and Livelihood Options,
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness,
- Dealing with Victims' Psychology,
- Long-term Counter Disaster Planning
- Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

- **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority

- **Liability for Mass Disaster**

  - Statutory liability
  - Contractual liability
  - Tortiousliability
  - Criminal liability
  - Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

- **Project Work**: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers’ Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Scheme:

Components	CAT	Mid Term Exam	Attendance/ Class performance	End Term Exam
Weightage (%)	**20**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non-governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management	-	-	2	-	-	3	-	-	-	-	-	2	-	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**Java Programming Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Explain the concepts of object oriented paradigms to solve problems.
2. Appraise the concept of reusable software components using inheritance, packages and interfaces
3. Create scalable applications that can robustly handle errors and exceptions in runtime applications
4. Designing applications using pre-built frameworks.

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn to the syntax of Java Programming Language and implement applications in it.
CO2. Recognize features of object-oriented design such as encapsulation, polymorphism inheritance and composition of systems based on object identity.
CO3. Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.
CO4. Apply access control mechanism to safeguard the data and functions that can be applied by the object.
CO5. Understand multithreading and evaluate exception handing to create new applications.
CO6. Design GUI applications using pre-built frameworks available in Java.

Catalog Description

This course complements ETCS 323A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments help organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**
3	Write a java program to implement various shapes using Abstract class	**2 lab hours**
4	Write a java program to demonstrate interfaces.	**2 lab hours**
5	Write a java program to show multithreaded producer and consumer application.	**2 lab hours**
6	Create a java programs that make use of all the 5 exception keywords.	**4 lab hours**
7	Convert the content of a given file into the uppercase content of the same file.	**4 lab hours**
8	Develop a scientific calculator using swings.	**4 lab hours**
9	Create a servlet that uses Cookies to store the number of times a user has visited your servlet.	**4 lab hours**
10	Create a simple java bean having bound and constrained properties.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn to the syntax of Java Programming Language and	**PO2**

	implement applications in it.	
CO2	Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance and composition of systems based on object identity.	**PO3**
CO3	Articulate re-usable programming components using Abstract Class, Interfaces and other permitted ways in packages.	**PO5**
CO4	Apply access control mechanism to safeguard the data and functions that can be applied by the object	**PO8**
CO5	Understand multithreading and evaluate exception handing to create new applications.	**PO1**
CO6	Design GUI applications using pre-built frameworks available in Java.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS361A	Java Programming Lab	2	3	3	-	2	-	-	2	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS257A	**Data Structures Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.
CO2. Implement a given Search problem (Linear Search and Binary Search).
CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.
CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in

variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours
14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS222A	**Computer Organization and Architecture**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will

learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: **12 lecture hours**

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: **10 lecture hours**

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: **8 lecture hours**

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: **10 lecture hours**

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

7. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

8. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the concepts of microprocessors, their principles and practices.	**PO2**
CO2	Write efficient programs in assembly language of the 8086 family of microprocessors.	**PO3**

CO3	Organize a modern computer system and be able to relate it to real examples.	**PO4**
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO5	Implement embedded a-pplications using Emulator.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS220A	**Analysis And Design Of Algorithms**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

7. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
8. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

1. Schaum's outline series, "Data Structure", McGraw Hills.

2. Y. Langsamet. al., "Data Structures using C and C++", PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS307A	Database Management Systems	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the data base design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: **12 lecture hours**

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: **8 lecture hours**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: **12 lecture hours**

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: 8 lecture hours

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

2. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**
CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**
CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems	-	2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer's needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace.

This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception- concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

3. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

14. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi

15. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
16. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning
17. McSchane, Organisation Behaviour, TMH, New Delhi
18. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
19. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi
20. Nelson, Debra L and James C Quick, Organisational Behaviour, Thomson Learning

Course Code	Course Title	L	T	P	S	C
ETCS228A	**Employability and Analytical Skills-I**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

- Communication
- Introduction to Communication
- Types of communication
- Verbal & Nonverbal Communication
- Barriers to Communication
- Body language
- Listening Skills
- Activity

- Language

Quant

- Types of Numbers, HCF & LCM
- Divisibility, Unit Digit.
- Remainder Theorem
- Equations, Factorials.

UNITII

Objective: Vocabulary Building & general speaking

- Basic Grammar/Communicative Grammar
- Parts of speech
- Nouns
- Pronouns: Noun Pronoun Agreement, Types with special emphasis over relative pronouns
- Verbs: Introduction Principal verbs and auxiliary verbs, subject-verb agreement
- Adjectives: degrees of comparison
- Adverb: Types and its usage in sentences
- Conjunctions: Coordinating and Co-relative conjunctions
- Prepositions
- Articles: Definite and Indefinite articles
- Usage of Tenses
- Subject verb agreement
- Sentence Structure: Simple Complex and Compound sentences
- Clauses

Quant

- Progression, Probability
- Permutation & Combination, Average, Percentage, Ratio & Proportion, Partnership
- Profit & Loss

UNIT III (Lectures-)

- Word formation
- Theory and exercise
- Synonyms and antonyms
- One-word substitutes
- Idioms
- Phrasal verbs
- Pair of words
- Homonyms, hyponyms, hypernyms
- Linking words: sequencing of sentences (to form a coherent paragraph

- Paragraph writing
- Supplying a suitable beginning/ending/middle sentence to make the paragraph coherent
- Idiomatic language (with emphasis on business communication),
- Punctuation depending on the meaning of the sentence, run on errors, sentence fragments, coma splices

Quant

- Problems on Ages.
- Mixture & Allegation
- Simple Interest & Compound Interest.

UNIT IV (Lectures-)

- General Essay writing, Writing Issues and Arguments (with emphasis on creativity and analysis of a topic)
- Story writing
- Business letter writing: Guidance in framing a ‘Statement of purpose’,
- Letters of Recommendation
- Email writing, email and business letter writing etiquette,
- Letters of complaints/responses to complaint

Quant

- Time & Work.
- Time, Speed and Distance
- Data Interpretation.

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To facilitate students in Database design.
4. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the

system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

Text Books

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books/Materials

3. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.

4. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 355A	Database Management Systems Lab	-	3	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	**Analysisand Design of Algorithms Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. To understand concept of different sorting algorithms.
2. To understand the concept of dynamic programming.
3. To understand concept of divide and conquer.
4. To understand Dictionary (ADT)
5. To understand concept of greedy algorithms.
6. To understand concept & features like max heap, min heap

Course Outcomes

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**
6	To Implement Matrix Chain Multiplication.	**2 lab hours**

7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs

	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	**Theory of Computation**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: **12 lecture hours**

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: **8 lecture hours**

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: **12 lecture hours**

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: **8 lecture hours**

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

4. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education.

2. Thomas A. Sudkamp,” An Introduction to the Theory of Computer Science, Languages and Machines”, Third Edition, Pearson Education.

3. Raymond Greenlaw an H.James Hoover, “Fundamentals of Theory of Computation, Principles and Practice”, Morgan Kaufmann Publishers.

4. MichealSipser, “Introduction of the Theory and Computation”, Thomson Brokecole.

5. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**
CO2	Design finite automata to accept a set of strings of a language	**PO3**
CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	Operating Systems	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Unit III: **12 lecture hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: **10 lecture hours**

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

1. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

1. Tannenbaum, "Operating Systems", PHI, 4th Edition.
2. William Stallings, "Operating Systems Internals and Design Principles", PHI
3. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
4. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS304A	**Computer Networks**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
C02. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: **8 lecture hours**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization:

Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

3. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
4. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS367A	**iOS Development Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of MAC OS				
Co-requisites	--				

Course Objectives

6. To be able to Understand the basics of Swift Programming language
7. To Learn and practice the iOS App that commonly used in iPhone
8. Understand and able to differentiate between the concept of iOS and OS X
9. Apply necessary information to program for automation.
10. Apprehend the basic of MAC System and how to publish iOS app on AppStore.

Course Outcomes

On completion of this course, the students will be able to

CO1. Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.

C02. Understand and know how to use properly UIKit, asynchronous code, Core Image, NSURL Session and JSON Map Kit and Core Location, Auto Layout, Source Control, Core Data, Animation, and the app submission process.

CO3. Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects

CO4. Organize their code professionally using objects and blocks, prototype several entry-level apps and try to publish on App store.

Catalog Description

The objective of the course is to provide skills to develop applications for OS X and iOS. It includes introduction to development framework Xcode. Objective-C is used as programming language to develop the applications. Objective-C is the superset of the C programming language and provides object-oriented capabilities and a dynamic runtime. Objective-C inherits the syntax, primitive types, and flow control statements of C and adds syntax for defining classes and methods. The list of experiments helps in making static and dynamic iOS App on based on real time systems.

List of Experiments (Indicative)

1	Case Study of Objective-C language.	2 lab hours
2	Case study of Windows and MAC systems	2 lab hours
3	Case Study of XCode based on MAC Systems	2 lab hours
4	Design an App for UISwitch based on Objective-C language	2 lab hours
5	Design an App for UISlider based on Objective-C language	2 lab hours
6	Design an App for UIStepper based on Objective-C language	2 lab hours
7	Write a program for creating Story Boards	2 lab hours
8	Design an App for UIAnimation based on Objective-C language	3 lab hours
9	Create a Simple Calculator using Objective-C Language	3 lab hours
10	Write an Objective-C program that displays the Phrase “Hello World”	1 lab hours
11	Write an Objective-C program for displaying the value of variables	2 lab hours
12	Write an Objective-C program for displaying the sum and subtraction of two variables	2 lab hours
13	Write an Objective-C program for displaying the multiplication and division of the two variables	2 lab hours
14	Write an Objective-C program that demonstrate control structure of Objective-C language	3 lab hours
15	Create a Button using Objective-C	2 lab hours

16	Make an interactive project based on iOS App using Objective-C Language	3 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create iPhone apps using Objective-C and Apple's new programming language, use industry tools and frameworks such as Cocoa, Xcode, UIKit, Git.	**PO2**
CO2	Understand and know how to use properly UIKit, asynchronous code, CoreImage, NSURLSession and JSON MapKit and CoreLocation, AutoLayout, Source Control, Core Data, Animation, and the app submission process.	**PO3**
CO3	Read and write programs based on Objective-C, also have a strong grasp of Objective-C objects	**PO5**
CO4	Organize their code professionally using objects and blocks, prototype several entry- level apps and try to publish on Appstore.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS367A	iOS Development Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
2. Provides a practical approach to assemble Ethernet/Internet networking.
3. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.

CO3. Demonstrate and measure different network scenarios and their performance behavior.

CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra’s algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**
12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool	**4 lab hours**

	(Ethereal/Wireshark)	
14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**

CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**
CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 255A	**Operating Systems Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

List of Experiments (Indicative)

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**

8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical	**4 lab hours**
9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS381A	**Practical Training – I**	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enable students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student’s ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I	-	-	3		3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	Course Title	L	T	P	S	C
ETCS325A	**Employability and Analytical Skills-II**	**2**	**0**	**0**	**0**	**2**
Version 1.0						
Pre-requisites/Exposure	**Non Applicable**					
Co-requisites	**Not Applicable**					
Course Teacher(s): Mr. Neeraj Singh						

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

1. Analytical and Calculative skills
2. Technical Knowledge
3. Logic building
4. Communication skills
5. Grooming
6. Presentation skills
7. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I

- General speaking -Just a minute session,
- Reading news clippings in the class,
- Extempore speech, expressing opinions,
- Making requests/suggestions/complaints, telephone etiquette.
- Professional Speaking
- Elocutions
- Debate

Quant

- Mensuration.

Reasoning

- Number Series, Alpha-Numeric Series.

UNITII

- Describing incidents and developing positive nonverbal communication. Analogies, YES-NO statements (sticking to a particular line of reasoning)
- Group discussion,
- Intricacies of a group discussion, topics for GD (with special focus on controversial topics),
- Structure of participation in a group discussion,
- Words often mis-used, words often mis-spelt,
- Multiple meanings of the same word (differentiating between meanings with the help of the given context),
- Business idioms and expressions foreign phrases, Enhanced difficulty level in spotting errors will be taken up with reference to competitive test based exercises.

Reasoning

- Seating Arrangement, Puzzle.
- Blood Relation, Coding & Decoding.

UNIT III

- Group discussion Advance
- Role Plays
- Video Showcasing
- Just a minute rounds
- Extempore
- Presentations – Team and Individual
- Team Lead activities
- Debates
- Free speech sessions

Reasoning

- Seating Arrangement, Puzzle.
- Data Sufficiency.
- Ranking Test, Venn-diagram, Statement and Conclusion, Statement and Inferences, Statement and Course of Action, Statement and Assumptions, Syllogism.

UNIT IV

- Professional grooming
- Inter personal skills,
- brushing up on general awareness,
- latest trends in their respective branches,
- resume preparation,
- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities, Importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

ETCS375A	**Mini Project**	L	T	P	C
Version 1.0		-	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 375A	Mini Project Lab	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS412A	**Compiler Design**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.

A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.

Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.

Type Checking: Type systems, Specification of a simple type checker.

Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.

Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.

Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, “Principles of Compiler Design”, Pearson Education.

<u>Reference Books/Materials</u>

1. Andrew L. Appel, “Modern Compiler Implementation in C”,Delhi, Foundation Books.
2. Dick Gruneet. Al., “Modern Compiler Design”, Wiley Dreamtech.
3. R. J. Schalkoff, “Artificial Intelligence – An Engineering Approach”, McGraw Hill Int. Ed. Singapore.
4. M. Sasikumar, S. Ramani, “Rule Based Expert Systems”, Narosa Publishing House.
5. Tim Johns, “Artificial Intelligence, Application Programming”, Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**
CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**
CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**
CO5	Distinguish between computability and non-computability and Decidability and undecidability.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS401A	**Artifical Intelligence**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO2. Apply these techniques in applications which involve perception, reasoning and learning.
CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO4. Acquire the knowledge of real world Knowledge representation.
CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: 8 lecture hours

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: 12 lecture hours

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: 12 lecture hours

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: 8 lecture hours

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

2. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

4. Artificial Intelligence, P. H. Winston,Pearson Education.
5. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
6. Principles of AI, N. J. Nilsson, Narosa Publishing House

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	**PO1**
CO2	Apply these techniques in applications which involve perception, reasoning and learning.	**PO4**

CO3	Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.	**PO5**
CO4	Acquire the knowledge of real world Knowledge representation.	**PO2**
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.	**PO3**
CO6	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.	**PO3**
CO7	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS401A	ARTIFICAL INTELLIGENCE	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 202A	**Software Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

On completion of this course, the students will be able to:

CO1. To learn and understand the Concepts of Software Engineering

CO2. To Learn and understand Software Development Life Cycle

CO3. To apply the project management and analysis principles to software project development.

CO4. To apply the design & testing principles to software project development.

CO5. Ability to execute tests, design test cases, use test tools, etc.

CO6. To Study about Software maintenance tools

Catalog Description

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

Unit I: **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

Unit II: **12 lecture hours**

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO,COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding:TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

Unit III: **8 lecture hours**

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

Unit IV: **12 lecture hours**

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, "Software Engineering", New Age International.
2. R. S. Pressman, "Software Engineering – A practitioner's approach", McGraw Hill Int. Ed.
3. W.S. Jawadekar, "Software Engineering – Principles and Practices", McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, "Classical & Object Oriented Software Engineering", IRWIN, TMH.
2. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
3. I. Sommerville, "Software Engineering", Addison Wesley.
4. K. Chandrasehakhar, "Software Engineering & Quality Assurance", BPB.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 202A	Software Engineering	3	3	3	3	3	-	-	-	-	-	2	-	3	3	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS451A	**Artificial Intelligence Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs

CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving

CO4. Know how to build simple knowledge-based systems

CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**
2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	PO1
CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	PO4
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	PO5
CO4	Know how to build simple knowledge-based systems	PO2
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	PSO3

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS451A	ARTIFICIAL INTELLIGENCE LAB	2	3	-	3	3	-	-	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Course Code	**Course Title**	**L**	**T**	**P**	**S**	**C**
ETCS330A	**Communication & Analytical Skills 3**	**3**	**1**	**0**	**0**	**4**
Version 1.0						
Pre-requisites/Exposure	**Not Applicable**					
Co-requisites	**Not Applicable**					

(L – Lecture T – Tutorial P – Practical S – Studio C – Credits)

COURSE OBJECTIVES

- ✓ Professional development of the students.
- ✓ To develop a platform with Intelligent combination of training, technology and interactive learning.
- ✓ Converting fresh graduates into priced assets who are ready to face any challenge head-on.
- ✓ Crafting candidates to be winners and train them to handle their failures as well
- ✓ To train students and make them job ready
- ✓ To understand HR perspective and Industry hiring patterns
- ✓ To understand and create Cross Industry and Industry specific Training Modules

COURSE OUTCOMES (COs)

8. Analytical and Calculative skills
9. Technical Knowledge
10. Logic building
11. Communication skills
12. Grooming
13. Presentation skills
14. Group discussion & Interview handling skills

Mapping of Course Outcome (Cos) with Program Outcomes (POs) and Programme Specific Outcomes (PSOs)

Course Code	Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3
WLS01-CSE	CO1	3	3	-	-	-	-	-	-	-	3
	CO2	3	3	-	-	-	-	-	-	-	3
	CO3	3	2	-	-	-	-	-	-	-	3
	CO4	3	2	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Evaluation Scheme:				
	Evaluation Component	**Duration**	**Weightage (%)**	**Date, Time & Venue**
1	Quiz/Assignment/ Presentation/ Extempore	120 Minutes	20	
2	Written Examination	120 Minutes	20	
3	Attendance		10	
4	End Term Examination	120 Minutes	50	
Total			**100**	

SYLLABUS

UNIT I **(Lectures-)**

- Different types of interviews (with emphasis on personal interview), preparation for an interview,
- areas of questioning,
- Answering questions on general traits like strengths/weaknesses/ hobbies/extracurricular activities,
- importance of non verbal communication while participating in interviews, tips to reduce nervousness during personal interviews,

- handling stress,
- Suggestions for responding to tough/unknown questions, preparation on self and personality development

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNITII

- Profile Building On LinkedIn
- Resume Building
- Video CV building.
- Professional Grooming
- E mail Writing

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT III (Lectures-)

- Interview Role Plays
- Individual Intro Video making
- Team Building sessions
- Self-analysis
- Telephone etiquettes

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

UNIT IV (Lectures-)

- Industry readiness (Resume writing, grooming, GDPI etc.)
- Grooming
- Mock sessions
- FAQs discussions
- Multiple Test series
- Brush-up on GDPI and Industry readiness

Quant & Reasoning

- Test series Practice
- Mass Hiring Companies Test Papers
- Doubt clearing sessions
- Mock tests
- One to One Feedback sessions

ETCS420A	**Graph Theory**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **10 lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on Graph, The Travelling Salesman Problem, Sperner’sLeema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley’s Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: 10 lecture hours

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski’s Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: 12lecture hours

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: 8 lecture hours

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

10. Introduction to Graph Theory, R.J. Wilson, Pearson Education.
11. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
12. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3	-	1	-	-	-	-	-	2	3	1	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS309A	**Distributed Computing Systems**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

<u>Unit I:</u> **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

<u>Unit II:</u> **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

<u>Unit III:</u> **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

<u>Unit IV:</u> **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and

Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

1. Ajay D. Kshemkalyani and MukeshSinghal, "Distributed Computing – Principles, Algorithms and Systems", Cambridge University Press.

Reference Books/Materials

1. George Coulouris, Jean Dellimore and Tim KIndberg, "Distributed Systems Concepts and Design", Pearson Education, 4th Edition.
2. MukeshSinghal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	**PO1**
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	**PO1**
CO3	Design and implement distributed applications	**PO3**

CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Distributed Computing Systems	2	-	3	3	-	-	-	-	-	-	-	2	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

1. Understand the Concept of Parallel Processing and its applications.
2. .Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. .Develop the Pipelining Concept for a given set of Instructions.
5. .Distinguish the performance of pipelining and non-pipelining environment in a processor.
6. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture

focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein's Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl's law, Gustafson'slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

Unit III: **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Unit IV: **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

9. Advanced computer architecture, Kai Hwang, McGraw Hills.
10. Computer Organization and Design, D. A. Patterson and J. L. Hennessey, Morgan Kaufmann.

REFERENCE BOOKS:

29. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
30. Memory System and Pipelined Processors, HarveyG.Cragon, Narosa Publication.
31. Parallel Computer, V.Rajaranam & C.S.R. Murthy, PHI.
32. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
33. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
34. Computer Organization & Architecture, Stalling W, PHI.
35. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**
CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS462A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS464A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS481A	**Practical Training – II**	L	T	P	C
Version 1.0		0	0	0	2
Pre-requisites/Exposure	Completion of sixth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enables students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS481A	Practical Training – II	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS 426A	**Natural Language Processing**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Explain the concepts of artificial intelligence to solve problems.
2. Appraise the concept of natural languages processing components using NLP tools.
3. Create scalable applications that can robustly handle errors in runtime applications.
4. Designing applications using pre-built NLP processor.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand approaches to syntax and semantics in NLP.

CO2. Understand approaches to discourse, generation, dialogue and summarization within NLP.

CO3. Understand current methods for statistical approaches to machine translation.

CO4. Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP

Catalog Description

The intent of the course is to present a fairly broad graduate-level introduction to Natural Language Processing, the study of computing systems that can process, understand, or communicate in human language. The primary focus of the course will be on understanding various NLP tasks, algorithms for effectively solving these problems, and methods for evaluating their performance. There will be a focus on statistical and neural-network learning algorithms that train on (annotated) text corpora to automatically acquire the knowledge needed to perform the task. Class lectures will discuss general issues as well as present abstract algorithms. Implemented versions of some of the algorithms will be provided in order to give a feel for how

the systems discussed in class "really work" and allow for extensions and experimentation as part of the course projects.

Course Content

Unit I: 10 lecture hours

Introduction to Natural Language Understanding: The study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English syntax.

Unit II: 7 lecture hours

Introduction to semantics and knowledge representation, Some applications like machine translation, database interface. Grammars and Parsing: Grammars and sentence Structure, Top-Down and Bottom-Up Parsers, Transition Network Grammars, Top-Down Chart Parsing. Feature Systems and Augmented Grammars: Basic Feature system for English, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks.

Unit III: 7 lecture hours

Grammars for Natural Language: Auxiliary Verbs and Verb Phrases, Movement Phenomenon in Language, Handling questions in Context-Free Grammars. Human preferences in Parsing, Encoding uncertainty, Deterministic Parser.

Unit IV: 10 lecture hours

Ambiguity Resolution: Statistical Methods, Probabilistic Language Processing, Estimating Probabilities, Part-of-Speech tagging, Obtaining Lexical Probabilities, Probabilistic Context-Free Grammars, Best First Parsing. Semantics and Logical Form, Word senses and Ambiguity, Encoding Ambiguity in Logical Form.

Text Books

4. Natural Language Understanding, Allen, Pearson Education.

Reference Books/Materials

7. Speech and Language Processing – An introduction to Language processing, Computational Linguistics, and Speech Recognition, D. Jurafsky & J. H. Martin, Pearson Education.
8. Foundations of Statistical Natural Language Processing, Manning, Christopher and Heinrich SchutzeMIT Press.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand approaches to syntax and semantics in NLP.	**PO1**
CO2	Understand approaches to discourse, generation, dialogue and summarization within NLP.	**PO2**
CO3	Understand current methods for statistical approaches to machine translation.	**PO3**
CO4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 426A	Natural Language Processing	2	3	3	-	-	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS465A	**Natural Language Processing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of Natural Language Processing lab is to introduce the students with the basics of NLP which will empower them for developing advanced NLP tools and solving practical problems in the field.

The experiments in this lab are arranged in a logical sequence to inculcate a new concept at every step, starting from very basic ones to advanced ones.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.

CO2. Able to design, implement, and analyze NLP algorithms

CO3. Able to design different language modeling Techniques

CO4. Analyze large volume text data generated from a range of real-world applications.

Course Description

The lab complements ETCS426A.

List of Experiments (Indicative)

1	To learn about morphological features of a word by analysing it. (Word Analysis)	**2 lab hours**
2	To generate word forms from root and suffix information. (Word Generation)	**2 lab hours**
3	Understanding the morphology of a word by the use of Add-Delete table (Morpgology)	**2 lab hours**
4	To learn to calculate bigrams from a given corpus and calculate probability of a sentence. (N-Grams)	**2 lab hours**
5	To learn how to apply add-one smoothing on sparse bigram	**2 lab hours**

	table. (N-Gram Smoothing)	
6	To calculate emission and transition matrix which will be helpful for tagging Parts of Speech using Hidden Markov Model. (POS Tagging – Hidden Markov Model)	**2 lab hours**
7	To find POS tags of words in a sentence using Viterbi decoding. (POS Tagging – Viterbi Decoding).	**2 lab hours**
8	To know the importance of context and size of training corpus in learning Parts of Speech. (Building POS Tagger).	**2 lab hours**
9	To understand the concept of chunking and get familiar with the basic chunk tagset. (Chunking).	**2 lab hours**
10	To know the importance of selecting proper features for training a model and size of training corpus in learning how to do cunking. (Building Chunker)	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to manipulate probabilities, construct statistical models and estimate parameters using supervised and unsupervised training methods.	**PO2, PO3, PO4**
CO2	Able to design, implement, and analyze NLP algorithms.	**PO2, PO3, PO4**
CO3	Able to design different language modeling techniques	**PO3, PO5**
CO 4	Analyze large volume text data generated from a range of real-world applications.	**PO2, PO3, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS465A	Natural Language Processing Lab		2	3	3	3							3	3	2	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 424A	**Data Warehouse And Data Mining**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand the functionality of the various data mining and data warehousing component

CO2. Appreciate the strengths and limitations of various data mining and data warehousing models

CO3. Explain the analyzing techniques of various data

CO4. Describe different methodologies used in data mining and data ware housing

CO5. Compare different approaches of data ware housing and data mining with various technologies

Catalog Description

This course will introduce the concepts of data ware house and data mining, which gives a complete description about the principles, used, architectures, applications, design and implementation of data mining and data ware housing concepts.

Course Content

Unit I: **10 lecture hours**

Introduction: Evolution Of Data Warehousing (Historical Context), The Data Warehouse - a Brief Overview, Characteristics, Operational Database Systems and Data Warehouse(OLTP & OLAP), Data Marts, Metadata.

Principles of Data Warehousing(Architecture and Design Techniques): System Processes, Data Warehousing Components, Architecture for a Warehouse, Three-tier Data Warehouse Architecture, Steps for the design and construction of Data Warehouses, Conceptual Data Architecture, Logical Architectures, Design Techniques.

Unit II: **12 lecture hours**

Multidimensional Data Models: Types of Data and Their Uses, From Tables and Spreadsheets to Data Cubes, Identifying Facts and Dimensions, Fact Tables, Designing Fact Tables, Designing Dimension Table, Data Warehouse Schemas- STAR Schema, Snowflake Schema, OLAP, OLAP Operations**,** Hypercube**,** ROLAP, MOLAP, From Data warehousing to Data Mining, Data warehouse Usage

Unit III: **12 lecture hours**

Data Mining: Motivation, Importance, Knowledge Discovery Process (KDD), KDD and Data Mining, Data Mining vs. Query Tools, Kind of Data, Data preprocessing, Functionalities, Interesting Patterns, Classification of data mining systems, Major issues.

Unit IV: **12 lecture hours**

Classification and Prediction: Classification & Prediction, Issues Regarding Classification & Prediction, Classification by Decision Tree Induction, Bayesian Classification, Classification by Back Propagation, Classification Parameters.

