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

2020-24

Approved in the 23rd Meeting of Academic Council Held on 23 June 2020

Academic Council
Member Secretary
1
K.R. Mangalam University

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

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

2020-24

Approved in the 23rd Meeting of Academic Council Held on 23 June 2020

PREFACE

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 (CSEwith specialization in AI & ML) 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. 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.
5. The School will ensure the revision of the curriculum to help students to achieve better employability; start