Cluster Analysis: Types of Data in Cluster Analysis, Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method, Model Based Clustering Method, Outlier Analysis.

Mining Association Rules: Association Rule Mining, Market Basket Analysis, Types of Association Rules, Methods for Mining Association

Text Books

Kamber and Han, "Data Mining Concepts and Techniques", Hartcourt India P. Ltd

Reference Books/Materials

1. W. H. Inmon, "Building the operational data store", 2nd Ed., John Wiley.
2. Paul Raj Poonia, "Fundamentals of Data Warehousing", John Wiley & Sons.
3. Sam Anahony, "Data Warehousing in the real world: A practical guide for building decision support systems", John Wiley.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the functionality of the various data mining and data warehousing component	**PO1**
CO2	Appreciate the strengths and limitations of various data mining and data warehousing models	**PO1**
CO3	Explain the analyzing techniques of various data	**PO2**
CO4	Describe different methodologies used in data mining and data ware housing	**PO2**
CO5	Compare different approaches of data ware housing and data mining with various technologies	**PO4, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO 2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO 10	PO11	PO12	PSO1	PSO2	PSO3
ETCS463A	Data warehouse and data mining	3	3	2	3	3	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS463A	**Data Warehousing And Data MiningLab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic Database concepts, Query tools				
Co-requisites	--				

Course Objectives

1. Be familiar with mathematical foundations of data mining tools.

2. Understand and implement classical models and algorithms in data warehouses and data mining

3. Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering.

4. Master data mining techniques in various applications like social, scientific and environmental context.

5. Develop skill in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Able to get the acquaintance to WEKA tool

CO2. Competent to preprocess the data for mining

CO3. Proficient in generating association rules

CO4. Able to build various classification models

CO5. Able to realize clusters from the available data

Catalog Description

The main objective of this lab is to impart the knowledge on how to implement classical models and algorithms in data warehousing and data mining and to characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering. At the end, the course provides a comparison of different conceptions of data mining.

List of Experiments (Indicative)

1	Demonstration of data pre-processing on datasets	**2 lab hours**
2	To list all the categorical (or nominal) attributes and the real valued attributes	**4 lab hours**
3	Create a data classification model using decision tree	**4 lab hours**
4	Create a data classification model using Naive Bayes	**2 lab hours**
5	Create a data classification model using rule based classifies	**2 lab hours**
6	Create a data classification model using statistical classifiers.	**4 lab hours**
7	Create a data classification model using neural networks.	**4 lab hours**
8	Create a data classification model	**4 lab hours**
9	Demonstrate the working of k-means algorithm for clustering the data.	**4 lab hours**
10	Create a clustering model using hierarchical clustering algorithm.	**2 lab hours**

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to get **the** acquaintance to WEKA tool	**PO5**
CO2	Competent to preprocess the data for mining	**PO2**
CO3	Proficient in generating association rules	**PO4**
CO4	Able to build various classification models	**PO3**
CO5	Able to realize clusters from the available data	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 463A	Data warehouse and data mining Lab	2	2	3	3	3	-	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS423A	**Neural Networks**	L	T	P	C
Version 1.0		4	-	0	4
Pre-requisites/Exposure	Artificial Intelligence and Machine learning				
Co-requisites	--				

Course Objectives

1. To be able to understand the analogy of biological and artificial neural networks.

2. To be able to use learning methods, optimization techniques, activation functions, variable transformations, pattern storage networks during the designing of Machine learning models.

3.To be able to understand the role of data mining and data analytics while designing the algorithms by using neural networks.

4.How neural networks can be used in prediction models and competitive leanings.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand all terminologies that are used in Neural network designing.

CO2. Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.

CO3. Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.

CO4.Write an algorithm for prediction modeling with the best performance.

Catalog Description

This course imparts the basic concepts of neural network algorithms. It enables them to write algorithms for solving problems with the help of supervised and unsupervised learning techniques. The course of neural networks helps to organize the historical data in a variety of ways to solve future problems. The course introduces the basic concepts about neural network activation functions, hyper parameter selection techniques, optimization techniques, it also discusses the pattern storage networks, competitive learning architecture, and applications.

Course Content

Unit I: **8 lecture hours**

Introduction to ANN: what is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation,

Artificial Intelligence and Neural Networks, Trends in Computing Comparison of BNN and ANN

Basics of Artificial Neural Networks: characteristics of neural networks terminology, models of neuron Mc Culloch - Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

Unit II: **12 lecture hours**

Backpropagation networks: Architecture of feed forward network, single layer ANN: Adaptive filtering problem, Unconstrained Organization Techniques, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

Unit III: **12 lecture hours**

Activation & Synaptic Dynamics: Introduction, Activation Dynamics models, synaptic Dynamics models, stability and convergence, recall in neural networks.

Basic functional units of ANN for pattern recognition tasks: Basic feed forward, Basic feedback and basic competitive learning neural network, Feed forward neural networks – Linear responsibility X-OR problem and solution, Analysis of pattern mapping networks summary of basic gradient search methods, Feedback neural networks - Pattern storage networks, stochastic networks and simulated annealing, Boltzmann machine and Boltzmann learning

Unit IV: **8 lecture hours**

Competitive learning neural networks: Components of CL network pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network.

Applications of ANN: Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.

Text Books

1. Neural networks A comprehensive foundations, Simon Haykin, Pearson Education

Reference Books/Materials

1. Artificial neural networks, B. Vegnanarayana, Prentice Hall of India (P) Ltd

2. Neural networks, Fuzzy logic and Genetic Algorithms, S. Rajsekaran , Vijayalakshmi Pari, PHI

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand all terminologies that are used in Neural network designing.	**PO1**
CO2	Use data exploration, data correction methods, optimization techniques, pattern storage algorithms using open platforms/software.	**PO1, PO2, PO4**
CO3	Design algorithms of supervised and unsupervised learning, classification, and regression while checking which algorithm will work better in which case.	**PO5, PSO1, PSO2**
CO4	Write an algorithm for prediction modelingwith the best performance.	**PO5, PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS423A	Neural Networks	2	3	-	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS460A	**Neural Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to

1. make students familiar with basic concepts and tool used in neural networks
2. teach students structure of a neuron including biological and artificial
3. teach learning in network (Supervised and Unsupervised)
4. teach concepts of learning rules.

Course Outcomes

On completion of this course, the students will be able to

CO1. Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems

CO2. Design single and multi-layer feed-forward neural networks

CO3. Understand supervised and unsupervised learning concepts & understand unsupervised learning

CO4. Apply convolution neural and recurrent neural net.

Course Description

The lab complements ETCS423A.

List of Experiments (Indicative)

1	To write a program to implement Perceptron	**2 lab hours**
2	To write a program to implement AND OR gates using Perceptron.	**2 lab hours**

3	To implement Crab Classification using pattern net	**2 lab hours**
4	To write a program to implement Wine Classification using Back propagation.	**2 lab hours**
5	To write a Script containing four functions Addition, Subtraction, Multiply and Divide functions	**2 lab hours**
6	Write a program to implement classification of linearly separable Data with a perceptron	**2 lab hours**
7	To study Long Short Term Memory for Time Series Prediction.	**2 lab hours**
8	To study Convolution Neural Network and Recurrent Neural Network.	**2 lab hours**
9	To study ImageNet, GoogleNet, ResNet convolutional Neural Networks	**2 lab hours**
10	To study the use of Long Short Term Memory / Gated Recurrent Units to predict the stock prices based on historic data	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Able to undertake cognitive tasks and processing of sensorial data such as vision, image- and speech recognition, control, robotics, expert systems	**PO2, PO3,PO4**
CO2	Design single and multi-layer feed-forward neural	**PO2, PO3,**

	networks	**PO4, PO5**
CO3	Understand supervised and unsupervised learning concepts & understand unsupervised learning.	**PO2, PO3, PO4, PO5**
CO 4	Apply convolution neural and recurrent neural net.	**PO2, PO3, PO4, PO5, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS460A	Neural Networks Lab	-	3	3	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS422A	**Cloud Computing**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multi core operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMW are, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: **10 lecture hours**

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: Open Stack.

Unit II: **6 lecture hours**

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: **10 lecture hours**

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

4. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, Venkata Josyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, Borko Furht, Springer

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS422A	Cloud Computing	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCA 362A	**Cloud Computing Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. Define & implement Virtualization using different types of Hypervisors

2. Describe steps to perform on demand application delivery

3. Examine the installation and configuration of Open stack cloud

4. Analyze and understand the functioning of different components involved in Amazon web services cloud platform.

5. Describe the functioning of Platform as a Service

6. Design & Synthesize Storage as a service using own Cloud

Course Outcomes

On completion of this course, the students will be able to

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7. Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

This course is designed to introduce the concepts of Cloud Computing as a new computing paradigm. The students will have an opportunity to explore the Cloud Computing various terminology, concepts, principles and applications. This course provides a hands-on comprehensive study of Cloud concepts and capabilities across the various Cloud service models including Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). A variety of real case studies and existing in market cloud- based tools will be identified and studied in order to provide students with a close overview to Cloud Computing applications.

Course Content

1	Development of applications on Google app engine.	**4 lab hours**
2	Case study of private Cloud setup through Open Stack	**4 lab hours**
3	Case study of private Cloud setup through Cloud Stack	**4 lab hours**
4	Case study of XEN/VMware/KVM hypervisor	**4 lab hours**
5	Case study of Amazon ec2.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement a public cloud instance using a public cloud service provider.	**PO5**
CO2	Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.	**PO1**
CO3	Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.	**PO4**
CO4	Apply trust-based security model to different layers.	**PO5**
CO5	Develop a risk-management strategy for moving to the Cloud.	**PO2**
CO6	Describe big data and use cases from selected business domains.	**PO3**
CO7	Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.	**PO3**
CO8	Analyze various cloud programming models and apply them to solve problems on the cloud.	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA362A	Cloud Computing Lab	2	3	3	2	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS421A	**Internet of Things**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O devices, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: **8 lecture hours**

Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs. Machine to Machine, Difference between IoT and M2M, Software Define Network

Unit II: **9 lecture hours**

Network and Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Unit III: **10 lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12 lecture hours**

Developing IoT's: Input/output Programming: Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program

		Outcomes
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS421A	Internet of Things	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS457A	**Internet of Things Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand IoT and its hardware and software components

CO2. Interface I/O, sensors and communication mobiles

CO3. Remotely monitor data and control devices

CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCS 418A. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

List of Experiments (Indicative)

1	Start Raspberry Pi and try various Linux commands in command terminal window	**2 lab hours**
2	Read your name and print Hello message with name.	**2 lab hours**
3	Read two numbers and print their sum, difference, product and division.	
4	Word and character count of a given string	
5	Area of a given shape (rectangle, triangle and circle) reading shape and appropriate values from standard input	**2 lab hours**
6	Print a name 'n' times, where name and n are read from standard input, using for and while loops.	

7	Handle Divided by Zero Exception.	
8	Print current time for 10 times with an interval of 10 seconds.	**2 lab hours**
9	Read a file line by line and print the word count of each line.	
10	To inter face LED/Buzzer with Arduino/Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.	**2 lab hours**
11	Switch on a relay at a given time using cron, where the relay's contact terminals are connected to a load.	**2 lab hours**
12	To install MySQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
13	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
14	WriteaprogramonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedat aandprint it.	**2 lab hours**
15	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumidity data to TCP client when requested..	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS457A	Internet of Things Lab	2	3	3	3	-	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS425A	**Machine Learning**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	NIL				
Co-requisites					

Course Objectives

1. To develop an appreciation for what is involved in learning from data.
2. To understand a wide variety of learning algorithms.
3. To understand how to apply a variety of learning algorithms to data.
4. To understand how to perform evaluation of learning algorithms and model selection.
5. To become familiar with Dimensionality reduction Techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Gain knowledge about basic concepts of Machine Learning

CO2. Identify machine learning techniques suitable for a given problem.

CO3. Solve the problems using various machine learning techniques.

CO4. Apply neural networks for suitable application.

CO5. Use a tool to implement typical clustering algorithms for different types of applications.

CO6. Apply Dimensionality reduction techniques.

Catalog Description

This course imparts comprehensive introduction to various topics in machine learning. It enables them to design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content

UNIT I **8 Hours**

Machine learning: overview and survey of its applications. Problem of induction and statistical inference: Input-output functions, Boolean functions, Parametric and nonparametric inference, Probability, uncertainty and Bayes theorem, Introduction to typical learning tasks: regression, pattern recognition, feature selection, classification, clustering, rule induction (association). Model validation techniques: cross-validation, leave-one-out, majority, Measures of performance (sensitivity, specificity, ROC curves, etc.)

UNIT II **8 Hours**

Dimensionality Reduction: Subset Selection, Shrinkage Methods, Principle Components Regression Linear Classification, Logistic Regression, Linear Discriminant Analysis Optimization, Classification-Separating Hyperplanes Classification

UNIT III **9 Hours**

Neural Networks: Non-linear Hypothesis, Biological Neurons, Model representation, Intuition for Neural Networks, Multiclass classification, Cost Function, Back Propagation Algorithm, Back Propagation Intuition, Weights initialization, Neural Network Training.

Support Vector Machines: Optimization Objective, Large Margin Classifiers, Kernels, SVM practical considerations

UNIT IV **10 Hours**

Supervised Learning: Additive model: logistic regression, Generative model: naïve Bayes classifier, Discriminative model: Decision trees, Neural networks.

Unsupervised Learning: Clustering: k-means, hierarchical, self-organizing map, EM algorithm, Feature selection principal component analysis.

Reinforcement Learning: Q-learning, Value function approximation, Policy search.

Text Books:

1. The Elements of Statistical Learning, T. Hastie, R. Tibshirani and J. H. Friedman, Springer.

Reference Books:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media
3. Jain V.K., “Data Sciences”, Khanna Publishing House, Delhi.
4. Jain V.K., “Big Data and Hadoop”, Khanna Publishing House, Delhi.
5. Jeeva Jose, “Machine Learning”, Khanna Publishing House, Delhi.
6. Chopra Rajiv, “Machine Learning”, Khanna Publishing House, Delhi.
7. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press
8. http://www.deeplearningbook.org
9. Jiawei Han and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Morgan Kaufmann Publisher

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Gain knowledge about basic concepts of Machine Learning	**PO1**
CO2	Identify machine learning techniques suitable for a given problem.	**PO4**
CO3	Solve the problems using various machine learning techniques.	**PO5**
CO4	Apply neural networks for suitable application.	**PO2**
CO5	Use a tool to implement typical clustering algorithms for different types of applications.	**PO3**

CO6	Apply Dimensionality reduction techniques.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS425A	Machine Learning	2	3	3	3	3	-	-	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS455A	**Machine Learning Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

1. Develop the technical and practical skills to apply machine learning to solve real-world problems.
2. Explore regression as a supervised machine learning technique to predict a continuous variable (response or target) from a set of other variables (features or predictors)
3. Discover how variable selection and shrinkage methods are used to improve the efficiency of a regression model when applied to complex data sets
4. Explore classification as a supervised machine learning technique to predict binary (or discrete) response variables from a set of features
5. Understand what neural networks are, its most successful applications, and how it can be used within a business context

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the implementation procedures for the machine learning algorithms .

CO2. Design Java/Python programs for various Learning algorithms.

CO3. Apply appropriate data sets to the Machine Learning algorithms.

CO4. Identify and apply Machine Learning algorithms to solve real world problems.

Note: The programs can be implemented in either JAVA or Python.

1.For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.

2.Datasetscan be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

Catalog Description

Machine Learning is concerned with computer programs that automatically improve their performance through experience. This course covers the theory and practical algorithms for machine learning from a variety of perspectives. We cover topics such as FIND-S, Candidate Elimination Algorithm, Decision tree (ID3 Algorithm), Back propagation Algorithm, Naïve Bayesian classifier, Bayesian Network, k-Means Algorithm, k-Nearest Neighbor Algorithm, Locally Weighted Regression Algorithm.

List of Experiments (Indicative)

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.	**2 lab hours**
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.	**2 lab hours**
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	**2 lab hours**
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	**2 lab hours**
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	**2 lab hours**
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.	**4 lab hours**

7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.	**4 lab hours**
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.	**4 lab hours**
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.	**4 lab hours**
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the implementation procedures for the machine learning algorithms.	**PO2**
CO2	Design Java/Python programs for various Learning algorithms.	**PO3**

CO3	Apply appropriate data sets to the Machine Learning algorithms.	**PO5**
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS455A	Machine learning Lab	-	3	3	-	2	-	-	2	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.
C02. Write technical documentation for the project implement.
CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.
CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship		3	3		3	2							3		2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS116A	**Introduction to Cloud Computing**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Computer Fundamentals				
Co-requisites	--				

Course Objectives

1. Be familiar with cloud fundamentals
2. Understand the cloud infrastructure and systems
3. Characterize the computing architectures

Course Outcomes

On completion of this course, the students will be able to:

CO1: Understand the vision of cloud computing
CO2: Learn the historical developments of cloud computing
CO3: Delve into cloud infrastructure and systems, application developing, and using cloud platforms.
CO4: Understand parallel computing, processing, and its various laws.
CO5: Learn distributed computing architectures and systems.

Catalog Description

This course gives learners a detailed overview of cloud computing, with deliberation on cloud infrastructure and systems. The course outlines the facets of parallel computing and distributed computing architectures and systems.

Course Content

Unit I:
8 hours

Cloud computing at a glance: The vision of cloud computing, defining a cloud, a closer look, the cloud computing reference model, characteristics and benefits, challenges ahead, historical developments: Distributed systems, Virtualization, Service-oriented computing, Utility-oriented computing

Unit II:
10 hours

Building cloud computing environments: Application development, Infrastructure and system development, Computing platforms and technologies, Amazon web services (AWS), Google Cloud Platform, Microsoft Azure

Unit III:
8 hours

Elements of parallel computing: What is parallel processing, Hardware architectures for parallel processing - Single-instruction, single-data (SISD) systems, Single-instruction, multiple-data (SIMD) systems, Multiple-instruction, single-data (MISD) systems, Multiple-instruction, multiple-data (MIMD) systems, Approaches to parallel programming, Levels of parallelism, Laws of caution

Unit IV:
10 hours

Elements of distributed computing: General concepts and definitions, Components of a distributed system, Architectural styles for distributed computing - Component and connectors, 2 Software architectural styles, System architectural styles, Models for Inter-process communication - Message-based communication, Models for message-based communication, Technologies for distributed computing - Remote procedure call, Distributed object frameworks, Service-oriented computing - What is a service, Service-oriented architecture, Web services

Text Books

1. Douglas Comer, "The Cloud Computing Book: The Future of Computing Explained", CRC Press.
2. Boualem Benatallah, Jinjun Chen, Lizhe Wang, Rajiv Ranjan, "Cloud Computing: Methodology Systems and Applications", CRC Press.
3. Arshdeep Bahga, Vijay Madisetti, "Cloud Computing: A Hands on Approach", Self-Published
4. Thomas Erl, Ricardo Puttini, Zaigham Mahmood, "Cloud Computing: Concepts, Technology and Architecture", Pearson Education.

Reference Books/Materials

1. Stephen Baron, "AWS: The Complete Beginner's Guide", Amazon Digital Services LLC
2. Ray Raphaels, "Cloud Computing from Beginning to End", CreateSpace Independent Publishing Platform
3. Adney Ainsley, "Microsoft Azure for Beginners: Getting Started with Microsoft Azure", CreateSpace Independent Publishing Platform

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the vision of cloud computing.	**PO1**
CO2	Learn the historical developments of cloud computing	**PO1, PO 3,**
CO3	Delve into cloud infrastructure and systems, application developing, and using cloud platforms.	**PO 3, PO4**
CO4	Understand parallel computing, processing, and its various laws.	**PO 3, PO4**
CO5	Learn distributed computing architectures and systems.	**PO1, PO3**

		Engineering Knowledge	Problem analysis	Design/developme nt of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course	Course	PO1	PO 2	PO3	PO4	P O	PO 6	PO7	P O	PO9	PO1 0	PO11	PO12	PSO1	PSO2	PSO3

Code	Title					5			8							
ETCS116A	Introduction to Cloud Computing	3	-	3	3	-	-	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS221A	**Cloud Computing Tools and Techniques**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basic Cloud essentials				
Co-requisites	--				

Course Objectives

- Discover how the top cloud players operate
- Use distinctive features of the cloud and traditional platforms
- Explain the facets of cloud interface
- Investigate the application development in cloud
- Learn how forms of layers in cloud architecture exists

Course Outcomes

On completion of this course, the students will be able to:

CO1: Explain the Cloud players

CO2: Understand the difference between cloud and traditional platforms

CO3: Lean the interfaces facets

CO4: Discuss the application development in cloud

CO5: Discuss the layers in architecture

Catalog Description

The course covers the essentials of top cloud players of AWS, Azure and GCP wherein the differentiating pointers are showcased on traditional platforms versus the cloud platforms

Course Content

Unit I: **8 lecture hours**

Cloud Players: Identifying the cloud players, Introducing AWS, Azure and GCP and usage recommendation for a particular scenario. The tools and techniques matrix

Unit II: **8 lecture hours**

Interfaces: Understand how Cloud Computing differs from traditional self-hosted IT deployment models. Interfaces (API, CLI, SDK) for interacting with cloud provider

Unit III: **10 lecture hours**

Cloud architecture considerations: Concurrency, speed and unpredictable loads. Agile practices and development, Model View Controller, Advanced Ajax and JQuery. Presenting to different browsers and devices. High-performance computing, Utility and Enterprise grid computing, Cloud Benefits, Application development, Security level of third party, Government policies.

Unit IV: **10 lecture hours**

Layers in cloud architecture, Software as a Service (SaaS), features of SaaS and benefits, Platform as a Service (PaaS), features of PaaS and benefits, Infrastructure as a Service (IaaS), features of IaaS and benefits, Service providers, challenges and risks in cloud adoption. Cloud deployment models, Simulator, understanding CloudSim simulator, CloudSim Architecture(User code, CloudSim, GridSim, SimJava) Platform for CloudSim, GreenCloud

Text Books

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATA McGraw- Hill , New Delhi – 2010

Reference Books/Materials

1. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Explain the Cloud players	**PO1, PO 2**
CO2	Understand the difference between cloud and traditional platforms	**PO1, PO 2, PO 3, PO4**
CO3	Learn the interfaces facets	**PO1, PO 3, PO4, PO 5**
CO4	Discuss the application development in cloud	**PO1, PO 3, PO4, PO5, PO8**
CO5	Discuss the layers in architecture	**PO1, PO 2, PO3, PO 8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS221A	Cloud Computing Tools and Techniques	3	2	3	3	2	-	-	2	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS223A	**Foundational Linux & Scripting**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Computer Fundamentals				
Co-requisites	--				

Course Objectives

- Understand the role of Administrator
- Learn Linux File system and hierarchy
- Learn about monitoring and configuration
- Understand package management
- Synthesise different metrics that are available for Linux monitoring

Course Outcomes

On completion of this course, the students will be able to:

1. Describe the role of Administrators and compare with that of Developers
2. Illustrate the structure of Linux file system hierarchy
3. Explain the basic scripting concepts and implement the best practices involved in writing scripts.
4. Outline concept of package management and Linux package managers
5. Assess the employment of Linux Groups

Catalog Description

The main objective of this course is to impart knowledge on Linux system administration among the participants. The course first describes the role of a Linux system administrator and the tasks performed by them. Participants will then learn about the Linux file system hierarchy in detail. The course then walks one through the Linux package management systems and Linux configuration and maintenance. Finally, participants will learn about Linux monitoring tools. At the end of this module, participants will have a mock exam to prove their understanding.

Course Content

Unit I: **6 hours**

Role of Administrator: Introduction to Linux, Different Types of Linux, what is GPLv2, Run Levels in Linux, Role of Linux Administrator, Developer vs Administrator, Critical Tasks of Linux Administrator, Requirements for Installing Linux, Installing Linux, Download ISO Image, Install Linux Using Oracle VirtualBox, Installation Completed, Booting in Linux

Unit II: **8 hours**

Delving Deep into Filesystem Hierarchy: Linux File System Hierarchy, Structure of Linux File System, Why a Linux File System is Unique?, Everything is a File, An Overview of Top Level Directories, Essential Commands in /bin and /sbin, Permissions in Linux, GRUB, MBR, Types of Files in Linux, File permissions, Linux editors (vi, nano, vim Introduction), using vi editor, explaining the difference between the vi & vim editor, Introduction to regular expressions, Introduction to filtering the output of a file, explaining grep command, less command, tail command, head command, find command

Unit III:

Scripting Development Tasks 6 hours

Writing Automation Scripts, Task Scheduling Using Cron, Basic Linux Commands, Best Practices for Scripting, Make use of Shell's Built-In Options, Naming Conventions, Annotations Make the Logic Clean, Command Substitution, Always Begin with a Shebang, Variable Substitution, Conditionals, Regular Expressions,

Unit IV: **8 hours**

"Make" and "Make files": Why "Make"? Why not Others?, Why not use "Bash Script" instead of "Make file"?, features of "Make", Various versions and Variants of "Make", Structure of a "Make file", What is a Rule?, Structure of a "Make file" Rule, Targets, Some Special Built-in Target Names, Automatic Variables, Suffix Rules, Pattern Rules, The "Make" command, "Make" arguments, recursive make file, Building Binary from Source Code, Conditionals in "Make file", Best Practices in writing "Make files"

Unit V: **8 hours**

Package Management Systems: Introduction to Package Management, Linux Package Managers, RPM, Yum, Package in Yum, Listing Available, Installed and Group Packages, Installing, Updating and Removing Group Packages, yum shell, APT, Debian Package Management System, Using apt, APT-get and APT-cache, apt-cache **Configuration & Maintenance:** Managing Public and Private Groups, Linux Group Management, Group Management Commands, Adding a New User in Linux, Modifying Existing Groups and Users, Adding a User to Groups, Ownership of Linux Files, Private Groups Usage, /etc/groups file, Setting Default Permissions for New Files Using umask, Security in Linux, Introduction to Monitoring

Text Book

Matthias Kalle Dalheimer, "Running Linux", O'REILLY MEDIA INC.

Reference Books/Materials

1. Brain by Ward, “How Linux Works”, No Starch Press
2. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, “UNIX and Linux System Administration Handbook”, O’Reilly Media
3. Tom Adelstein, Bill Lubanovic, “Linux System Administration”, O’REILLY MEDIA INC.
4. STEVER PERKER, “SHELL SCRIPTING: EXPERT RECIPES FOR LINUX, BASH, AND MORE”, WILEY

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the role of Administrators and compare with that of Developers	**PO1, PO6**
CO2	Illustrate the structure of Linux file system hierarchy	**PO1, PO 2, PO 3, PO4**
CO3	Explain the basic scripting concepts and implement the best practices involved in writing scripts.	**PO1, PO 3, PO4**
CO4	Outline concept of package management and Linux package managers	**PO1, PO 3**
CO5	Assess the employment of Linux Groups	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS223A	Foundational Linux & Scripting	3	3	2	3	-	1	-	-	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS218A	**Computational Services in the Cloud**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Cloud fundamentals				
Co-requisites	--				

Course Objectives

1. Define computational service in the cloud

2. Describe and demonstrate AWS, Azure and GCP

3. Learn about creating applications

Course Outcomes

On completion of this course, the students will be able to:

CO1: Learn Virtual Machine, virtual servers, and virtual networks

CO2: Learn about virtualization solutions

CO3: Demonstrate AWS, create user

CO4: Understand Microsoft Azure

CO5: Demonstrate and create Word Press application in Azure

Catalog Description

This course covers the networking infrastructures required for highly virtualized cloud deployments. The course covers virtualized datacenter and cloud concepts and features, and computational services of AWS, Azure, and GCP.

Course Content

Unit I: **10 hours**

Introduction: Virtual Machine, Why Virtual Machine? Virtual servers, Virtual Storage Virtual Networks, Virtual Networks using Virtual Storage From simple virtualization to Cloud, Major Components of Virtualization Environment, Characteristics of Virtualization - Characteristics of Virtualization, Taxonomy of virtualization techniques - Execution virtualization, Machine reference model - Instruction Set Architecture (ISA), Application Binary Interface, Security Rings and Privileged Mode - Ring 0 (most privileged) and 3 (least privileged) , Rings 1 and 2, Hardware-level virtualization - Type 1 Hypervisor, Type 2 Hypervisor, Choosing the right hypervisor, Hardware virtualization techniques - Full virtualization, Paravirtualization, Programming language-level virtualization and Other types, Programming language-level virtualization - Application-level virtualization, Other types of virtualizations – Storage, Network, Desktop, Application server Virtualizations

Unit II: **6 hours**

Virtualization and cloud computing: Advantages of virtualization, Disadvantages of virtualization, Technology examples - Xen: paravirtualization, VMware: full virtualization, Full Virtualization and Binary Translation, Virtualization solutions, End-user (desktop) virtualization, Server virtualization, Microsoft Hyper-V – Architecture

Unit III: **8 hours**

Introduction to AWS: Demonstration of Accessing AWS and creating user, The WordPress Blog in the Elastic Computing Cloud, an alternative Instance Interface- LightSail, Adding Scalability and Availability, Lab WordPress in Amazon Cloud Lab, WordPress in the Amazon LightSail Cloud, Lab - S3 Bucket and Programmatic, IAM user, Lab - Word Press plugin, Instance Cloning, and Load Balancer, Amazon Elastic Compute Cloud (Amazon EC2), Amazon EC2 instance types, Amazon EC2 pricing, Amazon EC2 Auto Scaling, Elastic Load Balancing, AWS messaging services, Serverless compute services and AWS container services

Unit IV: **8 hours**

Introduction to Microsoft Azure: Demonstration: Creating WordPress Application in Azure, Creating Provision Virtual Machine, Lab - Adding a File Share, Lab - Cloning the WordPress Virtual Machine, Lab - Adding a Load Balancer Introduction to Google Cloud Platform, Lab - Creating the Database, Lab - File-store and Instance Group Lab - The Load Balancer

Text Books

1. Stephen Springwell, “AWS: The Ultimate Guide to Amazon Web Services Step-by-step Guide from Beginners to Advanced”, Amplitude
2. Scott Patterson, “Learn AWS Serverless Computing: A beginner's guide to using AWS Lambda, Amazon API Gateway, and services from Amazon Web Services”, Packt
3. Vijayakumar, “Practical Azure Application Development: A Step-By-Step Approach to Build Feature-Rich Cloud-Ready Solutions”, Apress

Reference Books/Materials

1. Mustafa Toroman, “Hands-On Cloud Administration in Azure: Implement, monitor, and manage important Azure services and components including IaaS and PaaS”, Packt

2. John Savill, “Practical Azure Application Development: A Step-By-Step Approach to Build Feature-Rich Cloud-Ready Solutions”, Sybex
3. Mark Cohen, Kathryn Hurly, Paul Newson, “Google Compute Engine: Managing Secure and Scalable Cloud Computing”, O'Reilly

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn Virtual Machine, virtual servers, and virtual networks	**PO1**
CO2	Learn about virtualization solutions	**PO1, PO 2, PO 3, PO4**
CO3	Demonstrate AWS, create user	**PO1, PO 3, PO4**
CO4	Understand Microsoft Azure	**PO1, PO 3, PO4, PO8**
CO5	Demonstrate and create WordPress application in Azure	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS218A	Computational Services In The Cloud	3	3	3	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS305A	**Storage and Databases on Cloud**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Computer Fundamentals, Database Management Basics, Cloud Fundamentals				
Co-requisites	--				

Course Objectives

1. Learn how to setup an AWS account
2. Delve into Google Cloud Platform
3. Understand the AWS Core Storage Services
4. Learn the various types of GCP Storage Services
5. Gain an understanding of Azure Storage Services

Course Outcomes

On completion of this course, the students will be able to:

CO1 Learn how to setup an AWS account

CO2 Delve into Google Cloud Platform

CO3 Understand the AWS Core Storage Services

CO4 Learn the various types of GCP Storage Services

CO5 Gain an understanding of Azure Storage Services

Catalog Description

The course covers the facets of the cloud database as a database facility that is formed and accessible via a cloud platform. The participants will learn that it performs many of the same functions as a traditional database, but with the added benefit of flexibility provided by cloud computing.

Course Content

Unit 1: **8 hours**

Introduction: Setting Up AWS Account, AWS Security Best Practice AWS - Billing Alarm, Introducing Google Cloud Platform (GCP), Google Cloud Shell, Creating Virtual Machines in GCP Advanced, Azure Portal, Azure CLI, Azure SDK

Unit 2: **10 hours**

AWS Core Storage Services: Simple Storage Service (S3) - Introducing Data Consistency Model, Creating S3 Buckets, Configuring S3 Buckets, Relational Database Management Service (RDS), Amazon DynamoDB, Amazon Redshift, Implementing Data Lake in AWS Static Website in AWS, WordPress Application in AWS

Unit 3: **8 hours**

GCP Storage Services: Google Kubernetes Engine (GKE) Google Cloud Storage, Google Cloud Storage - Demo Google Cloud SQL, Google Cloud SQL - Overview Google Cloud SQL - GKE Cluster, Google Cloud SQL - Kubernetes Volumes Google Cloud SQL - Google Cloud SQL Google Cloud SQL - Final Touch, Deploying Microservice Application in GKE Overview, Deploying Microservice Application in GKE Rolling Update Deploying Microservice Application in GKE Implementing CICD

Unit 4: **6 hours**

Azure Storage Service: Introducing Azure Blob, Azure Blob with Azure CLI, Azure SQL, Azure Backup – Overview, Azure Backup - Azure CLI, Azure Backup - Advanced

Text Books

1. AWS Documentation Team, "AWS Storage Gateway User Guide", Samurai Media Limited
2. Joseph Barron, "Storage Options in the AWS Cloud", Amazon
3. JT Wolohan, "Object Storage across the cloud: AWS, Azure and GCP", Manniing Publications

Reference Books

1. Richard L. Nuckolls, "Azure Storage, Streaming, and Batch Analytics", Manniing Publications
2. Ahmad Osama, "Azure Data Engineering Cookbook: Design and implement batch and streaming analytics using Azure Cloud", Packt
3. Mark Cohen, Cathryn Hurley, Paul Newson, "Google Compute Engine", O'Reilly

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn how to setup an AWS account	**PO1, PO2, PO3**
CO2	Delve into Google Cloud Platform	**PO1, PO 2, PO 3, PO4**
CO3	Understand the AWS Core Storage Services	**PO1, PO 3, PO4**
CO4	Learn the various types of GCP Storage Services	**PO1, PO 3, PO4, PO8**
CO5	Gain an understanding of Azure Storage Services	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS305A	Storage and Databases on Cloud	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS319A	**Application Development and DevOps on Cloud**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of DevOps, Cloud Services and Infrastructure				
Co-requisites	--				

Course Objectives

1. Explain the developer's focus and learn end-to-end SDLC
2. Understand the application of DevOps for speeding applications
3. Discuss the DevOps process, continuous delivery, and project & portfolio management
4. Understand working with various DevOps Tools and define CICD Pipeline
5. Explain the facets of CICD Pipeline and Cloud DevOps tools
6. Learn the use AWS CodeStar, AWS CodeCommit, and AWS CodePipeline

Course Outcomes

On completion of this course, the students will be able to:

1. Analyze a developer's focus and learn end-to-end SDLC
2. Learn the DevOps process, continuous delivery, and project & portfolio management
3. Use various DevOps Tools and define CICD Pipeline
4. Define CICD Pipeline and Cloud DevOps tools
5. Use AWS CodeStar, AWS CodeCommit, and AWS CodePipeline

Catalog Description

The course describes the software development life cycle and interrelation cloud with DevOps. The connections between DevOps and cloud computing are straightforward: Cloud computing's centralized nature provides DevOps automation with a standard and centralized platform for testing, deployment, and production.

Course Content

Unit I:
8 hours

Definition of DevOps: Challenges of traditional IT systems & processes, History and emergence of DevOps, DevOps definition and principles governing DevOps, DevOps and Agile, The need for building a business use case for DevOps, Developers Focus: End-to-end SDLC, Legacy SDLC, Manual Integration, More About SDLC, Software, History of Software Engineering and Software, Development Methodologies, Traditional Software Development Models, Waterfall Model, Classical Waterfall Model, Traditional IT Organizations, Developers vs IT Operations Conflict, Birth of Agile, Four Values of the Agile Manifesto, Agile and Lean, The Role of Cloud in DevOps, Cloud for successful Ops, Secure Cloud Platforms for DevOps, Cloud & IT Budgets, building a business case for cloud computing, Infrastructure as Code (IAC)

Unit II: 8 hours

Application of DevOps: Applying DevOps to Speed-up Application: Delivery, Developer Transition, DevOps Process, What is Continuous Delivery, DevOps Tools, Project and Portfolio Management, Labs -DevOps Tools, Minimum Viable Product (MVP), Benefits of MVP, Application Deployment, Automated Application Deployment, Application Release Automation (ARA), Components of Application Release Automation (ARA), Continuous Integration, Best Practices of CI, Benefits of CI, Continuous Delivery

Unit III : 8 hours

CICD: Core CI Process, VCS, Merging Local Changes to Integration Branch, Fork & Pull, Code Review, Automated code builds – Key metrics, Static Code Analysis, Snapshot, Sample Bug Report, Automated Unit Testing- JUNIT, Test Frameworks, Automated Unit Testing Process, Code Coverage analysis, Code Coverage Methods, Condition Coverage, Line Coverage, Publishing Code Coverage reports to Jenkins, Uploading build artifact to a repository, Advanced CI process, Automated Functional Testing, Publish Report to the Development Team, Google Canary release Case study

Unit IV: 6 hours

Azure DevOps: Cloud DevOps Tools and CICD Pipeline Introduction: Azure DevOps, Azure DevOps, CICD Pipeline, Azure DevOps Documentation, Develop an App on Visual Studio, Exploring the developed Apps

Unit V: 6 hours

AWS Devops : Cloud DevOps Tools and CICD Pipeline: Using AWS, AWS CodeStar, AWS, CodeCommit, AWS CodePipeline, Labs - Deployment using AWS CodeStar and CodeCommit

Textbooks:

1. Mitesh Soni, "Hands-On Azure Devops: Cicd Implementation for Mobile, Hybrid, And Web Applications Using Azure Devops and Microsoft Azure: CICD Implementation for DevOps and Microsoft Azure", BPB Publishers
2. Machiraju, "Devops for Azure Applications: Deploy Web Applications on Azure", Apress
3. Sachin Srivastava, "DevOps with AWS The Effective, Practical Way", NotionPress

Reference Books:

1. Yogesh Raheja, Nathaniel Felsen, Guiseppe Borgese, "Effective DevOps with AWS: Implement continuous delivery and integration in the AWS environment, 2nd Edition", Packt
2. Veselin Kantsev, "Implementing Devops on Aws", Packt

- Pierluigi Riti, "Pro DevOps with Google Cloud Platform: With Docker, Jenkins, and Kubernetes", Apres

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze a developer's focus and learn end-to-end SDLC	**PO1**

CO2	Learn the DevOps process, continuous delivery, and project & portfolio management	**PO1, PO 2, PO 3, PO4**
CO3	Explain the use of various DevOps Tools and define CICD Pipeline	**PO1, PO 3, PO4**
CO4	Learn CICD Pipeline and Cloud DevOps tools	**PO1, PO 3, PO4, PO8**
CO5	Use AWS CodeStar, AWS CodeCommit, and AWS CodePipeline	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication
Course Code	Course Title	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS319A	Application Development and DevOps on Cloud	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS322A	**Messaging & Monitoring**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Cloud Fundamentals, Cloud architecture and computational services				
Co-requisites	--DevOps				

Course Objectives

1. Understand the Messaging services
2. Understand the use cases and metrics of messaging services
3. Learn the various ways of monitoring logs and metrics
4. Understand the use cases of monitoring logs and metrics
5. Gain knowledge about alerting based on monitoring threshold.

Course Outcomes

On completion of this course, the students will be able to:

1. Define Messaging services
2. Understand the use cases and metrics of messaging services
3. Learn the various ways of monitoring logs and metrics
4. Understand the use cases of monitoring logs and metrics
5. Gain knowledge about alerting based on monitoring threshold.

Catalog Description

The course will showcase ways of improving the understanding of participants of the performance, availability, and health of your applications and infrastructure.

Course Content

Unit I **10 hours**

Introduction: What is Messaging and Monitoring? End-to-end infrastructure monitoring, Monitoring in Amazon Web Services, Monitoring in Microsoft Azure, Monitoring in Google Cloud, Monitoring Cloud IT Services and Operations

Unit II: **10 hours**

Security in Cloud: Define a shared responsibility model for optimal cloud security, Infrastructure Security, Network level security, Host level security, Application-level security, Data privacy and security Issues. Access Control and Authentication in cloud computing

Unit III: **10 hours**

Messaging & Monitoring: Messaging service and its applications Logs, Metrics, Methods of Monitoring Logs & Metrics & Their Applications Monitoring Threshold-Based Alerting Plan and put in place a well-designed logging and monitoring infrastructure. Service level indicators (SLIs) and service level objectives should be defined (SLOs), Create useful monitoring dashboards and alerts. Monitoring, troubleshooting, and enhancement of Google Cloud infrastructure, AWS, and Azure

Text Books

1. Mainak Chakrabortyu, Ajit Pratap Kundan, "Monitoring Cloud Native Applications", Apress
2. Michael Hausenblas, "Cloud Observability in Action", Manning Publishing

Reference Books

1. Kenichi Shibata, Rob Skillington, Martin Mao, "Cloud Native Monitoring", O'Reilly

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Define Messaging services	**PO1**
CO2	Understand the use cases and metrics of messaging services	**PO1, PO 2, PO 3, PO4**
CO3	Learn the various ways of monitoring logs and metrics	**PO1, PO 3, PO4**
CO4	Understand the use cases of monitoring logs and metrics	**PO1, PO 3, PO4, PO8**
CO5	Gain knowledge about alerting based on monitoring threshold	**PO1, PO 2, PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS322A	Messaging & Monitoring	3	3	2	3	-	-	-	3	-	-	-	-	3	3	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

6.2.5 Syllabus of Courses specific to B.Tech. in (Computer Science & Engineering) (CSE) with specialization in UX/UI in association with ImaginXP

Scheme of studies:

SEMESTER I

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-I	3	1	-	4
2	ETPH109A	Engineering Physics	3	1	0	4
3	UCES125A	Environmental Studies	3	-	-	3
4	ETME101A	Basics of Mechanical Engineering	3	1	-	4
5	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	-	4
6	ETPH151A	Engineering Physics Lab	-	-	2	1
7	ETEC151A	Basics of Electrical & Electronics Engineering Lab	-	-	2	1
8	ETME151A	Basics of Mechanical Engineering Lab	-	-	2	1
9		Open Elective	4	-	-	4
TOTAL			**19**	**4**	**6**	**26**

SEMESTER II

SNo	Course Code	Course Title	L	T	P	C
1	ETMA105A	Applied Mathematics-II	3	1	-	4
2	ETCS104A	Introduction to Computer Science and Programming in Python	3	1	-	4
3	ETCH119A	Engineering Chemistry	3	1	-	4
4	ETCS110A	Introduction to UX Design	4	-	-	4
5	ETCS114A	Empathy and Understanding Problems	2	-	-	2
6	ETME 155A	Engineering Graphics Lab	-	-	3	1.5
7	ETCS150A	Introduction to Computer Science and Programming in Python Lab	-	-	2	1
8	ETCS152A	Empathy and Understanding Problems Lab	-	-	2	1
9		Open Elective	4	-	-	4
10	ETME 157A	Workshop Practices	-	-	3	1.5

TOTAL	19	3	10	27

SEMESTER III

SNo	Course Code	Course Title	L	T	P	C
1	ETMA215A	PROBABILITY AND STATISTICS	4	-	-	4
2	ETCS213A	Technology in Experience Design	3	-	-	3
3	ETCS231A	Discrete Mathematics	3	1	-	4
4	ETCS217A	Data Structures	3	1	-	4
5	UCDM301A	Disaster Management	3	-	-	3
6	ETCS215A	User Research	3	-	-	3
7	ETCS251A	User Research Lab	-	-	4	2
8	ETCS257A	Data Structures Lab	-	-	2	1
9	MOOC001A	The Joy of Computing using Python (MOOC)	1	-	-	3
TOTAL			**20**	**2**	**6**	**27**

SEMESTER IV

SNo	Course Code	Course Title	L	T	P	C
1	ETCS222A	Computer Organization & Architecture	3	1	-	4
2	ETCS212A	Introduction to UI Design	3	-	-	3
3	ETCS220A	Analysis and Design of Algorithms	3	1	-	4
4	ETCS307A	Database Management Systems	3	1	-	4
5	ETCS216A	Information Architecture	3	-	-	3
6	ETCS228A	Employability and Analytical Skills-I	2	-	-	2
7	ETCS 355A	Database Management Systems Lab	-	-	2	1
8	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
9	ETCS256A	UI Design Lab	-	-	2	1
10	ETMC602A	Essentials of Organizational Behavior	3	-	-	3
TOTAL			**20**	**3**	**6**	**26**

SEMESTER V

SNo	Course Code	Course Title	L	T	P	C
1	ETCS303A	Introduction to Interaction Design	3	-	-	3
2	ETCS211A	Operating Systems	3	1	-	4
3	ETCS304A	Computer Networks	3	1	-	4
4	ETCS305A	Design Thinking	3	-	-	3
5	ETCS351A	Design Thinking Lab	-	-	4	2
6	ETCS365A	Computer Networks Lab	-	-	2	1
7	ETCS255A	Operating System Lab	-	-	2	1
8	ETCS381A	Practical Training I	-	-	-	1
9	ETCS325A	Employability and Analytical Skills-II	2	-	-	2
10	ETCS375A	Mini Project	-	-	-	3
	ETCS 214A	Theory of Computation	3	1	-	4
TOTAL			**17**	**3**	**10**	**28**

SEMESTER VI

SNo	Course Code	Course Title	L	T	P	C
1	ETCS401A	Artificial Intelligence	3	1	-	4
2	ETCS302A	Wireframing & Prototyping	3	-	-	3
3	ETCS358A	Wireframing & Prototyping Lab	-	-	2	1
4	ETCS 202A	Software Engineering	3	1	-	4
5	ETCS330A	Employability and Analytical Skills-III	2	-	-	2
6	ETCS451A	Artificial Intelligence Lab	-	-	2	1
7	**Elective**					
(i)	ETCS310A	Advanced Computer Architecture	3	-	-	3
(ii)	ETCS318A	Usability Testing	3	-	-	3
(iii)	ETCS420A	Graph Theory	3	-	-	3
8	ETCS412A	Compiler Design	3	1	-	4
9	ETCS462A	Minor Project	-	-	-	5
TOTAL			**17**	**2**	**6**	**27**

SEMESTER VII

SNo	Course Code	Course Title	L	T	P	C
1	ETCS464A	Major Project	-	-	-	6
2	ETCS429A	Portfolio Development & Review	3	-	-	3
3	ETCS467A	Visual Design Tools Lab	-	-	4	2
4		Bootcamp (Training and Placement)	2	-	-	0
5	**Elective**					
(i)	ETCS433A	UX Design for Futuristic Technologies - HMI	3	-	-	3
(ii)	ETCS309A	Distributed Computing Systems	3	-	-	3
6	**Elective – III**					
(i)	ETCS435A	Design Thinking for Product Management	3	-	-	3
(ii)	ETCS206A	Computer Graphics	3	-	-	3
TOTAL			**11**	-	**4**	**17**

SEMESTER VIII

S.No	Course Code	Course Title	L	T	P	C
1	ETCS490A	**Industrial Internship**	-	-	-	12
TOTAL			-	-	-	**12**

Total Credits [C]	**190**

6.1 Syllabus of B.Tech Computer Science & Engineering in UX/UI with ImaginXp

ETMA105A	**Applied Mathematics-I**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Complex numbers and its applications
2. To understand and learn about the differential calculus and find the curve tracing.
3. Deliver a brief knowledge of Matrices and its properties.
4. Apply the concept of eigenvalue and eigenvector to find higher power of the matrix.
5. Recognize and find the general solution of ordinary differential equation

Course Outcomes

On completion of this course, the students will be able to

CO19. Understand and able to apply the basic concept of complex variable.

CO20. Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.

CO21. Applied the differential calculus method for curve tracing and radios of curvatures.

CO22. Use the characteristic polynomial to compute the eigenvalues and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.

CO23. Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.

CO24. Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-I is the mathematical study of basic concepts, principles, and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: complex number and variables, ordinary differential equations, differential calculus and matrices. The concepts of applied mathematics-I are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **10 lecture hours**

Complex Numbers and Infinite Series: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Convergence and Divergence of Infinite series, Necessary condition for convergence, Positive term infinite series test, Alternating series, Lebnitz test, Absolute and Conditional Convergence.

Unit II: **10 lecture hours**

Application of Differential Calculus: Successive differentiation, Leibnitz theorem (without proof), Taylor's and Maclaurin's theorem and expansion of functions, Asymptotes (Cartesian and polar), Curve Tracing, Curvature, Radius of Curvature.

Unit III: **10lecture hours**

Matrices and its application: Elementary transformation, Inverse of matrix by elementary operations, Rank, Linear and orthogonal transformations, Hermitian and skew - Hermitian forms, Solutions of simultaneous linear equations, Eigen values, Eigen vectors and its properties, Caley - Hamilton theorem (without proof), Diagonalisation of a matrix.

Unit IV: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters,

Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

6. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
7. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of complex variable.	**PO1**
CO2	Recognize and able to apply the concepts of continuity and differentiability for complex functions and solve the analytic function and its properties.	**PO8**
CO3	Applied the differential calculus method for curve tracing and radios of curvatures.	**PO2**
CO4	Use the characteristic polynomial to compute the eigen values and eigenvectors of a square matrix and use them to Diagonalizable matrices when this is possible.	**PO4**

CO5	Explain the qualitative long-term behavior of the solutions to an ODE or system of ODE's.	**PO3**
CO6	Demonstrate knowledge and understanding ordinary differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA 105A	Applied Mathematics - I	3	3	3	3	-	-	-	1	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH109A	**Engineering Physics**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**1**	**0**	**4**
Pre-requisites/Exposure	**Waves & Optics**				
Co-requisites					

Course Objectives

1. Learning different types of harmonic oscillators.
2. Understanding phenomenon of non dispersive and transverse waves in strings.
3. Analyzing propagation of light, geometric and wave optics.
4. Understanding of various laser systems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Understand difference between different types of harmonic oscillators and can find quality factor.

CO2. Solve non-dispersive transverse and longitudinal waves equations.

CO3. Analyze propagation of light, geometric and wave optics.

CO4. Design different laser source systems.

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

UNIT-I **10 Lecture Hours**

Simple harmonic motion, damped and forced simple harmonic oscillator

Mechanical and electrical simple harmonic oscillators damped harmonic oscillator: heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor.

UNIT-II **10 Lecture Hours**

Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection, and transmission of waves at a boundary. Longitudinal waves and the wave equation for them, acoustics waves and speed of sound, wave groups and group velocity.

UNIT-III **10 Lecture Hours**

The propagation of light and geometric optics

Laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection.

Wave optics

Huygens ‘Principle, superposition of waves and interference of light by wave front splitting and amplitude splitting: Young’s double slit experiment, Newton’s rings. Fraunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision: Diffraction gratings and their resolving power.

UNIT-IV **10 Lecture Hours**

Lasers

Amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (Ruby, Neodymium), dye lasers. Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

6. Ian G. Main, Oscillations and waves in physics
7. H.J. Pain, The physics of vibrations and waves
8. E. Hecht, Optics

9. A. Ghatak, Optics
10. O. Svelto, Principles of Lasers

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand difference between different types of harmonic oscillators and can find quality factor.	**PO1**
CO2	Solve non-dispersive transverse and longitudinal waves equations.	**PO4**
CO3	Analyze propagation of light, geometric and wave optics	**PO5**
CO4	Design different laser source systems.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH109A	Engineering Physics	2	2		3	3								3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCES125A	**Environmental Studies**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of Environment				
Co-requisites	--				

Course Objectives

1. To aware the students about the environment.
2. To learn the students concepts and methods from ecological and physical sciences and their application in environmental problem solving.
3. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
4. Communicate clearly and competently matters of environmental concern and understanding to a variety of audiences in appropriate forms.

Course Outcomes

On completion of this course, the students will be able to

CO1. To comprehend and become responsive regarding environmental issues.

CO2.Acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.

CO3. Enable the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.

CO4.To know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.

CO5. Become consciousness about healthy and safe environment.

Catalog Description

This course imparts the basic concepts of environment which enable them to solve basic problems related to their surroundings. This course helps them to get an idea adverse effect of industrialization, population and degradation of natural resources on the environment. The course introduces the concepts of renewable and non-renewable resources.

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.

Land resources; land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).

Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Case studies of the following ecosystems:

a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biological diversity: genetic, species and ecosystem diversity; Biogeographic zones of India; Biodiversity patterns and global biodiversity hot spots ; India as a mega-biodiversity nation; Endangered and endemic species of India; Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity; Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.

Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

7. Kaushik and Kaushik, Environmental Studies, New Age International Publishers (P) Ltd. New Delhi.

Reference Books/Materials

5. A.K. De, Environmental Chemistry, New Age International Publishers (P) Ltd. New Delhi.
6. S.E. Manahan, Environmental Chemistry, CRC Press.
7. S.S Dara and D.D. Mishra, Environmental Chemistry and Pollution Control, S.Chand& Company Ltd, New Delhi.
8. R. Gadi, S. Rattan, S. Mohapatra, Environmental Studies Kataria Publishers, New Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	**PO7**
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	**PO8**
CO3	It enables the students to discuss their concern at national and international level with respect to formulate protection acts and sustainable developments policies.	**PO10**
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCES125A	Environmental Studies	-	-	-	-	-	2	3	3	-	3	-	-	-	1	2

1=weakly mapped

2= moderately mapped

3=strongly mapped.

ETME 101A	**Basics of Mechanical Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Thermodynamics, Fluid Machinery and Power transmission				
Co-requisites	--				

Course Objectives: The subject expects students to achieve the following objectives.

1. Understanding Basic Materials and Manufacturing Processes.
2. Have an understanding of laws of thermodynamics and Thermodynamic processes.
3. Understanding working Principles of Thermal Machines and Power Transmitting Devices.
4. Impart knowledge of General Principles of Mechanical system.

Course Outcomes: Upon the completion of this course the students will be able to:

CO1. Know the basics of thermodynamics and workshop machinery.

CO2 Understand the basic knowledge of Refrigeration and Hydraulic Machinery.

CO3. Get the knowledge about power transmission method and device with mechanical properties.

CO4. Know the various concept about NC, CNC Machines.

Catalog Description

This course gives introductory knowledge about Thermodynamics, refrigeration, cooling, power transmission, and the basics of CNC and Hydraulic machines. It enables the students to understand the working of these systems. It also enhances the students thinking capability to calculate the efficiency and load capacity of the systems. This course is also helping students to answer fundamental questions of Mechanical Engineering at the time of the interview.

Course Content

Unit I: **12 lecture hours**

Introduction to Machine Tools and Commonly used Machine Tools in a Workshop: Lathe, Shaper, Planer, Milling, Drilling, Slotter, Introduction to Metal Cutting.

Basic concept of thermodynamics: Introduction, States, Work, Heat, Temperature, Zeroth, 1st, 2nd and 3rd law of thermodynamics, Concept of internal energy, enthalpy, and entropy. Problems Properties of Steam & Steam Generator Formation of steam at constant pressure, Thermodynamic properties of Steam, use of steam tables, Measurement of dryness fraction by throttling calorimeter.

Unit II: 10 lecture hours

Refrigeration & Air-conditioning: Introduction to refrigeration and air -conditioning, Rating of refrigeration machines, Coefficient of performance, Simple refrigeration vapor compression cycle, Psychometric charts and its use, Human comforts.

Hydraulic Turbines & Pumps: Introduction, Classification, Construction details and working of Pelton, Francis and Kaplan turbines, Specific speed and selection of turbines, Classification of water pumps and their working.

Unit III: 12 lecture hours

Power Transmission Methods and Devices: Introduction to Power transmission, Belt, Rope, Chain and Gear drive, Types and functioning of clutches.

Stresses and Strains: Introduction, Concept & types of Stresses and strains, Poison’s ratio, stresses, and strains in simple and compound bars under axial, flexure & torsional loading, Stress-strain diagrams, Hooks law, Elastic constants & their relationships.

Unit IV: 6 lecture hours

Introduction to Manufacturing Systems: Fundamentals of Numerical Control (NC), Advantage of NC systems, Classifications of NC, Comparison of NC and CNC

Text Books:

8. Elements of Mechanical Engineering – R.K.RajputLakmi Pub., Delhi
9. Elements of Mechanical Engineering – D.S.Kumar, S.K. Kataria and Sons
10. Engineering Thermodynamics- P.K.Nag TMH, New Delhi
11. Refrigeration & Air-conditioning – Arora &Domkundwar, Dhanpat rai &co.pvt ltd
12. Workshop Technology Vol.I& II - Hazra & Chaudhary, Asian Book Comp., New Delhi.
13. Process and Materials of Manufacture -- Lindberg, R.A. Prentice Hall of India, New Delhi.
14. Principles of Manufacturing Materials and Processes - Campbell, J.S.- McGraw- Hill

Reference Books/Materials:

13. Strength of Materials – Popov, Pub. PHI, New Delhi.

14. Hydraulic Machines – Jagdish Lal, Pub. Metropolitan, Allahabad.

15. Strength of Materials - G.H. Ryder, Pub. ELBS.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Know the basics of thermodynamics and workshop machinery.	**PO1**
CO2	Understand the basic knowledge of Refrigeration and Hydraulic Machinery.	**PO2**

CO3	Get the knowledge about power transmission method and device with mechanical properties.	**PO3**
CO4	Know the various concept about NC, CNC Machines.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 101A	Basics of Mechanical Engineering	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETEC 101A	**Basics Of Electrical & Electronics Engineering**	L	T	P	C
		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand the circuit behavior on the DC and AC supply.
2. To analyses the complex circuits using various theorems to resolve it to a simple circuit.
3. To be able to perform analysis of single-phase ac circuits consisting of combinations (series and parallel) elements
4. To analyses the circuit response with addition of circuit elements i.e inductor and capacitors.
5. To gain basic insight of semiconductors based switching and amplifying circuits, also with brief overview of working of logic gates.

Course Outcomes

On completion of this course, the students will be able to

CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.
C02	Determine an understanding of logic gates.
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.
CO4	Create an understanding of semiconductor devices application to existing devices.
CO5	Learn the basics of electronics devices used in practical application.
CO6	Able to determine waveform basics by obtaining it on analyzer devices.

Catalog Description

The aim of the course is to familiarize students with complex AC and DC circuits. For better recognition and learning point of view to identify the response of circuits with addition of capacitor and inductor elements in AC and DC circuits as real time. This course consists of learning with experimental studies involved of semiconductor switches and utilization as amplifier circuits. Basic topics included are AC and DC circuits, Series and Parallel Connections, CRO introduction and utilization, AC circuits with capacitor and inductor responses, Digital logic gates, Semiconductor introduction as BJT, MOSFET etc. along with their application to solving practical engineering problems.

Course Content

Unit I **10 Hour**

Circuit Analysis: Ohm's Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin’s, Norton's, Reciprocity, Maximum Power Transfer Theorem, Millman's Theorem, Star-Delta Transformation. Application of theorem to the Analysis of D.C. circuits.

Unit II **11 Hour**

A.C. Circuits: R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor representation, Response of R-L, R-C and R-L-C circuit to sinusoidal input Resonance-series and parallel R-L-C Circuits, Q-factor, Bandwidth.

Cathode Ray Oscilloscope: Basic CRO circuit (Block Diagram), Cathode ray tube (CRT) & its component

Unit II **10 Hour**

Semiconductor Physics: Basic concepts, Intrinsic and extrinsic semiconductors, diffusion and drift currents.

P-N junction diode: Ideal diode, P-N junction under open-circuit and closed-circuit, Diode Current Equation, Diode Resistance, Transition and Diffusion Capacitance, Effect of Temperature, Carrier Life Time, Continuity Equation.

Special Diodes: Zener Diode, Photodiode, Light Emitting Diodes, applications of Diodes.

Unit II **9 Hour**

Digital Electronics: Boolean algebra, Truth tables of logic gates (AND, OR, NOT), NAND, NOR as universal gates

Bipolar junction transistor: Introduction to transistors: construction, transistor operations, BJT characteristics, load line, operating point, leakage currents.

Application of BJT: CB, CE configurations, Introduction to FETs and MOSFETs.

TEXT BOOKS:

1. D.P. Kothari & I J Nagrath, Basic Electrical Engineering, Tata McGraw Hill , New Delhi.
2. B L Thareja – A text book of Electrical Technology
3. Boylestad&Nashelsky, "Electronic Devices & Circuits", Pearson Education, 10^{th} Edition.
4. V. K. Mehta & Rohit Mehta, "Principles of Electronics", S. Chand Publishers, 27^{th} Edition.

REFERENCE BOOKS:

6. Electrical Engineering Fundamentals, V.Del Toro
7. Problems in Electrical Engineering – Parker Smith.S.
8. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
9. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
10. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", DhanpatRai& Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply Knowledge of AC and DC Circuits in making real time projects to solve engineering difficulties.	**PO1**
CO2	Determine an understanding of logic gates.	**PO2**
CO3	Demonstrate the ability to identify series, parallel complex circuits. Utilization of the preliminary knowledge gained to obtain real existing power related problems.	**PO2**
CO4	Create an understanding of semiconductor devices application to existing apparatuses	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 101A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING	3	3	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETEC 151A	**Basics Of Electrical & Electronics Engineering Lab**	L	T	P	C
		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

<u>Course Objectives</u>

1.To understand the DC and AC circuit behavior by application of network theorems.

2.To elaborate complex signals over oscilloscope devices with reading.

3.To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.

4.To analyses the BJT in build circuits as per practical application point of view.

5.To gain basic insight of truth table based logic gate decisions and to provide application based output using seven segment display.

<u>Course Outcomes</u>

On completion of this course, the students will be able to

CO1 Get an exposure to common electrical components and their ratings.

C02 Determines proper electrical connections as per wires of appropriate ratings.

CO3 Understand the usage of common electrical measuring instruments.

CO4 Ability to discover applications related to seven segment display type of devices

<u>Catalog Description</u>

The aim of the course is to acquaint the students with basics of AC and DC circuits. Identification of tools and devices to provide demonstration capabilities involved after learning AC in waveform format. Proofing of Complex AC waveform with practical circuit calculations. Basic topics included are AC and DC circuits, Cathode Ray Oscilloscope, Function Generator, LC, RL circuits, Superposition Theorems, Zener diode, Truth table verification with seven segment displays. All along with their application in real time situations.

Course Content

1. To get familiar with the working knowledge of the following instruments:

e) Cathode ray oscilloscope (CRO)

f) Multimeter (Analog and Digital)

g) Function generator

h) Power supply

8. To measure phase difference between two waveforms using CRO. To measure an unknown frequency from Lissajous figures using CRO

9. To Verify the Thevenin' s and Norton's theorem

10. To Verify the Superposition theorem

11. To measure voltage, current and power in an A.C. circuit by LCR impedance method

12. To study the frequency response curve in series and parallel R-L-C circuit

7. a)Plot the forward and reverse V-I characteristics of P-N junction diode

b) Calculation of cut-in voltage c) Study of Zener diode in breakdown region

8. To plot and study the input and output characteristics of BJT in common-emitter configuration.

9. Verification of truth tables of logic gates (OR,AND, NOT, NAND, NOR).

10. To get familiar with the working and use of seven-segment display.

Reference Books For Lab Studies:

1. Electrical Engineering Fundamentals, V.Del Toro
2. Problems in Electrical Engineering – Parker Smith.S.
3. Sedra A S and Smith K C, "Microelectronic Circuits" 4th Ed., New York, Oxford University Press, New York.
4. Tocci R J and Widmer N S, "Digital Systems – Principles and Applications", 8th Ed., Pearson Education India, New Delhi.
5. A.K. Sawhney, "A course in Electrical & Electronics Measurements & Instrumentation", Dhanpat Rai & Sons.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get an exposure to common electrical components and their ratings.	**PO1**
CO2	Determines proper electrical connections as per wires of appropriate ratings.	**PO2**
CO3	Understand the usage of common electrical measuring instruments.	**PO2**
CO4	Ability to discover applications related to seven segment display type of devices	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2	-	-	-	-	-	-	-	-	-	3	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETPH151A	**Engineering Physics Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Physics				
Co-requisites	--				

Course Objectives

1. The abstraction from fields using the examples of the gravitational fields, with some applications
2. To learn how interference, diffraction and polarization of light take place.
3. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
4. Expand and exercise the students' physical intuition and thinking process through the understanding of the theory and application of this knowledge to the solution of practical problems

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire fundamental knowledge of mechanics and able to apply on physical systems.
CO2. Better insight aboutwave nature of light.
CO3. Better understanding of data interpretation which enhances problem solving approach.
CO4. Develop the ability to correlates the daily life phenomenon to physics using mathematical tools

Catalog Description

This course imparts the basic concepts of waves and optics. This course enables learners to solve non-dispersive transverse and longitudinal waves equations. This course helps learners to analyze propagation of light, geometric and wave optics. The course introduces the basic concepts about lasers and helps learners to design different laser source systems.

Course Content

LIST OF EXPERIMENTS

8) To determine the value of acceleration due to gravity using Bar pendulum.
9) To determine the value of acceleration due to gravity using Kater's pendulum.
10) To determine the wavelength of sodium light using Newton`s ring apparatus.
11) To determine the wavelength of prominent lines of mercury by plane diffraction grating.
12) To determine the refractive index of the material of the prism for the given colours (wavelengths) of mercury light with the help of spectrometer.
13) To determine the specific rotation of cane sugar solution with the help of half shade polarimeter.
14) To determine the wavelength of He-Ne LASER using transmission diffraction grating.

Text Books

- C. L.Arora, B.Sc Practical Physics (S Chand and Co. Ltd., New Delhi).
- Harnam Singh, Hemne P S, B.Sc. Practical Physics (S. Chand & Co).
- InduPrakash, Ramakrishna, A Text Book of Practical Physics (KitabMahal, New Delhi).

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire fundamental knowledge of mechanics and able to apply on physical systems	**PO1& PO2**
CO2	Better insight aboutwave nature of light.	**PO4**

CO3	Better understanding of data interpretation which enhances problem solving approach.	**PO5**
CO4	Develop the ability to correlates the daily life phenomenon to physics using mathematical tools	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETPH151A	Engineering Physics Lab	2	3	-	3	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME151A	**Basics of Mechanical Engineering Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basic concepts of Physics				
Co-requisites	--				

Course Objectives

1. To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start & Double Start Worm & Worm Wheel, Differential Wheel & Axle.
2. To study simple screw jack and compound screw jack and determine their efficiency.
3. To verify the law of Moments using Parallel Force apparatus. (Simply supported type)
4. To evaluate the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminium) on an inclined plane.
5. To Study Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
6. To Study the vapor compression Refrigeration System and Window Room Air Conditioner.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1 Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.
CO2 Understand concepts of screw jack, friction, law of moments.
CO3 Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.
CO4 Get the knowledge of various Refrigeration and Air- Conditioning Systems.

Catalog Description

This course complements ETME151A. It enables and introduces the students to the study of various mechanical engineering concepts and prepares the student for further studies and better understanding of engineering subjects like Engineering Thermodynamics, strength of materials and theory of machines, etc. through practical exposure.

List of Experiments (Indicative)

1	To verify the law of Force Polygon.	**2 lab hours**
2	To verify the law of Moments using Parallel Force apparatus. (Simply supported type)	**2 lab hours**
3	To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.	**2 lab hours**
4	To find the forces in the members of Jib Crane.	**2 lab hours**
5	To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.	**2 lab hours**
6	To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle	**2 lab hours**
7	To verify the law of moments using Bell crank lever.	**2 lab hours**
8	To calculate the Mechanical Advantage, Velocity Ratio and Efficiency of Single Start, Double Start and Triple Start Worm & Worm Wheel.	**3 lab hours**
9	To Study Two-Stroke & Four-Stroke Diesel Engines.	**2 lab hours**
10	To Study Two-Stroke & Four-Stroke Petrol Engines.	**2 lab hours**
11	To Study the vapor compression Refrigeration System.	**2 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the Mechanical Advantage, Velocity Ratio and Efficiency of various systems.	**PO1**
CO2	Understand concepts of screw jack, friction, law of moments.	**PO4**

CO3	Understand the Two-Stroke & Four-Stroke Diesel Engines and Petrol Engines.	**PO5**
CO4	Get the knowledge of various Refrigeration and Air-Conditioning Systems	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 151A	Basics of Mechanical Engineering Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA105A	Applied Mathematics-II	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Provide the brief idea to students of Laplace transformation.
2. To understand Curl, divergence and gradient with their applications and have the idea of directional derivatives and derive the equations of tangent planes and normal lines.
3. Apply the Green, Stoke and Gauss Theorem to find the area and volume of the object.
4. Recognize and implement the concept of differential equations and learn various methods to solve ordinary differential equations
5. Apply the method of characteristics to solve first order partial differential equations.

Course Outcomes

On completion of this course, the students will be able to

CO7. Understand and able to apply the basic concept of Laplace transform.

CO8. Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.

CO9. Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.

CO10. Learn the concepts of orthogonally diagonalise symmetric matrices and quadratic forms.

CO11. Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about the functions.

CO12. Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.

Catalog Description

Applied mathematics-II is the mathematical study of general scientific concepts, principles, and phenomena that, because of their widespread occurrence and application, relate or unify various disciplines. The core of the program the following principles and their mathematical formulations: Linear transformation, partial differential equations, ordinary differential equations and vector calculus. The concepts of applied mathematics-II are extremely useful in physics, economics and social sciences, natural sciences, and engineering. Due to its broad range of applications, linear algebra is one of the most widely taught subjects in college-level mathematics.Important objectives of the linear algebra are to develop and strengthen the students' problem-solving skills and to teach them to read, write, speak, and think in the language of mathematics. In particular, students learn how to apply the tools of calculus to a variety of problem situations.

Course Content

Unit I: **09 lecture hours**

Laplace Transformation: Existence condition, Laplace transform of standard functions, Properties, Inverse Laplace transform of functions, Convolution theorem, solving linear differential equations using Laplace transform. Heaviside unit step function, Impulse function, Periodic function and their transforms.

Unit II: **10 lecture hours**

Vector Calculus: Scalar and vector point functions, Gradient, Divergence, Curl with their physical significance, Directional derivatives, Properties, Line integrals, Surface integrals and Volume integrals, Gauss theorem, Green's theorem and Stoke's theorem (without proof).

Unit III: **10 lecture hours**

Ordinary Differential Equations: Exact differential equations of first order and first degree, Linear differential equations of higher order with constant coefficients, Variation of parameters, Solution of simultaneous linear differential equations, Solution of homogeneous differential equations - Cauchy and Legendre forms.

Unit IV: **10 lecture hours**

Partial Differential Equations and its applications: Formation of partial differential equations, Lagrange's linear equation, Charpit's method of non-linear partial differential equations, Method of separation of variables, Solution of wave and heat conduction equations, Initial and boundary value problems.

Text Books

1. Kresyzig, "Advanced Engineering Mathematics", John Wiley and Sons.
2. Jain and Iyengar, "Advanced Engineering Mathematics", Narosa Publication

Reference Books/Materials

8. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
9. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company.

.**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and able to apply the basic concept of Laplace transform.	**PO1**
CO2	Recognize and able to apply the concepts of vector function, vector field, scalar field, gradient, divergence and curl.	**PO8**
CO3	Demonstrate the Green, Stoke and Gauss Theorem to find the area and volume of the object in real world.	**PO2**
CO4	Learn the concepts of orthogonally diagonalise symmetric	**PO4**

	matrices and quadratic forms.	
CO5	Determine and find Extend the concept of series solutions to solve differential equations and learn orthogonality about thefunctions.	**PO3**
CO6	Demonstrate knowledge and understanding partial differential equations and how they relate to different modeling situations.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMA105A	Applied Mathematics-II	2	3	2	3	-	-	-	2	-	-	-	-	3	-	-

1= weakly mapped
2= moderately mapped
3= strongly mapped

ETCS104A	**Introduction To Computer Science And Programming In Python**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

Introduction to Computer and Programming in Python is intended for students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems and to help students, regardless of their major, feel justifiably confident of their ability to write small programs that allow them to accomplish useful goals. The class will use the Python 3.5 programming language.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Programming: Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm:

Flowchart / Pseudo code with examples. From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

UNIT II **8 LECTURE HOURS**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration, String Manipulation, Guess and Check, Approximations, Bisection, Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files

UNIT III **10 LECTURE HOURS**

Classes and Object: Oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Handling Exceptions, Decorators

UNIT IV **10 LECTURE HOURS**

Simple Algorithms and Data structures: File Handling, Search Algorithms, Sorting, Algorithms, Hash Tables

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**
CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS104A	Introduction to Computer Science and Programming in Python	2	2	2	2	-	-	-	-	-	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCH119A	**Engineering Chemistry**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	12^{th} Standard Chemistry				
Co-requisites	--				

Course Objectives:

- To acquire knowledge of engineering materials and about fuels.
- To develop the interest among the students regarding chemistry and their applications in engineering.
- To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.
- To acquire knowledge about desalination of brackish water and treatment of municipal water.
- To gain the knowledge of conducting polymers, bio-degradable polymers and fiber reinforced plastics.

Course Outcomes:

CO1: Develop the understanding of Technology involved in improving quality of water for its industrial use.

CO2: Identify instrumental techniques for analysis and analyze the quality parameters of chemical fuels.

CO3: Develop the understanding of Chemical structure of polymers and its effect on their various properties when used as engineering materials.

CO4: Impart the knowledge of fuels and biofuels with its properties and applications.

CO5: Illustrate the principles involved in thermodynamics and kinetic theory of gases which are used in daily life.

CO6: They can predict potential applications of chemistry and practical utility in order to

become good engineers and entrepreneurs.

Catalog Description

This course gives an introduction to chemistry of water and an overview of different methods used for purification of water using various inorganic and organic compounds with detection of major and minor ions present in water. Various techniques used for preparation of fuels, biofuels and techniques used for analysis are reviewed. The purpose of this course is to develop a strong foundation in the principles and methods to understand the kinetic theory of gases, thermodynamics, phase rule, polymer and biopolymers. There will be an excursion at the end of the semester.

Course Content

Unit I: **10 lecture hours**

Water Technology: Introduction and characteristics of water; Hardness and its determination (EDTA method only); Alkalinity and its determination; Boiler feed water; Boiler problems - scale, sludge, priming & foaming, their causes & prevention; Caustic embrittlement & corrosion -Causes & prevention; Removal of silica & dissolved gases; Water softening processes : Lime - soda process, Ion exchange method, carbonate & phosphate conditioning, colloidal conditioning & calgon treatment; Water for domestic use.

Unit II: **10 lecture hours**

Fuels: Classification; Calorific value of fuel and its determination; Bomb calorimeter; Boy's Gas calorimeter; Solid fuels- Proximate and ultimate analysis, High & Low temperature carbonization, manufacture of coke (Otto-Hoffmann oven); Liquid Fuels - Petroleum-Chemical composition, fractional distillation, Thermal & catalytic cracking, Octane & Cetane No. and its significance; Power alcohol, Analysis of flue gases (Orsat's apparatus).

Unit III: **10 lecture hours**

Gaseous state and thermo chemistry: Gas laws and kinetic theory of gases; Distribution of molecular velocities; Mean free path; Real gases-non ideal behavior; Causes of deviation from ideal behavior; Vander Waal's equation; liquefaction of gases.

Hess's Law; Heat of Reaction; Heat of dilution; Heat of Hydration; Heat of neutralization and Heat of Combustion; Effect of temperature on heat of reaction at constant pressure (Kirchhoff s equation); Flame Temperature

Unit IV: **10 lecture hours**

The phase rule and polymers: Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and carbon dioxide system, Two component system:Lead-silver,Na2SO4-water.

Polymers and its classification; Mechanism of addition and condensation polymers; Coordination polymerization; Synthesis, properties and uses of urea formaldehyde, phenol formaldehyde, poly vinyl acetate and polythene; Conducting and bio-polymers.**)**

Text Books

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose& J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Develop the understanding of Technology involved in improving qualityof water for its industrial use.	**PO2**
CO2	Identify instrumental techniques for analysis and analyze the qualityparameters of chemical fuels.	**PO1**
CO3	Develop the understanding of Chemical structure of polymers and itseffect on their various properties when used as engineering materials.	**PO6**
CO4	Impart the knowledge of fuels and biofuels with its propertiesand applications.	**PO7**
CO5	Illustrate the principles involved in thermodynamicsand kinetic theory of gases which are used in daily life.	**PO3**
CO6	They can predictpotential applications of chemistry and practical utility in order to become goodengineers and entrepreneurs	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCH119A	Engineering Chemistry	3	3	2	-	-	3	2	-	-	-	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS110A	**Introduction to UX Design**	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the knowledge of user- centered design, user -centered methods in design, graphic design on screens.
2. Simulation and prototyping techniques, usability testing methods, interface technologies and user centered design in corporate perspective
3. Practical exposure with iterative design of a graphical user interface to organize information about users into useful summaries with affinity
4. To convey user research findings with personas and scenarios and to learn the skill of sketching as a process for user experience design.

Course Outcomes

On completion of this course, the students will be able to:-

CO1:- To understand the concept of UX design and how it has evolved

CO2:- Able to understand UX design process and methodology

CO3:- Able to understand how UX industry work

CO4:- To know the job, roles and responsibilities in UX industry

CO5:- To understand the importance of UX in digitalization and different types of industries

Catalog Description

The focus of this course is to introduce the learner to User Experience (UX) Design. User Experience design is design that is user centered. The goal is to design artifacts that allow the users to meet their needs in the most effective efficient and satisfying manner. The course introduces the novice to a cycle of discovery and evaluation and a set of techniques that meet the user's needs.

Course Content

UNIT I **09 LECTURE HOURS**

Introduction to UX Design:- Understand the evolution of UX design as an industry practice and learning about UX industry experts, Design around us, Job roles and responsibilities in the UX industry, UX industry trends in various sectors, Ergonomics for UX Designers.

UNIT II **12 LECTURE HOURS**

Processes and Methodologies:- Understanding UX design processes and methodologies, user centred design, ImaginXP 6D Process.

UNIT III **12 LECTURE HOURS**

Tools and Technology in UX Design:- Tools, prototype, Industry standards, Technology, NFC, Chatbot, Introduction to Voice User Interface and Gesture Based Interfaces.

UNIT IV **09 LECTURE HOURS**

Multiple Domains and Trends in UX Design:- UX industry trends in various sectors.

UNIT V **18 LECTURE HOURS**

Project :- Project on UX design process, industry trends.

Reference Books:

1. Designing for Digital Age: How to create human-centered products and services - Kim Goodwin.
2. Sketching the User experiences - Bill Buxton
3. The design of everyday things - Don Norman
4. The elements of user experience - Jesse James Garrett

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To understand the concept of UX design and how it has evolved	**PO1**
CO2	Able to understand UX design process and methodology	**PO2**
CO3	Able to understand how UX industry work	**PO09,PSO01**
CO4	To know the job, roles and responsibilities in UX industry	**PO09, PSO1**
CO5	To understand the importance of UX in digitalization and different types of industries	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS110A	Introduction to UX Design	2	2	-	-	-	-	-	-	3	2	-	-	3	3	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS114A	**Empathy and Understanding Problems**	L	T	P	C
Version 1.0		2	0	0	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Define design thinking
2. Demonstrate design thinking as a human-centered process focusing on customers and their needs
3. Describe the role of empathy in the design-thinking process
4. Illustrate the key parts of the design-thinking process

Course Outcomes

CO1:- To understand the concept of empathy and empathizing with users effectively

CO2:- Discern the facts after duly analyzing the information received from the user

CO3:- To learn how to define the problem on the basis of facts

CO4:- To grasp various empathy techniques and tools

CO5:- To practice various tools to comprehend root cause of the problem leading to correct definition

Catalog Description

This course introduces the principles and practices of human-centered design (also sometimes called “design thinking”) which are essential for developing innovative and inclusive products, services, processes and policies. You will learn by doing, experiencing the design process through exercises and a mini-bootcamp. In this course, you will learn about and experience key human-centered design practices: empathize, reframe, ideate, prototype and test. You will learn why human-centered design is a central component of Gender Analytics. You will develop skills in problem finding (and not just problem solving) by understanding users', stakeholders’ and beneficiaries' lived experiences.

Course Content

UNIT I **03 LECTURE HOURS**

Introduction to Empathy:- What is Empathy, learn how to understand users & their problems, techniques to empathize with users and identify key user problems.

UNIT II **09 LECTURE HOURS**

Analyzing facts from Empathy to Dig Deeper :- Learn how to gain insights from empathy and define problem statements, Mental models, Understanding people's psychology and Behaviour, Human attention and its application in design, Applying Principles of Memory in UX Design, Cognitive Load- what it is and why we must avoid it, Famous Case studies on people centric design, Tips to remember when designing for people.

UNIT II I **06 LECTURE HOURS**

Empathy Tools and Techniques:- Empathy tools – techniques for getting empathy insights through interview.0020

UNIT IV **06 LECTURE HOURS**

Application of Empathy in design:- Empathy maps, emotional mapping, observation.

Reference Books:

1. A practitioner's guide to empathy and user research by Eshayat Taskin, Shashank Shwet, Sonam Agarwal, Vidhika Rohatgi
2. Empathy: Why it matters, how to get it - Roman Kizanie
3. Emotional Design- Don Norman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To understand the concept of empathy and empathizing with users effectively	**PO6**
CO2	Discern the facts after duly analyzing the information received from the user	**PO2**
CO3	To learn how to define the problem on the basis of facts	**PO2**
CO4	To grasp various empathy techniques and tools	**PO05**
CO5	To practice various tools to comprehend root cause of the problem leading to correct definition	**PO1,PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS114A	Empathy and Understanding Problems	2	3	-	-	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME155A	**Engineering Graphics Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic concepts of drawing				
Co-requisites	--				

Course Objectives

The Basic aim of this subject is to: -

1. Learn to sketch and take field dimensions.
2. Learn to take data and transform it into graphic drawings.
3. Learn basic Auto Cad skills and learn basic engineering drawing formats.
4. Prepare the student for future Engineering positions for designing.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1. To know and understand the conventions and the method of engineering drawing.

CO2. Interpret engineering drawings using fundamental technical mathematics.

CO3. Construct basic and intermediate geometry, to improve their visualization skills so that they can apply this skill in developing new products.

CO4. To improve their technical communication skill in the form of communicative drawings and to comprehend the theory of projection.

Catalog Description

This course covers the fundamentals of engineering graphics including the drawing oforthographic, isometric, and auxiliary projections.Other topics include scaling, sectioning,dimensioning, and drawing documentation. This course uses the latest release of computer-aideddesign (CAD) software commonly used in industry to introduce students to CAD interface,
structure, and commands.

List of Experiments (Indicative)

1	To understand Drawing Instruments and their uses, Dimensioning, line conventions and free hand practicing.	**3 lab hours**
2	To learn basics of AUTO CAD, layout of the software, standard tool bar/menus and description of most used tool bars, navigational tools.	**3 lab hours**
3	To understand the co -ordinate system and reference planes, HP, VP, RPP & LPP, creation of 2D/3D environment, selection of drawing size and scale, commands and creation of lines, co-ordinate points, axes, poly lines, square, rectangle, polygons, sp lines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.	**3 lab hours**
4	To understand Orthographic Projections, Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants.	**3 lab hours**
5	To understand Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes.	**3 lab hours**
6	To understand the projections of plane surfaces such as triangle, square, rectangle, rhombus, pentagon, hexagon, and circle.	**3 lab hours**
7	To understandProjections of Solids such as right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders, and cones in different positions.	**3 lab hours**
8	To understand about the Sections and Development of Lateral Surfaces of Solids.	**3 lab hours**
9	To Study Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders, and cones having base on Horizontal Plane.	**3 lab hours**
10	To study and draw Isometric projection of simple plane figures such as tetrahedron, hexahedron(cube).	**3 lab hours**
11	To draw the isometric projection of right regular prisms, pyramids, cylinders, cones, spheres, cut spheres.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To know and understand the conventions and the method of engineering drawing.	**PO1**
CO2	Interpret engineering drawings using fundamental technical mathematics.	**PO2**
CO3	Construct basic and intermediate geometry, to improve their visualization skills so that they	**PO3**
CO4	To improve their technical communication skill in the form of communicative drawings and to	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 155A	Engineering Graphics Lab	3	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS150A	**Introduction To Computers And Programming In Python Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

Master the fundamentals of writing Python scripts.

Learn core Python scripting elements such as variables and flow control structures.

Discover how to work with lists and sequence data.

Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Course Content

List of Experiments

1	Develop programs to implement list	**2 lab hours**
2	Develop programs to implement Dictionary	**2 lab hours**
3	Develop programs to implement tuples	**2 lab hours**
4	Develop programs to understand the control structures of python	**2 lab hours**

5	Develop programs to implement function with stress on scoping	**2 lab hours**
6	Develop programs to implement classes and objects	**2 lab hours**
7	Develop programs to implement exception handling.	**2 lab hours**
8	Develop programs to implement linear search and binary search.	**2 lab hours**
9	Develop programs to implement insertion sort	**2 lab hours**
10	Develop programs to implement bubble sort.	**2 lab hours**
11	Develop programs to implement quick sort.	**2 Labs**
12	Develop programs to implement heap sort.	**2 Labs**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Examination Scheme:

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3**
CO3	To use the object oriented programming approach in solving problems	**PO5**
CO 4	To handle exceptions gracefully	**PSO1**
	To develop searching and sorting algorithms	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS150A	Introduction to computers and programming in python Lab		2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS152A	**Empathy and Understanding Problems Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Empathy and Understanding Problems				
Co-requisites	--				

Course Objectives

1. Study a problem from multiple perspectives
2. Learn how to frame the design challenge properly.
3. Learn how to ideate, prototype and Iterate solutions.
4. Learn from the overall design process how to create value as entrepreneurs
5. Learn how to design successful products or enterprises

Course Outcomes

CO1:- To understand the concept of empathy and empathizing with users effectively

CO2:- Discern the facts after duly analyzing the information received from the user

CO3:- To learn how to define the problem on the basis of facts

CO4:- To grasp various empathy techniques and tools

CO5:- To practice various tools to comprehend root cause of the problem leading to correct definition

Catalog Description

This course introduces the principles and practices of human-centered design (also sometimes called "design thinking") which are essential for developing innovative and inclusive products, services, processes and policies. You will learn by doing, experiencing the design process through exercises and a mini-bootcamp. In this course, you will learn about and experience key human-centered design practices: empathize, reframe, ideate, prototype and test. You will learn why human-centered design is a central component of Gender Analytics. You will develop skills in problem finding (and not just problem solving) by understanding users', stakeholders' and beneficiaries' lived experiences.

List of Experiments (Indicative)

1. Using a pre chosen problem, students will learn how to understand users' mental model and psychology
2. Students will conduct field study and observe users.
3. Apply empathy techniques during interviews and derive insights.
4. Create empathy maps, emotional mapping etc

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To understand the concept of empathy and empathizing with users effectively	**PO6**
CO2	Discern the facts after duly analyzing the information received from the user	**PO2**
CO3	To learn how to define the problem on the basis of facts	**PO2**
CO4	To grasp various empathy techniques and tools	**PO05**
CO5	To practice various tools to comprehend root cause of the problem leading to correct definition	**PO1,PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS152A	Empathy and Understanding Problems Lab	2	3	-	-	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETME157A	**Workshop Practice**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Basic of mechanical engineering				
Co-requisites	--				

Course Objectives

The objective of this course is to develop:

1. Understanding different manufacturing techniques and their relative advantages / disadvantages with respect to different applications
2. The selection of a suitable technique for meeting a specific fabrication need
3. Acquire a minimum practical skill with respect to the different manufacturing methods and develop the confidence to design & fabricate small components for their project work and also to participate in various national and international technical competitions.

Course Outcomes

Upon the completion of this course the students will be able to:

CO1.Introduction to different manufacturing methods in different fields of engineering

CO2. Practical exposure to different fabrication techniques

CO3. Creation of simple components using different materials

CO4.Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.

Catalog Description

This course is intended to expose engineering students to different types of manufacturing/ fabrication processes, dealing with different materials such as metals, ceramics, plastics, wood, glass etc. While the actual practice of fabrication techniques is given more weight age, some lectures and video clips available on different methods of manufacturing are also included.

List of Experiments (Indicative)

1	To introduce various shops and common tools used with their safety precautions	**3 lab hours**
2	To make T-joint in carpentry shop	**3 lab hours**
3	To make Bridal-joint in carpentry shop	**3 lab hours**
4	To make Double V-Butt joint in welding shop	**3 lab hours**
5	To make Lap joint in welding shop	**3 lab hours**
6	To make saw - cut filling V-cut taper at the corners, circular cut in fitting shop.	**3 lab hours**
7	To fit square in square, triangle in square using fitting hand tools.	**3 lab hours**
8	To Study various types of welding and perform Arc welding and Oxy-Acetylene Welding.	**3 lab hours**
9	To Study about the micrometer and vernier caliper.	**3 lab hours**
10	To Study about the various machine tools.	**3 lab hours**
11	To make jobs by using various machine tools.	**3 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Introduction to different manufacturing methods in different fields of engineering	**PO1**
CO2	Practical exposure to different fabrication techniques	**PO4**
CO3	Creation of simple components using different materials	**PO5**

CO4	Exposure to some of the advanced and latest manufacturing techniques being employed in the industry.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethical and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETME 157A	Workshop Practice	3	-	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMA215A	**Probability And Statistics**	L	T	P	C
Version 1.0		4	-	-	4
Pre-requisites/Exposure	Basic algebra				
Co-requisites	--				

Course Objectives

1. To understand distributions in the study of the joint behaviour of two random variables.

2. To establish a formulation helping to predict one variable in terms of the other that is, correlation and linear regression.

3. To understand central limit theorem, which establish the remarkable fact that the empirical frequencies of so many natural populations, exhibit a bell-shaped curve.

Course Outcomes

On completion of this course, the students will be able to

CO1 Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.

CO2 Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.

CO3 Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.

CO4 Compute the covariance and correlation between jointly distributed variables.

CO5 Apply the method of least squares to estimate the parameters in a regression model.

CO6 Understand the law of large numbers and the central limit theorem.

Catalog Description

This course aims to provide an understanding of the basic concepts in probability, conditional probability and independent events. It will also focus on the random variable, mathematical expectation, and different types of univariate and bivariate distributions. In this course, student will learn how to describe relationships between two numerical quantities and characterized these relationships graphically, in the form of summary statistics, and through simple linear regression models.

Course Content

UNIT-I **8 lectures**

Probability Functions and Moment Generating Function

Basic notions of probability, Conditional probability and independence, Baye's theorem; Random variables - Discrete and continuous, Cumulative distribution function, Probability mass/density functions; Transformations, Mathematical expectation, Moments, Moment generating function, Characteristic function.

UNIT-II **12 lectures**

Univariate Discrete and Continuous Distributions

Discrete distributions**:** Uniform, Bernoulli, Binomial, Negative binomial, Geometric and Poisson; Continuous distributions**:** Uniform, Gamma, Exponential, Chi-square, Beta and normal; Normal approximation to the binomial distribution.

UNIT-III **8 lectures**

Bivariate Distribution

Joint cumulative distribution function and its properties, Joint probability density function, Marginal distributions, Expectation of function of two random variables, Joint moment generating function, Conditional distributions and expectations.

UNIT-IV **12 lectures**

Correlation, Regression and Central Limit Theorem

The Correlation coefficient, Covariance, Calculation of covariance from joint moment generating function, Independent random variables, Linear regression for two variables, The method of least squares, Bivariate normal distribution, Chebyshev's theorem, Strong law of large numbers, Central limit theorem and weak law of large numbers.

Modeling Uncertainty

Uncertainty, Information and entropy, Uniform Priors, Polya's urn model and random graphs.

Reference Books/Materials

11. Robert V. Hogg, Joseph W. McKean & Allen T. Craig (2013). Introduction to Mathematical Statistics(7th edition), Pearson Education.
12. Irwin Miller &Marylees Miller (2014). John E. Freund's Mathematical Statistics with Applications (8thedition). Pearson. Dorling Kindersley Pvt. Ltd. India.
13. Jim Pitman (1993). Probability, Springer-Verlag.
14. Sheldon M. Ross (2014). Introduction to Probability Models (11th edition). Elsevier.
15. A. M. Yaglom and I. M. Yaglom (1983). Probability and Information. D. Reidel Publishing Company. Distributed by Hindustan Publishing Corporation (India) Delhi.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.	**PO4**
CO2	Define and explain the different statistical distributions and the typical phenomena that each distribution often describes.	**PO5**
CO3	Calculate probabilities and derive the marginal and conditional distributions of bivariate random variables.	**PO3**
CO4	Compute the covariance and correlation between jointly distributed variables.	**PO2**
CO5	Apply the method of least squares to estimate the parameters in a regression model.	**PO1**
CO6	Understand the law of large numbers and the central limit theorem.	**PO11**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO 5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO4	PSO5
ETMA 215A	Probability and Statistics	3	2	2	3	3	-	-	-	-	-	2	-	2	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS213A	Technology in Experience Design	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To be able to understand technology for digital experience.
2. To understand Technological feasibility and viability.
3. Use futuristic Technologies. .

Course Outcomes

On completion of this course, the students will be able to:

CO1:- Get to know futuristic technologies and their implementation in design

CO2:- Able to comprehend technology constraints on design

CO3:- Understand technology for digital experience and product ecosystems

CO4:- Research project in design using the latest technology

Catalog Description

Design is an essential part of providing a great user experience (UX), offering the user what they need in the most efficient and satisfying manner. This introductory course introduces the novice designer to a systematic and data-driven process cycle of discovery and evaluation, as well as a set of techniques, used to meet a user's needs. You will be introduced to this four-step user interface design cycle and learn how to gather information about what the user needs, how to design and model interfaces based on those needs, and how to evaluate the design to meet the user's end goal. Anyone, regardless of their current training, who is willing to learn these techniques and follow the proposed cycle can be a UX designer.

Course Content

Unit I: **06 lecture hours**

Technology for digital experience: Understanding technology for digital experience and product ecosystems – form factors, operating systems, Wi-Fi, Bluetooth, sensors and other hardware components.

Unit II: **06 lecture hours**

Technological feasibility and viability: Understanding technological feasibility and viability. Technology constraints on design..

Unit III: **09 lecture hours**

Futuristic Technologies: Learning about futuristic technologies and their implementation in design, Wearable medical devices, Introduction to Augmented reality and virtual reality and how to design for them, Artificial Intelligence and its use cases.

Unit IV: **09 lecture hours**

Futuristic Technologies continued: ntroduction to Internet of Things and UX, Conversational Design, How to design for chatbots and voice interfaces.

Unit IV: **15 lecture hours**

Research Project:- Research project on upcoming technologies and defining product ecosystems and constraints of key technologies.

Reference Books/Materials

1. Emotions, technology and design - Sharon Y. Tettegah

2. Augmented Reality: Principles and Practice - Dieter Schmalstieg

3. Augmented Reality: An emerging technologies guide - Gregory Kipper and Joseph Rampolla

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Get to know futuristic technologies and their implementation in design	**PO1**
CO2	Able to comprehend technology constraints on design	**PO2**
CO3	Understand technology for digital experience and product ecosystems	**PO5**
CO4	Research project in design using the latest technology	**PO3,PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS213A	Technology in Experience Design	2	2	2		3								3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS231A	Discrete Mathematics	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Concepts from basic math – algebra, geometry, pre-calculus				
Co-requisites	--				

Course Objectives

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Acquire an understanding set theory, functions, and relations.

CO2. Develop the given problem as graph networks and solve with techniques of graph theory.

CO3. Understanding the language of mathematical logic and expressing statements in terms of logic.

CO4. Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.

CO5. Gaining insight into applications of discrete mathematics to various practical problems.

Catalog Description

The course is an introduction to discrete mathematics as a foundation to work within the fields of computer science, information technologies, and software development.

Course Content

Unit I: **10 lecture hours**

Set Theory: Introduction to set theory, Set operations, Algebra of sets, Duality, Finite and Infinite sets, Classes of sets, Power Sets, Multi sets, Cartesian Product, Representation of relations, Types of relation, Equivalence relations and partitions , Partial ordering relations and lattices Function and its types, Composition of function and relations, Cardinality and inverse relations

Unit II: **12 lecture hours**

Graphs And Trees: Introduction to graphs, Directed and Undirected graphs, Homomorphic and Isomorphic graphs, Subgraphs, Cut points and Bridges, Multigraph and Weighted graph, Paths and circuits, Shortest path in weighted graphs, Eurelian path and circuits, Hamilton paths and circuits, Planar graphs, Euler's formula, Trees, Spanning trees, Binary trees and its traversals.

Unit III: **12 lecture hours**

Propositional logic: Basic operations: AND (^), OR(v), NOT(~), Truth value of a compound statement, propositions, tautologies, contradictions, Validity of Arguments

Group theory: Definition and examples of a monoid, Semigroup, Groups and rings, Homomorphism, Isomorphism and Auto morphism, Subgroups and Normal subgroups, Cyclic groups, Co-Sets, Lagrange's theorem.

Unit IV: **10 lecture hours**

Recursion and Recurrence Relation: linear recurrence relation with constant coefficients, Homogeneous solutions, Solutions, Total solution of a recurrence relation using generating functions.

Techniques Of Counting: Permutations with and without repetition, Combination.

Text Books

1. Keneth H. Rosen, "Discrete Mathematics and Its Applications", TMH.

2. C.L. Liu, "Elements of Discrete Mathematics", TMH.

Reference Books/Materials

1. Kolman, Busby & Ross, “Discrete Mathematical Structures”, PHI.
2. NarsinghDeo, “Graph Theory with Application to Engineering and Computer Science”, PHI.
3. J. P. Trembly& P. Manohar, “Discrete Mathematical Structures with Applications to Computer Science”, McGraw Hill.
4. Vinay Kumar, “Discrete Mathematics”, BPB Publications.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire an understanding set theory, functions, and relations.	**PO1**
CO2	Develop the given problem as graph networks and solve with techniques of graph theory.	**PO2**
CO3	Understanding the language of mathematical logic and expressing statements in terms of logic.	**PO1**
CO4	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.	**PO3**
CO5	Gaining insight into applications of discrete mathematics to various practical problems.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS231A	Discrete Mathematics	3	3	2	-	-	-	-	-	-	-	-	-	2	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS217A	**Data Structures**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

C02. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list,Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course imparts the basic concepts of data structures and algorithms. It enables them to write algorithms for solving problems with the help of fundamental data structures. The course of data structures help organizing the data in variety of ways to solve the problem efficiently. The course

introduces the basic concepts about stacks, queues, lists, trees and graphs. It also discusses about daily problems like searching and sorting techniques

Course Content

Unit I: **8 lecture hours**

Introduction to Data Structures: Definition of data structures and abstract data types, Static and Dynamic implementations, Examples and real life applications; Arrays**:** ordered lists, representation of arrays, sparse matrices, polynomial arithmetic

Running time: Analysis of Algorithms and their complexities: Time Complexities, Big – Oh - notation, Running Times, Best Case, Worst Case, Average Case, Factors depends on running time, Introduction to Recursion, Divide and Conquer Algorithm, Time & Space Tradeoff.

Unit II: **12 lecture hours**

The Stacks: ADT Stack and its operation, Array based implementation of stacks, Linked List based implementation of stacks, Examples: Infix, postfix, prefix representation, Conversions, Applications, Algorithms and their complexities

Queues and Lists: ADT Queue and its operation, Array based implementation of linear Queues, Circular implementation of Queues, Linked Lists: Singly linked lists: Representation of linked lists in memory, Traversing, Searching, Insertion into, Deletion from linked list Linked List implementation of Queues and Stacks Lists, Straight / circular implementation of doubly linked Queues / Lists, Priority Queues, Applications, Algorithms and their complexities

Unit III: **12 lecture hours**

Trees: Basic Terminology, Binary Trees and their representation, expression evaluation, Complete Binary trees, Extended binary trees, traversing binary trees, Searching, Insertion and Deletion in binary search trees (with and without recursion), AVL trees, Threaded trees, B+ trees, algorithms and their analysis.

Graphs: Terminology and Representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, Adjacency matrices, Transversal Connected Component and Spanning trees, Shortest path, algorithms and their analysis.

Unit IV: **8 lecture hours**

Sorting Algorithms: Introduction, Sorting by exchange, selection sort, insertion sort, Bubble sort, Straight selection sort, Efficiency of above algorithms, Shell sort, Performance of shell sort, Merge sort, Merging of sorted arrays& Algorithms; Quick sort Algorithm analysis, heap sort: Heap Construction, Heap sort, bottom – up, Top – down Heap sort approach;

Searching Algorithms: Straight Sequential Search, Binary Search (recursive & non–recursive Algorithm

Text Books

3. E. Horowitz and S. Sahani, “Fundamentals of Data Structures”, Galgotia Book source Pvt. Ltd.

4. R. L. Kruse, B. P. Leung, C. L. Tondo, “Data Structures and program design in C”, PHI

Reference Books/Materials

3. Schaum’s outline series, “Data Structure”, McGraw Hills.

4. Y. Langsamet. al., “Data Structures using C and C++”, PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and	**PO4**

	Binary Search).	
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS217A	Data Structures	2	2		3	3								3		

1=weakly mapped
2= moderately mapped
3=strongly mapped

UCDM301	**Disaster Managment**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. To increase the knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences.
2. Understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy.
3. To ensure skills and abilities to analyze potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.
4. To ensure skills and ability to design, implement and evaluate research on disaster.

Course Outcomes:

After completing the program, the student will able to understand

CO4. Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.

CO5. The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.

CO6. It also acquaints learners with the existing legal framework for disaster management.

CO4. Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people’s responsibility for how it is used.

Catalog Description:

This course incorporates different types of disasters so that students are well aware of the circumstances around them. We have included one project in the syllabus so that they can thoroughly study the pre & post disastrous situations as well as the role of society in these difficult situations.

Course Content

Unit I: 8 lecture hours

Introduction to Disasters: Concept and definitions- Disaster, Hazard, vulnerability, resilience, and risks.

Different Types of Disaster: Causes, effects and practical examples for all disasters.

- Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc
- Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Epidemic and Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc.

Unit II: 8 lecture hours

Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster.
- Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies.
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management.
- Relief and Recovery
- Medical Health Response to Different Disasters

Unit III: 6 lecture hours

Rehabilitation, Reconstruction and Recovery

- ➢ Reconstruction and Rehabilitation as a Means of Development.
- ➢ Damage Assessment
- ➢ Post Disaster effects and Remedial Measures.
- ➢ Creation of Long-term Job Opportunities and Livelihood Options,
- ➢ Disaster Resistant House Construction
- ➢ Sanitation and Hygiene
- ➢ Education and Awareness,
- ➢ Dealing with Victims' Psychology,
- ➢ Long-term Counter Disaster Planning
- ➢ Role of Educational Institute.

Unit IV: **10 lecture hours**

Disaster Management in India

- ➢ **Disaster Management Act, 2005:**
  Disaster management framework in India before and after Disaster Management Act, 2005, National Level Nodal Agencies, National Disaster Management Authority
- ➢ **Liability for Mass Disaster**
  - ➢ Statutory liability
  - ➢ Contractual liability
  - ➢ Tortiousliability
  - ➢ Criminal liability
  - ➢ Measure of damages

- ➢ **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

Project Work: The project/ field work is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived based on the geographic location and hazard profile of the region where the institute is located.

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control

- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinationalLiability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof. Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)
- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam

Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.	**PSO3**
CO2	The course examines disaster profile of our country and illustrates the role played by various governmental and non- governmental organizations & its effective management.	**PO3**
CO3	It also acquaints learners with the existing legal framework for disaster management.	**PO12**
CO4	Capacity to analyze and evaluate research work on the field of emergencies and disaster while demonstrating insight into the potential and limitations of science, its role in society and people's responsibility for how it is used.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
UCDM301A	Disaster Management	-	-	2	-	-	3	-	-	-	-	-	2	-	-	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS215A	**User Research**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. Understand usability testing and user experience
2. Study logistic and theoretical components of applied research
3. Explore best practices for developing a research plan
4. Learn how research contributes to a design effort
5. Develop, conduct, analyze and report findings from a user research study
6. Ensure that research is applicable to product development
7. Explore quantitative and qualitative research methods

Course Outcomes:

After completing the program, the student will able to

CO1:- understand the importance of User research, Understanding the different user research methodologies.

CO2:- grasp hands-on experience of tools for user research

CO3:- cognitive psychology and user behavior

CO4:- perform user research with users on a chosen problem

Catalog Description:

This course incorporates integration of UX Research and UX Design to create great products through understanding user needs, rapidly generating prototypes, and evaluating design concepts. Learners will gain hands-on experience with taking a product from initial concept, through user research, ideation and refinement, formal analysis, prototyping, and user testing, applying perspectives and methods to ensure a great user experience at every step..

Course Content

Unit I: **3 lecture hours**

Introduction to User Research: Introduction to User Research and its Importance, Understanding User interaction.

Unit II: **12 lecture hours**

User Research Methodologies:- Introduction to User Research and its Importance, Understanding User interactions, planning for a User Research User Segment, defining persona for research & recruiting users, desk research, primary research, preparing a Questionnaire for user research, focus group discussion, personal interviews, do and don'ts of interviewing, Online surveys - tools, do and don'ts, Analysis Interview Tips & Techniques.

Unit III: **12 lecture hours**

Field study: Hands on practice of methodologies :- Preparing and Conducting research workshop, Preparing questionnaire for Interviews, and Online surveys.

Unit IV: **10 lecture hours**

Research Analysis :- Analyzing qualitative and quantitative results, Transcribing interviews, Thematic analysis, Cluster analysis, Tools of empathy like Persona, Empathy Map, understanding user scenarios, Storyboarding and when to use it, User Journey Map, Steps to create a journey map, AS-IS vs TO-BE journey maps, Documenting Qualitative Research, Documenting Quantitative Research.

Project Work: Students will choose a topic and they will discuss it with the professors. Parameters and feedback will also be discussed.

Reference Books:

1. A practitioner's guide to empathy and user research by Eshayat Taskin, Shashank Shwet, Sonam Agarwal, Vidhika Rohatgi

2. Interviewing Users: How to Uncover Compelling Insights by Steve Portigal

3. Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches by Patricia Leavy

4. User Experience Mapping: Enhance UX with User Story Map, Journey Map and Diagrams by Peter W. Szabo

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the importance of User research, Understanding the different user research methodologies.	**PSO2**
CO2	Grasp hands-on experience of tools for user research	**PO5, PSO1**
CO3	Cognitive psychology and user behavior	**PO6**
CO4	Perform user research with users on a chosen problem	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS215A	User Research	-	2	2	-	3	3	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS251A	**User Research Lab**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

1. Understand usability testing and user experience
2. Study logistic and theoretical components of applied research
3. Explore best practices for developing a research plan
4. Learn how research contributes to a design effort
5. Develop, conduct, analyze and report findings from a user research study
6. Ensure that research is applicable to product development
7. Explore quantitative and qualitative research methods

Course Outcomes:

After completing the program, the student will able to

CO1:- understand the importance of User research, Understanding the different user research methodologies.

CO2:- grasp hands-on experience of tools for user research

CO3:- cognitive psychology and user behavior

CO4:- perform user research with users on a chosen problem

Catalog Description:

This course incorporates integration of UX Research and UX Design to create great products through understanding user needs, rapidly generating prototypes, and evaluating design concepts. Learners will gain hands-on experience with taking a product from initial concept, through user research, ideation and refinement, formal analysis, prototyping, and user testing, applying perspectives and methods to ensure a great user experience at every step..

List of Experiments (Indicative)

1. Using a pre chosen problem, students will perform desk research using Internet sources, data analytics reports, LinkedIn publications etc.
2. Students will select and recruit participants. Prepare an interview questionnaire.
3. Interview participants using any of the user research methods taught for both qualitative and quantitative research.
4. Analyse the user research data to obtain insights.
5. Using the insights, students will create personas, empathy maps, scenarios/storyboards and map the user's journey.

Reference Books:

1. A practitioner's guide to empathy and user research by Eshayat Taskin, Shashank Shwet, Sonam Agarwal, Vidhika Rohatgi

2. Interviewing Users: How to Uncover Compelling Insights by Steve Portigal

3. Research Design: Quantitative, Qualitative, Mixed Methods, Arts-Based, and Community-Based Participatory Research Approaches by Patricia Leavy

4. User Experience Mapping: Enhance UX with User Story Map, Journey Map and Diagrams by Peter W. Szabo

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the importance of User research, Understanding the different user research methodologies.	**PSO2**
CO2	Grasp hands-on experience of tools for user research	**PO5, PSO1**
CO3	Cognitive psychology and user behavior	**PO6**
CO4	Perform user research with users on a chosen problem	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS251A	User Research Lab		2	2	-	3	3	-	-	-	-	-		3	-	-

1=weakly mapped
2= moderately mapped

3=strongly mapped

		L	T	P	C
ETCS257A	**Data Structures Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To be able to compute the efficiency of algorithms in terms of time and space complexities.
2. To understand concepts of searching and sorting algorithms.
3. Using various data structures viz. stacks, queues, linked list, trees and graphs to develop efficient algorithms through efficient representation of data and operations that can be applied.
4. To enable them to develop algorithms for solving problem by applying concepts of data structures.

Course Outcomes

On completion of this course, the students will be able to

CO1. Analyze the algorithms to determine the time and computation complexity and justify the correctness.

CO2. Implement a given Search problem (Linear Search and Binary Search).

CO3. Write algorithms concerning various data structures like Stack, Queue, Linked list, Graph search and traversal techniques and analyze the same to determine the time and computation complexity.

CO4. Write an algorithm for Selection Sort, Bubble Sort, Insertion Sort, Quick Sort,
Merge Sort, Heap sort and compare their performance in term of Space and time complexity.

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours
3	Write a program to implement push and pop operation in Stack.	2 lab hours
4	Write a program to convert a Infix notation to post fix notation using stacks	2 lab hours
5	Write a program to evaluate postfix notation using stacks	2 lab hours
6	Write a program to implement a linear queue	2 lab hours
7	Write a program for swapping two numbers using call by value and call by reference strategies.	2 lab hours
8	Write a program to insert and delete a node in linked list. The number of nodes to inserted and deleted should be governed by user.	3 lab hours
9	Write a program to implement a linear search arrays and linked list.	2 lab hours
10	Using iteration and recursion concepts write programs for finding the element in the array using the Binary search method.	2 lab hours
11	Write the programs to implement bubble sort.	2 lab hours
12	Write a program using iteration and recursion concepts for quick sort.	2 lab hours
13	Write a program to implement merge sort.	2 lab hours

14	Write a program to simulate various tree traversal techniques.	3 lab hours
15	Write a program to simulate various BFS and DFS.	4 lab hours

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the algorithms to determine the time and computation complexity	**PO1**
CO2	Implement a given Search problem (Linear Search and Binary Search).	**PO4**
CO3	Write algorithms concerning various data structures	**PO5**
CO4	Write an algorithm for internal and external sorting	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS257A	Data Structures Lab	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

MOOC001A	**The Joy of Computing using Python (MOOC)**	L	T	P	C
Version 1.0		1	0	0	3
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.

2. Master the fundamentals of writing Python scripts.

3. Learn core Python scripting elements such as variables and flow control structures.

4. Discover how to work with lists and sequence data.

5. Position students so that they can compete for projects and excel in subjects with programming components.

Course Outcomes

On completion of this course, the students will be able to

CO 1 To learn the syntax and semantics of Python programming language

CO 2 To use the structural programming approach in solving the problem.

CO 3 To use the object oriented programming approach in solving problems

CO 4 To handle exceptions gracefully

CO 5 To develop searching and sorting algorithms

Catalog Description

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

Course Content

1. Motivation for Computing
2. Welcome to Programming!!
3. Variables and Expressions : Design your own calculator
4. Loops and Conditionals : Hopscotch once again
5. Lists, Tuples and Conditionals : Lets go on a trip
6. Abstraction Everywhere : Apps in your phone
7. Counting Candies : Crowd to the rescue
8. Birthday Paradox : Find your twin
9. Google Translate : Speak in any Language
10. Currency Converter : Count your foreign trip expenses
11. Monte Hall : 3 doors and a twist
12. Sorting : Arrange the books
13. Searching : Find in seconds
14. Substitution Cipher : What's the secret !!
15. Sentiment Analysis : Analyse your Facebook data
16. 20 questions game : I can read your mind
17. Permutations : Jumbled Words
18. Spot the similarities : Dobble game
19. Count the words : Hundreds, Thousands or Millions.
20. Rock, Paper and Scissor : Cheating not allowed !!
21. Lie detector : No lies, only TRUTH
22. Calculation of the Area : Don't measure.
23. Six degrees of separation : Meet your favourites
24. Image Processing : Fun with images
25. Tic tac toe : Let's play

26. Snakes and Ladders : Down the memory lane.
27. Recursion : Tower of Hanoi
28. Page Rank : How Google Works !!

TEXT BOOKS:

1. John V Guttag. “Introduction to Computation and Programming Using Python”, Prentice Hall of India

Reference Books

1. R. Nageswara Rao, “Core Python Programming”, Dreamtech

2. Wesley J. Chun. “Core Python Programming, Second Edition”, Prentice Hall

3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Python”, Wiley

4. Kenneth A. Lambert, “Fundamentals of Python,First Programs”, CENGAGE Publication

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn the syntax and semantics of Python programming language	**PO1, PO2**
CO2	To use the structural programming approach in solving the problem.	**PO3, PO4**

CO3	To use the object oriented programming approach in solving problems	**PO10**
CO4	To handle exceptions gracefully	**PSO1**
CO5	To develop searching and sorting algorithms	**PSO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
MOOC001A	The Joy of Computing using Python (MOOC)	2	2	2	2						2			3	3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS222A	**Computer Organization and Architecture**	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

1. How Computer Systems work & the basic principles?
2. Instruction Level Architecture and Instruction Execution
3. The current state of art in memory system design
4. How I/O devices are accessed and its principles?
5. To provide the knowledge on Instruction Level Parallelism
6. To impart the knowledge on micro programming
7. Concepts of advanced pipelining techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the concepts of microprocessors, their principles and practices.

CO2. Write efficient programs in assembly language of the 8086 family of microprocessors.

CO3. Organize a modern computer system and be able to relate it to real examples.

CO4. Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.

CO5. Implement embedded applications using Emulator.

Catalog Description

Computer architecture is the science and art of selecting and interconnecting hardware components to create a computer that meets functional, performance, and cost goals. Computer organization defines the constituent parts of the system, how they are interconnected, and how they interoperate in order to implement the architectural specification. In this course, you will learn the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language, and designs to improve performance.

Course Content

Unit I: 12 lecture hours

Functional blocks of a computer: CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look- ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

Unit II: 10 lecture hours

Introduction to x86 architecture.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit III: 8lecture hours

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit IV: 10lecture hours

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books

3. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
4. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Reference Books/Materials

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. "Computer Organization and Embedded Systems", 6th Edition by Carl Hamacher, McGraw Hill Higher Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the concepts of microprocessors, their principles and practices.	**PO2**
CO2	Write efficient programs in assembly language of the	**PO3**

	8086 family of microprocessors.	
CO3	Organize a modern computer system and be able to relate it to real examples.	**PO4**
CO4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO5	Implement embedded applications using Emulator.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Computer Organization and Architecture	-	2	3	3	2	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS212A	**Introduction to UI Design**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	-				

Course Objectives

To provide students with the knowledge of user- centered design, user -centered methods in design, graphic design on screens, simulation and prototyping techniques, usability testing methods, interface technologies and user centered design in corporate perspective.

Course Outcomes

CO1:- Learning the Importance and scope of Interaction design

CO2:- Design of interactive products, Methods of interaction design, Tools for interaction design

CO3:- Able to grasp hands-on experience of tools for creating interfaces for human and machine

CO4:- Implementing the study to create interfaces for human machine interactions

CO5:- Cross platform interface design and responsive design, UI concept and design guidelines

CO6:- UI design documentation and design delivery documentation

Catalog Description

In this course, students will gain an understanding of the critical importance of user interface design. Students will also learn industry-standard methods for how to approach the design of a user interface and key theories and frameworks that underlie the design of most interfaces you use today.

Students will then gain a high-level understanding of the user-interface design process. You will be introduced to common design scenarios - e.g. improving on existing designs and starting a new design from scratch - and the general design processes that tend to be used for each scenario. Finally, introducing the large body of existing knowledge on design by providing overviews of core user interface design theories and concepts. This key foundational information will help you avoid “reinventing the wheel” when you are designing your interfaces in this specialization.

Course Content

Unit I: 09 lecture hours

Elements and Principles of Design: Introduction to design, Colour and its attributes, line, shape including categories texture, space, form, 7 Stage model of action cycle for design tools, Unity, harmony and methods, balance and its types, hierarchy, Scale/proportion, dominance/emphasis, rhythm, similarity and contrast, Visual Hierarchy & Visual Direction, Page Scanning Patterns, legibility and readability, grid, layout, Gestalt's principle – 1, Hick's law, The Pareto principle - 80/20 rule, The rule of thirds, Hicks Law, Fitts' law, The golden ratio, Occam's razor.

Unit II: 09 lecture hours

Typography and Iconography:- What is typography, Typeface's history and study, Types of fonts - serif and non-serif, Font anatomy, Importance of Typography in modern age UI design, Usage of type for print vs digital, Latest Trends in Typography, what is iconography, visualization of icons, industry standards and specifications for iconography, designing for various form factors, trends in iconography, User perception about iconography.

Unit III: 12 lecture hours

Introduction to Visual Tools:-: Introduction to visual design tools including lab session on elements of visual design and tools, Photoshop – Interface & Workspace, Modifying workspace, tools and layers, blending options, Photoshop – layer effect filters, Image editing and enhancing, mixing, layer masking, External Plug-ins, Illustrator - Interface & Workspace, Modifying workspace, tools and layers, blending options, Illustrator – working with vectors, object libraries, layer effect filters, Image editing and enhancing, mixing, layer masking, drawing, External Plug-ins, Introduction to AdobeXD.

Unit IV: 09 lecture hours

UI Concept, design guidelines and tools: Creation of cross platform interface design and responsive design, Introduction to UI design concept and guidelines and Zeplin, The process of UI design documentation and design delivery documentation.

Reference Books/Materials

1. Thinking with Type - By Ellen Lupton
2. The Elements of Typographic Style - By Robert Bringhurst
3. Logo Modernism – By Jens Müller
4. Universal principles of Design - William Lidwell, Kritina Holden, Jill Butler
5. Design of Everyday life – Don Norman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learning the Importance and scope of Interaction design	**PO1**
CO2	Design of interactive products, Methods of interaction design, Tools for interaction design	**PO3**
CO3	Able to grasp hands-on experience of tools for creating interfaces for human and machine	**PO2**
CO4	Implementing the study to create interfaces for human machine interactions.	**PO5**
CO5	Cross platform interface design and responsive design, UI concept and design guidelines	**PO5**
CO6	UI design documentation and design delivery documentation	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 222A	Introduction to UI Design	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS220A	**Analysis and Design of Algorithms**	L	T	P	C

Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
2. Students should be able to understand the necessary divide and conquer algorithms.
3. To familiarize students with greedy and dynamic programming concepts
4. Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes

On completion of this course, the students will be able to

CO 1 Analyze the asymptotic performance of algorithms.

CO 2 Write rigorous correctness proofs for algorithms.

CO 3 Demonstrate a familiarity with major algorithms and data structures.

CO 4 Apply important algorithmic design paradigms and methods of analysis.

CO 5 Synthesize efficient algorithms in common engineering design situations.

Catalog Description

This course introduces basic methods for the design and analysis of efficient algorithms emphasizing methods useful in practice. Different algorithms for a given computational task are presented and their relative merits evaluated based on performance measures. The following important computational problems will be discussed: sorting, searching, elements of dynamic programming and greedy algorithms, advanced data structures, graph algorithms (shortest path, spanning trees, tree traversals), string matching, elements of computational geometry, NP completeness

Course Content

Unit I: **8 lecture hours**

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade- offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Unit II: **12 lecture hours**

Fundamental Algorithmic Strategies: Brute -Force, Greedy, Dynamic Programming, Branch-and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

Unit III: **12 lecture hours**

Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Unit IV: **8 lecture hours**

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques. Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Text Books

3. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
4. Fundamentals of Algorithms – E. Horowitz et al.

Reference Books/Materials

3. Schaum's outline series, "Data Structure", McGraw Hills.

4. Y. Langsamet. al., “Data Structures using C and C++”, PHI.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze the asymptotic performance of algorithms.	**PO1**
CO2	Write rigorous correctness proofs for algorithms.	**PO4**
CO3	Demonstrate a familiarity with major algorithms and data structures.	**PO5**
CO4	Apply important algorithmic design paradigms and methods of analysis.	**PO2**
CO5	Synthesize efficient algorithms in common engineering design situations.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 220A	Analysis and design of algorithms	2	2	-	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS307A	**Database Management Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Base				
Co-requisites	--				

Course Objectives

1. To understand the different issues involved in the design and implementation of a database system.
2. To study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. To understand and use data manipulation language to query, update, and manage a database.
4. To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5. To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6. For a given query write relational algebra expressions for that query and optimize the developed expression.

Course Outcomes

On completion of this course, the students will be able to

CO1. Independently understand basic database technology.

CO2.Describe the fundamental elements of relational database management systems

CO3. Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.

CO4.Design ER-models to represent simple database application scenarios

CO5. Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.

CO6.Improve the database design by normalization.

CO7. Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.

CO8. Students will be able to work in a group on the design, and implementation of a database system project.

Catalog Description

Database Management Systems (DBMS) are vital components of modern information systems. Database applications are pervasive and range in size from small in-memory databases to terra bytes or even larger in various applications domains. The course focuses on the fundamentals of knowledge base and relational database management systems, and the current developments in database theory and their practice. The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies.

Course Content

Unit I: 12 lecture hours

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Unit II: 8 lecture hours

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization:

Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

Unit III: **12 lecture hours**

Storage strategies: Indices, B-trees, hashing, Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery

Unit IV: **8 lecture hours**

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books

1.“Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

2. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J.D. Ullman, Computer Science Press.

Reference Books/Materials

2. “Fundamentals of Database Systems”, R. Elmasri and S. Navathe, Pearson Education

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Independently understand basic database technology.	**PO2**
CO2	Describe the fundamental elements of relational database management systems	**PO3**
CO3	Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.	**PO4**
CO4	Design ER-models to represent simple database application scenarios	**PO5**
CO5	Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.	**PO4**
CO6	Improve the database design by normalization.	**PO4**
CO7	Familiar with basic database storage structures and access techniques: file and page organizations, indexing methods including B tree, and hashing.	**PO9**
CO8	Students will be able to work in a group on the design, and implementation of a database system project.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS307A	Database Management Systems	-	2	3	3	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS216A	**Information Architecture**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To develop an IA that clearly illustrates the depth of content, its organization and priority.
2. To work with clients or stakeholders to find out how content should be edited, approved and published.
3. To understand the five core types of IA models, and when to use each type.
4. To develop the best way to test and validate your IA with clients, stakeholders and users.
5. To identify and diagram the content workflows critical to your product's success.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understanding Information architecture.

CO2. Tools and techniques of Information architecture.

CO3. Hands on using excel as a tool for card sorting.

CO4. Creating IA for different industries

CO5. Learning types and structures and structures of IA.

Catalog Description

Information architecture is all about creating meaning out of data. In UX design, this means creating meaning that brings value to your users by meeting their goals. Thus, IA sits in the intersection of user goals, content, and context. Good information architecture greatly impacts the user experience. The faster the users get to their final destination, the greater their satisfaction. Therefore, we should never forget that knowing the users and their information-seeking behaviors is the key to success.

Course Content

Unit I: **6 lecture hours**

Creating Task Flows: - What are task flows, basics to create task flows, Task flow analysis, AS-IS and TO-BE process, Implementing into simple problems

Unit II: **9 lecture hours**

Introduction to Information Architecture: - What is Information architecture, Structure, hierarchy and types of Information architecture, Principles and steps of Information Architecture.

Unit III: **9 lecture hours**

Tools and Techniques of Information Architecture: - Learning affinity mapping, Card sorting, Analysis of Information architecture, Using excel as a tool for card sorting, Activity based

Unit IV: **9 lecture hours**

Designing Information Architecture for Business Strategy & Exploring Gaps: - Designing Information Architecture for enterprise to meet its organizational goals using a tree structure. Making the case using the site mapping and content inventory and audit.

Unit I: **12 lecture hours**

Project: - Using a pre chosen topic, students will design task flows to understand how user will access the application or website. Students will select the structure type, organization scheme, labels, and logic. With help of various techniques, students will create Information Architecture and Site Maps

Text Books

1 A Practical Guide to Information Architecture by Donna Spencer.

Reference Books/Materials

1. User Is Always Right: A Practical Guide to Creating and Using Personas for the Web by Steve Mulder
2. The User's Journey: Storymapping Products That People Love by Donna Lichaw

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understanding Information architecture.	**PO2**
CO2	Tools and techniques of Information architecture.	**PO5**
CO3	Hands on using excel as a tool for card sorting.	**PO5**
CO4	Creating IA for different industries	**PO3**
CO5	Learning types and structures and structures of IA.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS216A	Information Architecture	2	2	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS355A	**Database Managemet Systems Lab**	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To explain basic database concepts, applications, data models, schemas and instances.
2. To demonstrate the use of constraints and relational algebra operations.
3. To facilitate students in Database design.
4. To familiarize issues of concurrency control and transaction management.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Apply the basic concepts of Database Systems and Applications.

CO2. Use the basics of SQL and construct queries using SQL in database creation and interaction.

CO3. Design a commercial relational database system (Oracle, MySQL) by writing SQL using the

system.

CO4. Analyze and Select storage and recovery techniques of database system.

Catalog Description

This course introduces the core principles and techniques required in the design and implementation of database systems. This introductory application-oriented course covers the relational database systems RDBMS - the predominant system for business scientific and engineering applications at present. It includes Entity-Relational model, Normalization, Relational model, Relational algebra, and data access queries as well as an introduction to SQL. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control and Recovery. It also provides students with theoretical knowledge and practical skills in the use of databases and database management systems in information technology applications.

Course Content

List of Experiments

S.No	Experiment	No of Hours
1	Design a Database and create required tables. For e.g. Bank, College Database	4
2	Apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.	2
3	Write a SQL statement for implementing ALTER, UPDATE and DELETE.	2
4	Write the queries to implement the joins.	4
5	Write the queries for implementing the following functions: MAX (), MIN (), AVG (), COUNT ().	2
6	Write the queries to implement the concept of Integrity constrains	4
7	Write the queries to create the views.	2
8	Perform the queries for triggers.	4
9	Perform the following operation for demonstrating the insertion, updating and deletion using the referential integrity constraints.	2
10	Do some more practice based on your class work.	2

Text Books

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books/Materials

3. "Principles of Database and Knowledge – Base Systems", Vol 1 by J.D. Ullman, Computer Science Press.
4. "Fundamentals of Database Systems", R. Elmasri and S. Navathe, Pearson Education.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the basic concepts of Database Systems and Applications	**PO5**
CO2	Use the basics of SQL and construct queries using SQL in database creation and interaction	**PO3**
CO3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system	**PO3**
CO4	Analyze and Select storage and recovery techniques of database system.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 355A	Database Management Systems Lab	-	3	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS262A	**Analysisand Design of Algorithms Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

<u>Course Objectives</u>

1. To understand concept of different sorting algorithms.
2. To understand the concept of dynamic programming.
3. To understand concept of divide and conquer.
4. To understand Dictionary (ADT)
5. To understand concept of greedy algorithms.
6. To understand concept & features like max heap, min heap

<u>Course Outcomes</u>

On completion of this course, the students will be able to

CO 1 Student will be able to implement optimal solution for various dynamic problems.

CO 2 To understand various sorting techniques.

CO 3 Analyze working of various operations on graphs.

CO 4 To understand concept of string matching in data structure

Course Content

List of Experiments

1	To analyze time complexity of insertion sort	**2 lab hours**
2	To analyze time complexity of Quick sort	**2 lab hours**
3	To analyze time complexity of merge sort	**2 lab hours**
4	Implement Largest Common Subsequence.	**2 lab hours**
5	To Implement Optimal Binary Search Tree.	**2 lab hours**
6	To Implement Matrix Chain Multiplication.	**2 lab hours**

7	To Implement Strassen's matrix multiplication Algorithm.	**2 lab hours**
8	To implement Knapsack Problem.	**2 lab hours**
9	To implement Activity Selection Problem.	**2 lab hours**
10	To implement Dijkstra's Algorithm.	**2 lab hours**
11	To implement Warshall's Algorithm.	**2 Labs**
12	To implement Bellman Ford's Algorithm.	**2 Labs**
13	To implement Depth First Search Algorithm.	**1 Lab**
14	To implement Breadth First Search Algorithm.	**1 Lab**
15	To implement NaïveString MatchingAlgorithm.	**1 Lab**
16	To implement Rabin Karp String MatchingAlgorithm	**1 Lab**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Student able to implement program for graph representation.	**PO2**
CO2	To understand operations like insert and search record in the database.	**PO3**
CO3	Analyze working of various operations on AVL Tree.	**PO5**
CO 4	To understand concept of file organization in data structure	**PSO1, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS262A	Analysis and design of algorithms Lab	-	2	3	-	3	-	-	-	3	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS256A	**UI Design Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

To provide students with the knowledge of user- centered design, user -centered methods in design, graphic design on screens, simulation and prototyping techniques, usability testing methods, interface technologies and user centered design in corporate perspective.

Course Outcomes

CO1:- Learning the Importance and scope of Interaction design

CO2:- Design of interactive products, Methods of interaction design, Tools for interaction design

CO3:- Able to grasp hands-on experience of tools for creating interfaces for human and machine

CO4:- Implementing the study to create interfaces for human machine interactions

CO5:- Cross platform interface design and responsive design, UI concept and design guidelines

CO6:- UI design documentation and design delivery documentation

Catalog Description

In this course, students will gain an understanding of the critical importance of user interface design. Students will also learn industry-standard methods for how to approach the design of a user interface and key theories and frameworks that underlie the design of most interfaces you use today.

Students will then gain a high-level understanding of the user-interface design process. You will be introduced to common design scenarios - e.g. improving on existing designs and starting a new design from scratch - and the general design processes that tend to be used for each scenario. Finally, introducing the large body of existing knowledge on design by providing overviews of core user interface design theories and concepts. This key foundational information will help you avoid “reinventing the wheel” when you are designing your interfaces in this specialization.

List of Experiments (Indicative)

1. Students will collaborate and decide several requirements and elements of the pre chosen topic Using a pre chosen topic, students will choose a font type and design various icons to be used in a website or app.
2. Students will create illustrations for the website or app after understanding what, why and how of the product or service provided.
3. Students will add various types of Imagery and will modify the same as per requirements

Reference Books/Materials

1. Thinking with Type - By Ellen Lupton
2. The Elements of Typographic Style - By Robert Bringhurst
3. Logo Modernism – By Jens Müller
4. Universal principles of Design - William Lidwell, Kritina Holden, Jill Butler
5. Design of Everyday life – Don Norman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Learning the Importance and scope of Interaction design	PO1
CO2	Design of interactive products, Methods of interaction design, Tools for interaction design	PO3
CO3	Able to grasp hands-on experience of tools for creating interfaces for human and machine	PO2

CO4	Implementing the study to create interfaces for human machine interactions.	**PO5**
CO5	Cross platform interface design and responsive design, UI concept and design guidelines	**PO5**
CO6	UI design documentation and design delivery documentation	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 256A	Introduction to UI Design	2	2	3	-	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETMC602A	Essentials of Organizational Behaviour	L	T	P	C
		3	0	0	3

Overview:

Human behaviour at work strives in the universal market, and to run the business effectively for a long term, it is critical for the organizations to shape their business with the current trends. For this, organizational behaviour is an important factor to operate the business. This course sheds light on understanding the employees in a better way to maximize the profits which are only possible by satisfying customer’s needs which are the ultimate target of an organization. It also considers factors that hamper or foster job satisfaction. This course focuses on how managers become effective leaders by addressing the human side of enterprise. This helps examine teams, individuals, and networks in the context of job satisfaction, organization culture, leadership and conflict resolution, understanding employees better, establishing productive relationships with peers and seniors over whom the manager has no formal authority, managing the performance of individual subordinates, introduces a model for strategic career management.

The course will help students examine the contemporary principles, techniques and research findings in management and organizational behaviour that are driving high performance and continuous improvement in business today. To understand management and organizational behaviour, concepts associated with continuous improvement in individual and group processes will be discussed. The focus in this course structure is laid on Organizational Behaviours, Diversity in Organization, Attitudes and Job Satisfaction, Personality and Values, Perceptions and Individual Decision Making, Motivation Concepts, Foundations of Group Behaviour, Communication, Leadership, Power and Politics, and Conflict and Negotiation.

The course will be taught with a combination of lectures and experiential learning techniques so that students will learn the specifics of a particular subject matter and about their own strengths and weaknesses as a learner (i.e. learning how to learn from experience). Each topic will be presented as an educational intervention to facilitate each stage of the experience- based learning process. Personal Application assignments and simulations are designed to relate personal experiences. Observational methods and team project are added to facilitate the understanding of these experiences. Theories and models are introduced to form generalizations and mental models. And finally, the intervention is structured with the purpose that will encourage students to experiment with and test what they have learned in class as well as in other areas of their lives.

Objective and Expected Outcome

The main objective of this course is to understand the human interactions in an organization find what is driving it and influence it for getting better results in attaining business goals. The

organizations in which people work have an effect on their thoughts, feelings, and actions. These thoughts, feelings, and actions, in turn, affect the organization itself.

This study aids to achieve the goals as it controls and develops human activity at work. The managers are responsible for the productivity. They need to make an impact on the employee behaviour, develop their skills, motivate them to work in a team collectively for better productivity and thus, ultimately achieve their targets.

This course will enable students to list and define basic organizational behaviour principles, and analyse how these influence behaviour in the workplace.

This will help analyse individual human behaviour in the workplace as influenced by personality, values, perceptions, and motivations. They would be able to outline the elements of group behaviour including group dynamics, communication, leadership, power & politics and conflict & negotiation and understand their own management style as it relates to influencing and managing behaviour in the organization systems. This course will enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.

Course Content:

UNIT I

Foundation and background of OB: contemporary challenges -workforce diversity, cross-cultural dynamics, changing nature of managerial work, ethical issues at work

UNIT II

Individual behaviour and processes: individual differences – values and attitudes; Perception-concept, process; Personality- concept, determinants; Learning and Reinforcement, Stress – causes, consequences and management

UNIT III

Interpersonal and team processes: Group, group development, developing teams – self-directed work teams, virtual teams; Empowerment - concept, significance, Conflict – concept, sources, types, management of conflict, Power and organizational politics

UNIT IV

Organizational processes and structure: organizational learning; organizational culture; organizational change and development

TEXT BOOK

4. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi

REFERENCE BOOKS:

21. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi
22. Robbins, S.P., Organisational Behaviour , Prentice Hall of India, New Delhi
23. Hellgiegel, D & J.W. Slocum, Organisational Behaviour, Thomson Learning

24. McSchane, Organisation Behaviour, TMH, New Delhi
25. Luthans, Fred, Organisational Behaviour, McGraw Hill, New York
26. New Storm and Keith Davis, Organisation Behaviour , TMH, New Delhi
27. Nelson, Debra L and James C Quick, Organisational Behaviour, Thomson Learning

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

ETCS303A	Introduction to Interaction Design	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand what interaction design is, the importance of user-centred design and methods of user information gathering.
2. To understand how the sensory, cognitive and physical capabilities of users inform the design of interactive products.
3. To recognize principles of interaction and user-centered design.
4. To identify methods, skills and techniques used in the production of interactive prototypes.

Course Outcomes

The outcome of the course are:-

CO1. Learning the Importance and scope of Interaction design.
CO2. Design of interactive products, Methods of interaction design, Tools for interaction design
CO3. Learn to design for accessibility.

Catalog Description

This course will provide students with a hands-on introduction to interaction design. The course will focus on design methods and design thinking, and will allow students to develop their design sensibilities and practical skills through a series of design exercises. The course will cover individual and group ideation techniques; and contemporary perspectives on interaction design for common platforms (e.g., web, desktop, tablet, mobile, and beyond). The course will combine readings, lectures, and in-class exercises to convey and reinforce the intellectual content. Individual and group assignments will provide an opportunity to engage more deeply with the material.

Course Content

Unit I: **6 lecture hours**

Introduction to Interaction design: Understanding scope and history of interaction in design, case studies, what is User Centered Design, Ergonomics (Physical, cognitive and organizational), Learning the different methods which includes tools and techniques of interaction design, Understanding micro-interactions.

Unit II: **9 lecture hours**

Designing for Special Needs: Designing for Accessibility, designing for special needs, WCAG principles, how to design a touch interface that is comfortable to use?

Unit III: **9 lecture hours**

Voice Based and Gesture Based Interaction: Introduction to VUI and Gesture based interactions, how to design interactions for them, Techniques and principles, examples and case studies of VUI and gesture-based products.

Unit IV: **6 lecture hours**

Introduction to UX Writing: Introduction to UX writing, Importance and Techniques, Writing for Copy, B2B and B2C copywriting, Microcopy Canvas, Examples and Case studies on UX writing.

Unit V: **15 lecture hours**

Project: Students will design selected mobile or web pages and add micro-interactions to them. They will look at accessibility principles to design the pages. They will use UX writing principles to write microcopy in the prototype to make it clear, concise and useful.

Reference Books:

1. Microinteractions: Designing with Details (Dan Saffer)

2. Designing Web Interfaces, Principles and Patterns for Rich Interactions (Bill Scott and Theresa Neil)

3. About Face: The Essentials of Interaction Design (Alan Cooper, Robert Reimann and David Cronin)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learning the Importance and scope of Interaction design.	**PO1**
CO2	Design of interactive products, Methods of interaction design, Tools for interaction design.	**PO3**
CO3	Learn to design for accessibility.	**PO2**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS303A	Introduction to Interaction Design	2	3	3	-	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS214A	Theory of Computation	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Develop a formal notation for strings, languages and machines.
2. Design finite automata to accept a set of strings of a language.
3. Prove that a given language is regular and apply the closure properties of languages.
4. Design context free grammars to generate strings from a context free language and convert them into normal forms.
5. Prove equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.
6. Identify the hierarchy of formal languages, grammars and machines.
7. Distinguish between computability and non-computability and Decidability and undecidability.

Course Outcomes

On completion of this course, the students will be able to

CO1. Write a formal notation for strings, languages and machines.

CO2. Design finite automata to accept a set of strings of a language.

CO3. Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars.

CO4. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course provides a formal connection between algorithmic problem solving and the theory of languages and automata and develop them into a mathematical view towards algorithmic design and in general computation itself. The course should in addition clarify the practical view towards the applications of these ideas in the engineering part of computer science.

Course Content

Unit I: **12 lecture hours**

Introduction to formal proof: Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Unit II: **8 lecture hours**

Regular Expression: FA and Regular Expressions, Proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Unit III: **12 lecture hours**

Context-Free Grammar (CFG): Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata. Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM.

Unit IV: **8 lecture hours**

A language that is not Recursively Enumerable (RE): An undecidable problem that is RE, Undecidable problems about Turing Machine, Post's Correspondence Problem.

Text Books

1. J.E. Hopcroft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education.

Reference Books/Materials

1. H.R. Lewis and C.H. Papadimitriou, “Elements of the theory of Computation”, Second Edition, Pearson Education.
2. Thomas A. Sudkamp,” An Introduction to the Theory of Computer Science, Languages and Machines”, Third Edition, Pearson Education.
3. Raymond Greenlaw an H.James Hoover, “Fundamentals of Theory of Computation, Principles and Practice”, Morgan Kaufmann Publishers.
4. MichealSipser, “Introduction of the Theory and Computation”, Thomson Brokecole.
5. J. Martin, “Introduction to Languages and the Theory of computation” Third Edition, Tata Mc Graw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write a formal notation for strings, languages and machines	**PO1**
CO2	Design finite automata to accept a set of strings of a language	**PO3**

CO3	Determine equivalence of languages accepted by Pushdown Automata and languages generated by context free grammars	**PO2**
CO4	Distinguish between computability and non-computability and Decidability and un-decidability	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS214A	Theory of Computation	2	3	3	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS211A	**Operating Systems**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

This course will provide an introduction to the internal operation of modern operating systems. In particular, the course will cover processes and threads, mutual exclusion, CPU scheduling, deadlock, memory management, and file systems.

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time;

Scheduling algorithms: Pre-emptive and Non-preemptive, FCFS, SJF, RR; Multiprocessorscheduling: Real Time scheduling: RM and EDF.

Unit III: **12 lecture hours**

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Unit IV: 10 lecture hours

Process-Synchronization & Deadlocks: Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc. Definition of Deadlocks, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

I/O Systems: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

Text Books

2. Silbersachatz and Galvin, "Operating System Concepts", Pearson

Reference Books/Materials

5. Tannenbaum, "Operating Systems", PHI, 4th Edition.
6. William Stallings, "Operating Systems Internals and Design Principles", PHI
7. HallMadnick, J. Donovan, "Operating Systems", Tata McGraw Hill.
8. W. Tomasi, "Electronic Communication Systems" Pearson Education, 5th Edition

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS304A	**Computer Networks**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Data Structure and Algorithms				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding the concepts of communication and computer networks.

Course Outcomes

On completion of this course, the students will be able to

CO1. To develop an understanding of modern network architectures from a design and performance perspective.
CO2. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
CO3. To provide an opportunity to do network programming
CO4. Explain the functions of the different layer of the OSI Protocol.
CO5. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Data Communication. Student will understand the applications of data structures and algorithms in networks. The internals of communications will be discussed throughout the course duration.

Course Content

Unit I: **8 lecture hours**

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization:

Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum

Unit II: **12 lecture hours**

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Unit IV: **8 lecture hours**

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books

3. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
4. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To develop an understanding of modern network architectures from a design and performance perspective.	**PO2, PO12**
CO2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	**PO12**
CO3	To provide an opportunity to do network programming	**PO2**
CO4	Explain the functions of the different layer of the OSI Protocol.	**PO4, PO5**
CO5	For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS304A	Computer Networks	-	3	-	3	3	-	-	-	-	-	3	3	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS305A	**Design Thinking**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To familiarize students with design thinking concepts and principles
2. To ensure students can practices the methods, processes and tools of design thinking.
3. To ensure students can apply the design thinking approach and have ability to model real world situations.
4. To enable students to analyse primary and secondary research in the introduction to design thinking

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn what design thinking and wicked problem is.

CO2. To learn to generate new ideas.

CO3. To grasp the methods of the design thinking 5D process

CO4. To comprehend and effectively use the tools and techniques to solve wicked problems.

CO5. To apprehend the application of design thinking with case studies.

Catalog Description

Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on the way to developing human centered products and/or services. This approach is at the very heart of design thinking. In this course, students will examine design thinking methodologies, processes and tools that can be used to make the world a better place. They explore design thinking theories, and how they can be applied to practical situations relevant to various academic disciplines and organizational roles. Among the topics covered are ideation, prototyping, iteration, and innovation. Through personal reflection, students will also examine how they can harness the power of design thinking for leading the creation of value for businesses, organizations, and society.

Course Content

Unit I: **9 lecture hours**

Introduction to Design thinking: Learning the meaning of design thinking and how it has evolved to solve wicked problems around the world, four pillars of wicked problems, Deep dive into the Design process followed by Designers around the world.

Unit II: **9 lecture hours**

Case studies in Design thinking: Getting to know the real-world applications and success stories of different industries.

Unit III: **9 lecture hours**

Design Frameworks: AARRR framework, Customer Experience Index (CX Index), Google's HEART framework, Social Impact Metrics, IDEO, Standford, ImaginXP 5D Process Explained with case studies.

Unit IV: **12 lecture hours**

Innovation & Creativity: What is Innovation? What is creativity? Difference between innovation and creativity, dynamics of creative thinking, becoming creatively fit as an individual, creative insight, idea generation, learn what is innovation and how leading organization across the world are implementing innovation, Role of creativity and innovation in organizations, idea evaluation, creativity in teams.

Reference Books:

1. Designing for Digital Age: How to create human-centered products and services - Kim Goodwin
2. The design of everyday things - Don Norman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn what design thinking and wicked problem is.	**PO2**
CO2	To learn to generate new ideas.	**PO3**
CO3	To grasp the methods of the design thinking 5D process	**PO1**
CO4	To comprehend and effectively use the tools and techniques to solve wicked problems.	**PO4, PO5**
CO5	To apprehend the application of design thinking with case studies.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS305A	Design Thinking	2	3	3	3	3	-	-	-	-	-	-	-	-	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS351A	Design Thinking Lab	L	T	P	C
Version 1.0		0	0	4	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To familiarize students with design thinking concepts and principles

2. To ensure students can practices the methods, processes and tools of design thinking.

3. To ensure students can apply the design thinking approach and have ability to model real world situations.

4. To enable students to analyse primary and secondary research in the introduction to design thinking

Course Outcomes

On completion of this course, the students will be able to

CO1. Learn what design thinking and wicked problem is.

CO2. To learn to generate new ideas.

CO3. To grasp the methods of the design thinking 5D process

CO4. To comprehend and effectively use the tools and techniques to solve wicked problems.

CO5. To apprehend the application of design thinking with case studies.

Catalog Description

Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on the way to developing human centered products and/or services. This approach is at the very heart of design thinking. In this course, students will examine design thinking methodologies, processes and tools that can be used to make the world a better place. They explore design thinking theories, and how they can be applied to practical situations relevant to various academic disciplines and organizational roles. Among the topics covered are ideation, prototyping, iteration, and innovation. Through personal reflection, students will also examine how they can harness the power of design thinking for leading the creation of value for businesses, organizations, and society.

List of Experiments (Indicative)

1. With help of various ideation methods taught, students will collaborate and decide several requirements and elements of the pre chosen topic.
2. Students will conduct research and derive insights of a chosen wicked problem.
3. Using the insights, students will create personas, empathy maps, scenarios/storyboards and map the user's journey

Reference Books:

1. Designing for Digital Age: How to create human-centered products and services - Kim Goodwin
2. The design of everyday things - Don Norman

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn what design thinking and wicked problem is.	**PO2**
CO2	To learn to generate new ideas.	**PO3**
CO3	To grasp the methods of the design thinking 5D process	**PO1**
CO4	To comprehend and effectively use the tools and techniques to solve wicked problems.	**PO4, PO5**

CO5	To apprehend the application of design thinking with case studies.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS351A	Design Thinking Lab	2	3	3	3	3	-	-	-	-	-	-	-	2	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS365A	**Computer Networks Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. Learn basic concepts of computer networking and acquire practical notions of protocols with the emphasis on TCP/IP.
2. Provides a practical approach to assemble Ethernet/Internet networking.
3. Understanding of the layered architecture and working of important protocols

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.

CO2. Execute and evaluate network administration commands and demonstrate their use in different network scenarios.

CO3. Demonstrate and measure different network scenarios and their performance behavior.

CO4. Design and setup an organization network using packet tracer.

Catalog Description

This course complements ETCS304A. It enables them to select and design network for solving real life problem with optimal solution(s). The list of experiments helps to understand details of component of network and protocol.

List of Experiments (Indicative)

1	Study of Network devices in detail	**2 lab hours**
2	Connect the computers in Local Area Network using packet tracer	**2 lab hours**
3	Implementation of Data Link Framing method - Character Count.	**2 lab hours**
4	Implementation of Data link framing method - Bit stuffing and Destuffing.	**2 lab hours**
5	Implementation of Error detection method - even and odd parity.	**2 lab hours**
6	Implementation of Error detection method - CRC Polynomials.	**2 lab hours**
7	Implementation of Data Link protocols - Unrestricted simplex protocol	**2 lab hours**
8	Implementation of data link protocols - Stop and Wait protocol	**2 lab hours**
9	Implementation of routing algorithms - Dijkstra’s algorithm	**2 lab hours**
10	Study of Network IP Addressing using packet tracer	**2 lab hours**
11	Design TCP client and server application to transfer file	**2 lab hours**
12	Design UDP client and server application to transfer file	**2 lab hours**
13	Working on Network Protocol Analyzer Tool (Ethereal/Wireshark)	**4 lab hours**

14	Working on NMAP Tool for Port scanning	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the structure and organization of computer networks; including the division into network layers, role of each layer, and relationships between the layers.	**PO2**
CO2	Execute and evaluate network administration commands and demonstrate their use in different network scenarios.	**PO3**
CO3	Demonstrate and measure different network scenarios and their performance behavior.	**PO5**
CO4	Design and setup an organization network using packet tracer.	**PO8**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS365A	Computer Networks Lab	-	3	3	-	2	-	-	3	-	-	-	-	3	3	

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 255A	Operating Systems Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Organization & Architecture				
Co-requisites	--				

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication.
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management
5. To learn to implement simple OS mechanisms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Create processes and threads.

CO2. Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.

CO3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

CO4. Design and implement file management system.

CO5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Catalog Description

Based on theory subject **ETCS 211A**, the following experiments are to be performed. It enables them to write algorithms for solving problems with the help of fundamental operating systems.

List of Experiments (Indicative)

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

1	Write a C program to simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority	**4 lab hours**
2	Write a C program to simulate multi-level queue scheduling algorithm considering the following scenario. All the processes in the system are divided into two categories – system processes and user processes. System processes are to be given higher priority than user processes. Use FCFS scheduling for the processes in each queue.	**2 lab hours**
3	Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.	**4 lab hours**
4	Write a C program to simulate the following file allocation strategies. a) Sequential b) Indexed c) Linked	**4 lab hours**
5	Write a C program to simulate the MVT and MFT memory management techniques.	**4 lab hours**
6	Write a C program to simulate the following contiguous memory allocation techniques a) Worst-fit b) Best-fit c) First-fit	**2 lab hours**
7	Write a C program to simulate paging technique of memory management	**4 lab hours**
8	Write a C program to simulate the following file organization techniques a) Single level directory b) Two level directory c) Hierarchical	**4 lab hours**
9	Write a C program to simulate Bankers algorithm for the purpose of deadlock avoidance.	**4 lab hours**
10	Write a C program to simulate page replacement algorithms a) FIFO b) LRU c) LFU	**2 lab hours**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Create processes and threads	**PO1**
CO2	Develop algorithms for process scheduling for a given specification of CPU utilization, throughput, Turnaround Time, Waiting Time, Response Time.	**PO2**
CO3	For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.	**PO4**
CO4	Design and implement file management system.	**PO3**
CO5	For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS255A	Operating Systems Lab	2	2	3	2	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS381A	Practical Training – I	L	T	P	C
Version 1.0		0	0	0	1
Pre-requisites/Exposure	Completion of fourth semester				
Co-requisites	--				

Course Objectives

The course is designed so as to expose the students to industry environment and to take up on-site assignment as trainees or interns.

Course Outcomes

On completion of this course, the students will be able to

CO1. Have an exposure to industrial practices and to work in teams.
CO2. Understand the impact of engineering solutions in a global, economic, environmental and societal context.
CO3. Develop the ability to engage in research and to involve in life-long learning.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course enables students to face the real time problems which are usually faced by working professional while working in the industry. While on this training program, students come to know about technical as well individual skills required by a professional for survival in the market .In fact, this course is about industrial implementation of the technologies. This course enable students to learn technologies on industrial level. The student will be working closely with the technical team. This course enhances student's ability to think out of the box and suggest new ways of implementing ideas in a better manner and should be able to brainstorm and come up with innovative ideas.

Course Content

Six weeks of work at industry site. Supervised by an expert at the industry.

Modes of Evaluation: Internship Report, Presentation and Project Review**:**

Components	Internship Report	Presentation/ Project Review
Weightage (%)	**50**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Have an exposure to industrial practices and to work in teams.	**PO5**
CO2	Understand the impact of engineering solutions in a global, economic, environmental and societal context	**PO7**
CO3	Develop the ability to engage in research and to involve in life-long learning	**PO3**
CO4	Communicate effectively and learn to be a team player	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS381A	Practical Training – I	-	-	3	-	3	-	2	-	-	3	-	-	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS375A	**Mini Project**	L	T	P	C
Version 1.0		-	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

CO2. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 375A	Mini Project Lab	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS412A	Compiler Design	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	Theory of Computation				
Co-requisites	--				

Course Objectives

1. To understand and list the different stages in the process of compilation.
2. Identify different methods of lexical analysis
3. Design top-down and bottom-up parsers
4. Identify synthesized and inherited attributes
5. Develop syntax directed translation schemes
6. Develop algorithms to generate code for a target machine

Course Outcomes

On completion of this course, the students will be able to:-

CO1. For a given grammar specification develop the lexical analyser

CO2. For a given parser specification design top-down and bottom-up parsers

CO3. Develop syntax directed translation schemes

CO4. Develop algorithms to generate code for a target machine

CO5. Distinguish between computability and non-computability and Decidability and undecidability.

Catalog Description

This course aims to provide a thorough understanding of the theory and practice of compiler implementation, learn finite state machines and lexical scanning, context free grammars, compiler parsing techniques, construction of abstract syntax trees, symbol tables, intermediate machine representations and actual code generation

Course Content

Unit I: **8 lecture hours**

Introduction to Compiling: Compilers, Analysis of the source program, the phase of a compiler, Cousins of the compiler, the grouping of phases, Compiler-constructions tools.

A Simple One-Pass Compiler: Syntax definition, Syntax-directed translation, Parsing, A translator for simple expressions, Lexical analysis, Incorporating a symbol table, Abstract stack machines.

Unit II: **12 lecture hours**

Lexical Analysis: The role of the lexical analyzer, Input buffering, Specification of tokens, Recognition of tokens, A language of specifying lexical analyzers, Design of a lexical analyzer generator.

Syntax Analysis: The role of the parser, writing a grammar, Top-down parsing; Bottom-up parsing, Operator-precedence parsing, LR parsers, Using ambiguous grammars, Parser generators.

Unit III: **12 lecture hours**

Syntax-Directed Translation: Syntax-direct definitions, Construction of syntax trees, Bottom-up evaluation of S- attributed definitions, L-attributed definitions, and Top-down translation.

Type Checking: Type systems, Specification of a simple type checker.

Run-Time Environments: Source language issues, Storage organization, Storage-allocation strategies, Access to nonlocal names, Parameter passing, Symbol tables, Language facilities for dynamic storage allocation, Dynamic storage allocation techniques.

Unit IV: **8 lecture hours**

Intermediate Code Generation: Intermediate languages, Declarations, Assignment statements, Boolean expressions.

Code Generation: Issues in the design of a code generator, Target machine, Run-time storage management, Basic blocks and flow graphs.

Code Optimization: Introduction, The Principle sources of optimization.

Text Books

1. Aho, Ullman & Ravi Sethi, "Principles of Compiler Design", Pearson Education.

Reference Books/Materials

1. Andrew L. Appel, “Modern Compiler Implementation in C”,Delhi, Foundation Books.
2. Dick Gruneet. Al., “Modern Compiler Design”, Wiley Dreamtech.
2. R. J. Schalkoff, “Artificial Intelligence – An Engineering Approach”, McGraw Hill Int. Ed. Singapore.
3. M. Sasikumar, S. Ramani, “Rule Based Expert Systems”, Narosa Publishing House.
4. Tim Johns, “Artificial Intelligence, Application Programming”, Wiley Dreamtech.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	For a given grammar specification develop the lexical analyser	**PO5**
CO2	For a given parser specification design top-down and bottom-up parsers	**PO2**
CO3	Develop syntax directed translation schemes	**PO3**
CO4	Develop algorithms to generate code for a target machine	**PO3**

CO5	Distinguish between computability and non-computability and Decidability and undecidability.	PO4

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 412A	Compiler Design	-	3	3	3	2	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS401A	**Artifical Intelligence**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO2. Apply these techniques in applications which involve perception, reasoning and learning.
CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO4. Acquire the knowledge of real world Knowledge representation.
CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.

CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: **8 lecture hours**

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: **12 lecture hours**

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: **12 lecture hours**

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: **8 lecture hours**

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

1. Artificial Intelligence, P. H. Winston,Pearson Education.
2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
3. Principles of AI, N. J. Nilsson, Narosa Publishing House

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.	PO1
CO2	Apply these techniques in applications which involve perception, reasoning and learning.	PO4

CO3	Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.	**PO5**
CO4	Acquire the knowledge of real world Knowledge representation.	**PO2**
CO5	Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.	**PO3**
CO6	Use different machine learning techniques to design AI machine and enveloping applications for real world problems.	**PO3**
CO7	Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.	**PSO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS401A	ARTIFICAL INTELLIGENCE	2	3	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS302A	**Wireframing & Prototyping**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Create storyboards to come up with ideas about solutions to user needs.
2. Build paper prototypes to create interactive designs.
3. Create wireframes on paper and digitally in the design tool Figma.
4. Design low-fidelity prototypes in Figma.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Practice to learn the tools required to design wireframes and prototypes.

CO2. Design wireframes on paper and translate paper concepts into digital wireframes and then prototypes.

CO3. Understand and practice the techniques involved in designing digital wireframes for UI Platforms.

CO4. Understand and practice the techniques involved in creating digital prototypes. Tools to be taught – Figma, AdobeXD.

Catalog Description

Build Wireframes and Low-Fidelity Prototypes is the third course in a certificate program that will equip you with the skills you need to apply to entry-level jobs in user experience (UX) design. In this course, you'll continue to design a mobile app for your professional UX portfolio. You'll start by creating storyboards and getting familiar with the basics of drawing. Then, you'll create paper wireframes and digital wireframes using the design tool Figma. You'll also create a paper prototype and a digital low-fidelity prototype in Figma.

Course Content

Unit I: **6 lecture hours**

Basics guidelines of Wireframing and Prototyping: Introduction to wireframes, understanding responsive design, primary, secondary and utility navigation, content, inline links, indexes, search, what is Prototyping, when do we need it, understanding rapid prototyping, Types of Prototypes, Overview of wireframing and prototyping digital tools.

Unit II: **9 lecture hours**

Designing wireframes on paper: Header, footer, sidebar, navigation systems, use of whitespace, web fonts and typography.

Unit III: **12 lecture hours**

Designing wireframes and prototypes on Figma and AdobeXD: Creating visual mockups, whitespace to style a form, scrolling, introduction to clickable prototypes using Figma and AdobeXD, importing and exporting assets.

Unit IV: **09 lecture hours**

Designing digital wireframes and prototypes for different UI platforms: Practical hands-on demonstration of paper-based wireframes and clickable prototypes using digital tools.

Reference Books:

1. Communicating Design: Developing Web Site Documentation for Design and Planning, Book by Daniel M. Brown
2. UI/UX Sketchbook For Wireframing And Prototyping: Big Size Edition Light Version
3. Mobile UI/UX Sketchbook: Wireframing and Prototyping Notebook for UI/UX Designers, Students, Mobile App Developers, and Hobbyists App Developer Notebooks

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Practice to learn the tools required to design wireframes and prototypes.	**PO5**
CO2	Design wireframes on paper and translate paper concepts into digital wireframes and then prototypes.	**PO3**
CO3	Understand and practice the techniques involved in designing digital wireframes for UI Platforms.	**PO2**
CO4	Understand and practice the techniques involved in creating digital prototypes. Tools to be taught – Figma, AdobeXD.	**PO5, PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 302A	Wireframing & Prototyping	2	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS358A	Wireframing & Prototyping Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Create storyboards to come up with ideas about solutions to user needs.
2. Build paper prototypes to create interactive designs.
3. Create wireframes on paper and digitally in the design tool Figma.
4. Design low-fidelity prototypes in Figma.

Course Outcomes

On completion of this course, the students will be able to:-

CO1. Practice to learn the tools required to design wireframes and prototypes.

CO2. Design wireframes on paper and translate paper concepts into digital wireframes and then prototypes.

CO3. Understand and practice the techniques involved in designing digital wireframes for UI Platforms.

CO4. Understand and practice the techniques involved in creating digital prototypes. Tools to be taught – Figma, AdobeXD.

Catalog Description

Build Wireframes and Low-Fidelity Prototypes is the third course in a certificate program that will equip you with the skills you need to apply to entry-level jobs in user experience (UX) design. In this course, you'll continue to design a mobile app for your professional UX portfolio. You'll start by creating storyboards and getting familiar with the basics of drawing. Then, you'll create paper wireframes and digital wireframes using the design tool Figma. You'll also create a paper prototype and a digital low-fidelity prototype in Figma.

List of Experiments (Indicative)

1. Using the pre chosen topic, students will create pen-paper wireframes to brainstorm raw design of the app or website
2. Once the raw design is ready, students will create mid fidelity wireframe using Figma and AdobeXD.
3. After wireframes are ready, students will create prototypes by connecting various flows in the design
4. Students will view the prototype in their devices and reiterate the process if any changes are needed

Reference Books:

1. Communicating Design: Developing Web Site Documentation for Design and Planning, Book by Daniel M. Brown
2. UI/UX Sketchbook For Wireframing And Prototyping: Big Size Edition Light Version
3. Mobile UI/UX Sketchbook: Wireframing and Prototyping Notebook for UI/UX Designers, Students, Mobile App Developers, and Hobbyists App Developer Notebooks

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Practice to learn the tools required to design wireframes and prototypes.	**PO5**
CO2	Design wireframes on paper and translate paper concepts into digital wireframes and then prototypes.	**PO3**
CO3	Understand and practice the techniques involved in designing digital wireframes for UI Platforms.	**PO2**
CO4	Understand and practice the techniques involved in creating digital prototypes. Tools to be taught – Figma, AdobeXD.	**PO5, PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 358A	Wireframing & Prototyping Lab	2	3	3	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 202A	**Software Engineering**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

On completion of this course, the students will be able to:

CO1. To learn and understand the Concepts of Software Engineering

CO2. To Learn and understand Software Development Life Cycle

CO3. To apply the project management and analysis principles to software project development.

CO4. To apply the design & testing principles to software project development.

CO5. Ability to execute tests, design test cases, use test tools, etc.

CO6. To Study about Software maintenance tools

Catalog Description

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

Unit I: **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

<u>Unit II:</u> **12 lecture hours**

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO,COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding:TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

<u>Unit III:</u> **8 lecture hours**

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

<u>Unit IV:</u> **12 lecture hours**

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, McGraw Hill Int. Ed.
3. W.S. Jawadekar, “Software Engineering – Principles and Practices”, McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, “Classical & Object Oriented Software Engineering”, IRWIN, TMH.
2. James Peter, W. Pedrycz, “Software Engineering: An Engineering Approach”, John Wiley & Sons.
3. I. Sommerville, “Software Engineering”, Addison Wesley.
4. K. Chandrasehakhar, “Software Engineering & Quality Assurance”, BPB.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 202A	Software Engineering	3	3	3	3	3	-	-	-	-	-	2	-	3	3	2

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS451A	**Artificial Intelligence Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to

CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs

CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)

CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving

CO4. Know how to build simple knowledge-based systems

CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**
2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	**PO1**
CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	**PO4**
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	**PO5**
CO4	Know how to build simple knowledge-based systems	**PO2**
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS451A	ARTIFICIAL INTELLIGENCE LAB	2	3	-	3	3	-	-	-	-	-	-	-	-	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS310A	**Advanced Computer Architecture**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Computer Organization and Architecture; Microprocessor				
Co-requisites	Digital Electronics				

Course Objectives

1. Understand the Concept of Parallel Processing and its applications.
2. .Implement the Hardware for Arithmetic Operations.
3. Analyze the performance of different scalar Computers.
4. .Develop the Pipelining Concept for a given set of Instructions.
5. .Distinguish the performance of pipelining and non-pipelining environment in a processor.
6. To make students know about the Parallelism concepts in Programming

Course Outcomes

On completion of this course, the students will be able to

CO1. Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.

CO2. Describe the design issues relating to the architectural options.

CO3. Describe the challenges faced in the implementation of these high-performance systems

CO4. Understand pipelining, instruction set architectures, memory addressing.

CO5. Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.

CO6. Understand the various models to achieve memory consistency.

Catalog Description

Advanced Computer Architecture (ACA) covers advanced topics in computer architecture focusing on multicore, graphics-processor unit (GPU), and heterogeneous SOC multiprocessor architectures and their implementation issues (architect's perspective). The objective of the course is to provide in-depth coverage of current and emerging trends in computer architecture focusing on performance and the hardware/software interface. The course emphasis is on analyzing fundamental issues in architecture design and their impact on application performance.

Course Content

Unit I: **10lecture hours**

Elements of modern computers (computing problems, algorithms, hardware, OS, system software);

Evolution of computer architecture; Factors affecting system performance; architectural development tracks (Multiple-processor tracks, Multi-Vector& SIMD tracks, Multithread & Dataflow tracks)

Conditions of parallelism (Data dependence, Resource dependence, control dependence, Bernstein's Conditions);Hardware& Software parallelism; Program partitioning & Scheduling; Program flow machines (Control flow, Dataflow, Demand driven); Parallel processor applications; Speedup performance laws (Amdahl's law, Gustafson'slaw); Scalability (Goals, Metrics, evolution of scalable architectures, open issues)

Unit II: **10 lecture hours**

System Interconnect Architectures: Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.

Advanced processors: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch prediction,

Unit III: **10 lecture hours**

Memory Hierarchy Design: Cache basics & cache performance, reducing miss rate and miss penalty, multilevel cache hierarchies, main memory organizations, design of memory hierarchies.

Multiprocessor architectures: Symmetric shared memory architectures, distributed shared memory architectures, models of memory consistency, cache coherence protocols (MSI, MESI, MOESI), scalable cache coherence, overview of directory based approaches, design challenges of directory protocols, memory based directory protocols, cache based directory protocols, protocol design tradeoffs, synchronization.

Unit IV: **10 lecture hours**

Parallel Models and Languages :- Parallel Programming Models(Shared-Variable, Message passing, Data-Parallel, Object-Oriented);Parallel languages & Compilers (language features for parallelism, parallel language constructs, optimizing compilers for parallelism);Code optimization & partitioning (Scalar optimization , Local & Global optimization, Vectorization , code generation & scheduling , Trace scheduling compilation); Parallel programming environments

TEXT BOOKS:

11. Advanced computer architecture, Kai Hwang, McGraw Hills.
12. Computer Organization and Design, D. A. Patterson and J. L. Hennessey, Morgan Kaufmann.

REFERENCE BOOKS:

36. Computer Architecture and Organization, J.P. Hayes, McGraw Hills.
37. Memory System and Pipelined Processors, HarveyG.Cragon, Narosa Publication.
38. Parallel Computer, V.Rajaranam & C.S.R. Murthy, PHI.

39. Foundation of Parallel Processing, R.K. Ghose, RajanMoona&Phalguni Gupta, Narosa Publications
40. Scalable Parallel Computers Architecture, Kai Hwang and Zu, MGH.
41. Computer Organization & Architecture, Stalling W, PHI.
42. Computer Architecture, Pipelined and Parallel Processor Design, M.J Flynn, Narosa Publishing.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Describe the various architectural concepts that may be applied to optimize and enhance the classical Von Neumann architecture into high performance computing hardware systems.	**PO1; PO2**
CO2	Describe the design issues relating to the architectural options.	**PO3**
CO3	Describe the challenges faced in the implementation of these high-performance systems .	**PO2**
CO4	Understand pipelining, instruction set architectures, memory addressing.	**PO4**
CO5	Understand the various techniques to enhance a processors ability to exploit Instruction-level parallelism (ILP), and its challenges.	**PO5; PO12**
CO6	Understand the various models to achieve memory consistency.	**PO2; PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3	-	-	-	-	-	-	2	3	2	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS318A	**Usability Testing**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Learn if participants are able to complete specified tasks successfully.
2. Find out how satisfied participants are with your Web site or other product.
3. Identify changes required to improve user performance and satisfaction.
4. Analyze the performance to see if it meets your usability objectives.

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Learn the process of conducting usability tests for digital products

CO2. Learning Preparations for usability testing and understanding Usability testing methodologies

CO3. To able to Conduct the Usability testing and document it

Catalog Description

Usability testing refers to evaluating a product or service by testing it with representative users. Typically, during a test, participants will try to complete typical tasks while observers watch, listen and takes notes. The goal is to identify any usability problems, collect qualitative and quantitative data and determine the participant's satisfaction with the product.

Course Content

Unit I: **9 lecture hours**

Process of Usability testing: What is Usability testing, Types of testing, Learning the steps to test different types of products/service/methods planning, executing, information gathering and documentation, case studies, heuristic evaluation and its importance, 10 Laws of Heuristic Evaluation, Understanding Heuristics through practical examples.

Unit II: **12 lecture hours**

Usability testing for Digital products: Learn how to create questionnaires, test cases and test moderation. Preparing for the testing of products, Understanding people's psychology and Behavior.

Unit III: **12 lecture hours**

Tools and Techniques of Usability Testing: Usability testing methodologies – task-based user testing, A/B testing, lab-based user testing, remote user testing, moderated & un-moderated user testing. Tools: Google Optimizer, Hotjar.

Unit IV: **12 lecture hours**

Project Discussion: Students will choose a topic and they will discuss it with the professors. Parameters and feedback will also be discussed.

Reference Books:

1. Measuring the User Experience: Collecting, Analyzing, and Presenting Usability Metrics (William Albert and Thomas Tullis)
2. Practical Guide to Usability Testing - Author: Joseph S. Dumas
3. Usability Inspection Methods - Authors: Jakob Nielsen
4. Usability Engineering - Author: Jakob Nielsen
5. Handbook of Usability Testing: How to Plan, Design, and Conduct Effective Tests - Author: Jared Spool, Jeffrey Rubin, Dana Chisnell

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Learn the process of conducting usability tests for digital products	**PO1, PO2**
CO2	Learning Preparations for usability testing and understanding Usability testing methodologies	**PO3, PO4**
CO3	To able to Conduct the Usability testing and document it	**PO5**

Course Code	Course Title	Engineering Knowledge PO1	Problem analysis PO2	Design/development of solutions PO3	Conduct investigations of complex problems PO4	Modern tool usage PO5	The engineer and society PO6	Environment and sustainability PO7	Ethics PO8	Individual or team work PO9	Communication PO10	Project management and finance PO11	Life-long Learning PO12	Application of Concepts PSO1	Innovation and Industry Friendly PSO2	Ethics and Communication Skills PSO3
ETCS318A	Usability Testing	2	3	3	3	2	-	-	-	-	-	-	-	3	1	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS420A	**Graph Theory**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Discrete Mathematics				
Co-requisites	--				

Course Objectives

1. Use definitions in graph theory to identify and construct examples
2. Apply theories and concepts to test and validate intuition and independent mathematical thinking in problem solving.
3. Reason from definitions to construct mathematical proofs
4. Read and write graph theory in a coherent and technically accurate manner

Course Outcomes

Students are expected to demonstrate the ability to:

CO1. Understand and apply the fundamental concepts in graph theory

CO2. Apply the graph theory-based tools in solving practical problems

CO3. Improve the proof writing skills

CO4. Understand the concept of plane graph and theory.

Catalog Description

The course covers basic theory and applications of graph theory. Graph theory is a study of graphs, trees and networks. Topics that will be discussed include Euler formula, Hamilton paths, planar graphs and coloring problem; the use of trees in sorting and prefix codes; useful algorithms on networks such as shortest path algorithm, minimal spanning tree algorithm and min-flow max-cut algorithm.

Course Content

Unit I: **11lecture hours**

INTRODUCTION: Graphs, Introduction, Isomorphism, Sub graphs, Walks, Paths, Circuits, Connectedness, Components, Euler Graphs , Hamiltonian Paths and Circuits, Operations on Graph, The Travelling Salesman Problem, Sperner's Leema, Trees, Properties of trees, Distance and Centers in Tree, Rooted and Binary Trees, Cayley's Theorem, Spanning trees, Fundamental Circuits,Spanning Trees in a Weighted Graph

Unit II: **11 lecture hours**

CONNECTIVITY & PLANARITY:, Cut Sets, Properties of Cut Set, All Cut Sets, Fundamental Circuits and Cut Sets, Connectivity and Separability, Network flows, Isomorphism, Combinational and Geometric Graphs, Planer Graphs , Kuratowski's Two Graphs, Different Representation of a Planer Graph, Detection of Planarity, Applications-The Chinese Postman Problem

Unit III: **12lecture hours**

MATRICES, COLOURING AND DIRECTED GRAPH: Incidence matrix, Submatrices, Circuit Matrix, Cut-Set Matrix,Path Matrix, Adjacency Matrix, Chromatic Number, Chromatic partitioning, Chromatic polynomial, Matching, Covering, Four Color Problem, Directed Graphs, Types of Directed Graphs, Digraphs and Binary Relations, Directed Paths and Connectedness, Euler DiGraphs, Adjacency Matrix of a Digraph, Paired Comparison and Tournaments

Unit IV: **8 lecture hours**

GRAPH ALGORITHM: Algorithms: Connectedness and Components, Spanning tree, Finding all Spanning Trees of a Graph, Set of Fundamental Circuits, Cut Vertices and Separability, Directed Circuits, Shortest Path Algorithm, DFS, Planarity Testing.

Textbooks

1. Graph Theory: With Application to Engineering and Computer Science, Narsingh Deo, PHI.

Reference Books

4. Introduction to Graph Theory, R.J. Wilson, Pearson Education.
5. A First Look at Graph Theory, Clark J. & Holton D.A, Allied Publishers.
6. Elements of Discrete Mathematics, Liu C.L, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and apply the fundamental concepts in graph theory	**PO1, PO2**
CO2	Apply the graph theory-based tools in solving practical problems	**PO3, PO4**
CO3	Improve the proof writing skills	**PO6, PO12**
CO4	Understand the concept of plane graph and theory.	**PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS420A	Graph Theory	3	3	3	3	-	1	-	-	-	-	-	2	3	1	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS462A	**Minor Project**	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

<u>Course Outcomes</u>

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

<u>Catalog Description</u>

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 462A	Minor Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS464A	**Major Project**	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

On completion of this course, the students will be able to

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.

C02. Use the relevant tools necessary for engineering practice.

CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.

CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	**PO3**
CO2	Use the relevant tools necessary for engineering practice.	**PO5**
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	**PO3**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Cours e Code	Course Title	PO1	PO2	PO3	PO4	P O 5	PO 6	PO7	P O 8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 464A	Major Project	-	-	3	-	2	-	-	-	-	3	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS429A	**Portfolio Development & Review**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Obtain an initial evaluation of your academic history to determine if there are any outstanding degree requirements for which you can document and demonstrate college-level knowledge.

2. Develop an inventory of knowledge and skills that can be documented or Demonstrated.

3. Brainstorm about and list what types of physical evidence exists to verify your competencies (knowledge and skills).

Course Outcomes

Upon completion of the course the students will be able to:

CO1 Industry project to be completed in semester 8.

CO2. Projects reports are to be submitted in a set format and mentors are assigned to each student for guidance through the project.

CO3. The project is evaluated as the end-term examination in the form of a jury conducted by an industry and academic panel.

Catalog Description

Portfolio development is the process by which a student documents and demonstrates college-level competencies (knowledge and skills) acquired in environments and agencies outside the traditional higher education classroom. In essence, it is evidence that the student has met learning outcomes or objectives equivalent to specific university courses. Knowledge and skills gained though work, training, or life experiences may translate to college credit if students can document and demonstrate comprehension of learning outcomes and objectives equivalent to our courses.

Course Content

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Industry project to be completed in semester 8	**PO5, PO9**
CO2	Projects reports are to be submitted in a set format and mentors are assigned to each student for guidance through the project	**PO2**
CO3	The project is evaluated as the end-term examination in the form of a jury conducted by an industry and academic panel.	**PO5, PSO3, PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS429A	Portfolio Development & Review	-	2	3	-	3	-	-	-	3	-	-	-	3	-	3

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS467A	Visual Design Tools Lab	L	T	P	C
Version 1.0		0	0	4	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Project Management Skills:
    - Identifying audience(s)
2. Design Skills:
    - Understanding and employing design principles
    - Understanding and employing color theory
    - Understanding the impact of typography
    - Understanding the relationship between color, typography, layout and tone
    - Providing multiple design ideas
    - Designing visual products from a visual perspective, and strengthen skills with various visual design tools and techniques
3. Research and Communication Skills:
    - Critiquing designs

Course Outcomes

On completion of this course, the students will be able to

CO1. Be able to Design vector artwork

CO2. Prepare graphics for web and print

CO3. Implement useful keyboard shortcuts

CO4. Learn illustrator the way a professional would use it

Catalog Description

This course will explore historical events, visual concepts and principles of visual design, including design elements, composition, form, color theory, and basic image making (vector and bitmap), message development and elements of visual story telling. Students will also dive into the practice of design by doing visual design project. The project will emphasize the design process and iterating on peer critique, which students will regularly give and receive.

List of Experiments (Indicative)

1. With help of various ideation methods taught, students will collaborate and decide requirements and elements of the pre chosen topic.
2. Using a pre chosen topic, Students will create wireframes and prototypes for a website or an app.
3. Students will choose a font type and design various icons to be used in a website or app.
4. Students will create illustrations for the website or app after understanding what, why and how of the product or service provided.
5. Students will add various interactions and micro interactions to their website or app

Modes of Evaluation: Quiz/Oral practical oral exam/presentation/projects/Practical Examination

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Be able to Design vector artwork	**PO5**
CO2	Prepare graphics for web and print	**PO2**

CO3	Implement useful keyboard shortcuts	**PO3**
CO4	Learn illustrator the way a professional would use it	**PO5**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS467A	Visual Design Tools Lab	2	3	-	-	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS433A	UX Design for Futuristic Technologies - HMI	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To be able to have an understanding on futuristic technologies
2. To be able to practice and implement technologies in new ideas
3. To be able to implement after understanding on different platforms

Course Outcomes

On completion of this course, the students will be able to:

CO1. Be able to understand the interactions between human and machine.

CO2. Understanding the different machines.

CO3. Able to grasp hands-on experience of tools for creating interfaces for human and machine.

CO4. Understanding cognitive psychology and user behavior.

CO5. Implementing the study to create interfaces for human machine interactions.

Catalog Description

User Experience (UX) Design is the process design use to create products that provide meaningful and relevant experience to users. This involves the design of the entire process of acquiring and integrating the product, including aspects of branding, design, usability, and function. This course is rooted in better understanding users to solve their problems, with as little fuss and as much joy as possible. UX designers spend much of their time speaking to users, learning how they go about their lives, and creating the best possible experience that addresses their problems. The UX/UI Design of the application improves the user experience and customer satisfaction that ultimately helps increase the number of users of the specific application. The UI and UX Design help to win the consumers' confidence and make them use your application or website providing them what they are looking for

You'll learn the foundations of UX design and what distinguishes good from bad UX. You will also explore the UX design process; user research, designing your experience, using your goals and ideas to draw wireframes, and then building usable prototypes..

Course Content

Unit I: **9 lecture hours**

Introduction to HMI: What is HMI? Who Uses HMI? Common Uses of HMI, What is the Difference between HMI and SCADA?

Unit II: **9 lecture hours**

Trends in HMI Technology: Understanding the different technologies of HMI, Past trends and current technologies, High- Performance HMIs, Touch Screens and Mobile Devices, Remote Monitoring, Edge-of-Network and Cloud HMIs Case studies in detail.

Unit III: **12 lecture hours**

Futuristic HMI's: Understanding the current trends, exploring ways to implement Augmented Reality (AR) and Virtual Reality (VR) to visualize manufacturing functions.

Unit IV: **15 lecture hours**

Project: - Project work on HMI which includes current trends.

Reference Books:

1. Digital Anatomy - Applications of Virtual, Mixed and Augmented Reality by Jean-François Uhl, Joaquim Jorge, Daniel Simões Lopes, Pedro F Campos
2. Technology-Augmented Perception and Cognition by Tilman Dingler, Evangelos Niforatos
3. Learn Human-Computer Interaction - Solve human problems and focus on rapid prototyping and validating solutions through user testing by Christopher Reid Becker
4. Emotions in Technology Design - From Experience to Ethics by Rebekah Rousi, Jaana Leikas, Pertti Saariluoma

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam

Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Be able to understand the interactions between human and machine.	**PO1**
CO2	Understanding the different machines.	**PO1**
CO3	Able to grasp hands-on experience of tools for creating interfaces for human and machine.	**PO5**
CO4	Understanding cognitive psychology and user behavior.	**PO6**
CO5	Implementing the study to create interfaces for human machine interactions.	**PO3, PO4**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 433A	UX Design for Futuristic Technologies - HMI	2	-	3	3	3	2	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS309A	**Distributed Computing Systems**	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Data Structure and Operating Systems				
Co-requisites	--				

Course Objectives

The course aims to provide an understanding of the principles on which the Internet and other distributed systems are based; their architecture, algorithms and how they meet the demands of contemporary distributed applications. The course covers the building blocks for a study of distributed systems and addressing the characteristics and the challenges that must be addressed in their design: scalability, heterogeneity, security and failure handling being the most significant. This course also covers issues and solutions related to the design and the implementation of distributed applications.

Course Outcomes

On completion of this course, the students will be able to:

CO1. Demonstrate knowledge of the basic elements and concepts related to distributed system technologies

CO2. Demonstrate knowledge of the core architectural aspects of distributed systems;

CO3. Design and implement distributed applications;

CO4. Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);

CO5. Use and apply important methods in distributed systems to support scalability and fault tolerance;

CO6. Demonstrate experience in building large-scale distributed applications.

Catalog Description

This course covers general introductory concepts in the design and implementation of distributed systems, covering all the major branches such as Cloud Computing, Grid Computing, Cluster Computing, Supercomputing, and Many-core Computing.

Course Content

Unit I: **8 lecture hours**

Introduction: Distributed Systems, Examples of Distributed Systems, Resource Sharing and the Web Challenges, System Models- Introduction, Architectural Models, Functional Models, Characterization of Distributed Systems, Client-Server Communication, Distributed Objects and Remote Invocation, Communication Between Distributed Objects, Remote Procedure Call, Events and Notifications.

Unit II: **8 lecture hours**

Distributed Operating Systems: Introduction, Issues, Communication Primitives, Inherent Limitations, Lamport's Logical Clock, Vector Clock, Causal Ordering, Global State, Cuts, Termination Detection, Distributed Mutual Exclusion, Non-Token Based Algorithms, Lamport's Algorithm - Token-Based Algorithms, Distributed Deadlock Detection Algorithms and Issues, Centralized Deadlock-Detection Algorithms, Agreement Protocols- Classification, Solutions, Applications.

Unit III: **8 lecture hours**

Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols, Design Issues, Distributed Scheduling – Issues, Components, Algorithms

Unit IV: **8 lecture hours**

Introduction to Distributed Algorithms, Kinds of Distributed Algorithm, Timing Models, Synchronous Network Algorithms: Synchronous Network Model, Leader Election in a Synchronous Ring, Algorithms in a General Synchronous Networks, Resource Security and

Protection – Introduction, the Access Matrix Model, Implementation of Access Matrix Model, Safety in the Access Matrix.

Text Books

2. Ajay D. Kshemkalyani and MukeshSinghal, “Distributed Computing – Principles, Algorithms and Systems”, Cambridge University Press.

Reference Books/Materials

3. George Coulouris, Jean Dellimore and Tim KIndberg, “Distributed Systems Concepts and Design”, Pearson Education, 4^{th} Edition.
4. MukeshSinghal and N. G. Shivaratri, “Advanced Concepts in Operating Systems”, McGraw-Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	10	50

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Demonstrate knowledge of the basic elements and concepts related to distributed system technologies	PO1
CO2	Demonstrate knowledge of the core architectural aspects of distributed systems;	PO1
CO3	Design and implement distributed applications	PO3

CO4	Demonstrate knowledge of details the main underlying components of distributed systems (such as RPC, file systems);	**PO4**
CO5	Use and apply important methods in distributed systems to support scalability and fault tolerance	**PO3, PO4**
CO6	Demonstrate experience in building large-scale distributed applications.	**PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 309A	Distributed Computing Systems	2	-	3	3	-	-	-	-	-	-	-	2	-	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 435A	**Design Thinking for Product Management**	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. What is design thinking and how it is used.
2. What are the benefits and challenges in using design thinking?
3. What are the key steps in the process and how do you undertake them.
4. How to use design-thinking in product management through every stage of the product life-cycle.

Course Outcomes

On completion of this course, the students will be able to

CO1. Understand business in UX.

CO2. Understanding the strategy involved in UX business.

CO3. Learn how to identify and interview stakeholders.

CO4. Understanding design management.

CO5. Implementing design management in product design and business.

Course Overview:

This course introduces the students to the world of design thinking, from conceptualizing an idea using design thinking to develop the first version of your product. The course is incredibly useful for anyone who wants to understand what design thinking is and how to put it into practice

Course Content

Unit I: **6 lecture hours**

Business UX: Understanding How a UX approach can help any business, The Business Value of UX Design, Strategy building, Aspects of key guidelines in UX business, values and emotions of user Behavior and cognitive psychology of market and business, Design policies, Importance of understanding business requirements, Discovering business goals.

Unit II: 9 hours

Stakeholder and Competitive Analysis: Importance of understanding business requirements, discovering business goals, Internal and external stakeholders, stakeholder analysis, stakeholder interviewing, meeting stakeholder expectations and feedback, Direct and Indirect Competitors, Competitor Analysis and its practice, Steps to Conduct Competitor analysis, Parameters to conduct competitor analysis.

Unit III: 9 hours

Design Management: What is design management, Taking Charge of Processes and People, The Evolution of Design Management, Areas of Design Management, Why Does Design Management Matter, Where Does Design Management Fall within Businesses? Value Proposition Canvas, Creating a UX Roadmap.

Unit IV: 9 hours

Zeplin and Jira and Introduction to Product lifecycle management: Learning how to develop and deliver documentation using Zeplin and How to communicate well and assign tasks among and within teams using Jira, what is Product Lifecycle Management (PLM)? What is the Product Life Cycle? Product life cycle stages, Benefits, areas of PLM.

Reference Books

1. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful

Businesses by Eric Ries

2. Fundamentals of User-Centered Design by Still and Crane

3. UX Strategy: How to Devise Innovative Digital Products that People Want: Jaime Levy

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand business in UX	**PO1**
CO2	Understanding the strategy involved in UX business.	**PO1**
CO3	Learn how to identify and interview stakeholders.	**PO4**
CO4	Understanding design management.	**PO2**
CO5	Implementing design management in product design and business.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Employability	Ethics and Behavior	Knowledge
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 435A	Design Thinking for Product Management	2	2	2	3	-	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

ETCS 206A	**Computer Graphics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Have knowledge and understanding of the structure of an interactive computer graphics system, and the separation of system components.
2. Have knowledge and understanding of geometrical transformations and 3D viewing.
3. Have knowledge and understanding of techniques for representing 3D geometrical objects.
4. Have knowledge and understanding of interaction techniques.

Course Outcomes

On completion of this course, the students will be able to

CO1. Acquire familiarity with the concepts and relevant mathematics of computer

graphics.

CO2. Implement various algorithms to scan, convert the basic geometrical primitives.

CO3. Describe the importance of viewing and projections.

CO4. To design basic graphics application programs.

CO5. Be able to design applications that display graphic images to given

specifications.

CO6. understand a typical graphics pipeline.

Course Overview:

This course aims at familiarizing the student with basic transformation techniques, Curves, Projections etc. The course contains various Clipping Algorithms. A focus will be put on knowledge of computer-based graphics creation so that at the student at end of the course is well equipped to pursue either an industrial or academic career in the area.

Course Content

Unit I: **8 lecture hours**

Transformation, Projections, and Clipping Algorithms: Introduction to computer graphics, applications, hardware and software, 2D graphics, Bresenham's Line Drawing Algorithm, Homogeneous Coordinate System for 2D and 3D, Various 2D, 3D Transformation matrices (Translation, Scaling, Rotation, Shear), Rotation about an arbitrary point (2D), Rotation about an arbitrary axis (3D), Computing location of V.P, Clipping Algorithms, Sutherland-Cohen Clipping Algorithm.

Unit II: **12 hours**

Curves and Surfaces: Bresenham's Circle Drawing Algorithm, Bezier Curves, 4 point and 5 point Bezier curves using Bernstein Polynomials, Conditions for smoothly joining curve segments, Bezier bi-cubic surface patch, B-Spline Curves, Cubic B-Spline curves using uniform knot vectors, Testing for first and second order continuities

Unit III: **12 hours**

Projection and Solid Modelling: Parallel Projection, Oblique Projection on xy plane, Isometric Projection, Perspective Projection, One Vanishing Point (V.P.) projection from a point on z axis, Generation of 2 V.P. Projection, Isometric Projection, Perspective, Projection, one vanishing Pint (VP), projection from 0 point on z axis, Generation of 2 VP Projector & Projections, Solid Modelling.

Unit IV: **8 hours**

Shading and Hidden Surface Removal: Shading, Illumination Model for diffused Reflection, Effect of ambient lighting, distances, Specular Reflection Model, Computing Reflection Vector, Curved Surfaces, Polygonal Approximations, Gourard Shading, Phong Model, Hidden Surface

Removal, Back Face Detection, Depth Buffer (Z-Buffer, A-Buffer) Method, Scan Line Method, Depth Sorting Method, Area Subdivision Method.

TEXT BOOKS:

1. Foley et. al., "Computer Graphics Principles & practice", Addison Wesley.

REFERENCES BOOKS:

1. D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw-Hill International Edition.
2. D. Hearn and P. Baker, "Computer Graphics", Prentice Hall.
3. R. Plastock and G. Kalley, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Acquire familiarity with the concepts and relevant mathematics of computer graphics.	**PO1**
CO2	Implement various algorithms to scan, convert the basic geometrical primitives.	**PO4**
CO3	Describe the importance of viewing and projections.	**PO5**
CO4	Design basic graphics application programs.	**PO2**
CO5	Be able to design applications that display graphic images to given specifications.	**PO3**

CO6	Understand a typical graphics pipeline.	**PO1**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Employability	Ethics and Behavior	Knowledge
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 206A	Computer Graphics	2	2	2	3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped
2= moderately mapped
3=strongly mapped

		L	T	P	C
ETCS490A	**Industrial Internship**	L	T	P	C
Version 1.0		-	-	-	12
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

On completion of this course, the students will be able to

CO1. Carry out the extensive literature survey/study in the area on internship provided.

CO2. Write technical documentation for the project implement.

CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.

CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination
Examination Scheme:

Components	**Quiz**	**Attendance**	**Mid Term Exam**	**Presentation/ Assignment/ etc.**	**End Term Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 490A	Industrial Internship	-	3	3	-	3	2	-	-	-	-	-	-	3		2

1=weakly mapped
2= moderately mapped
3=strongly mappedssssss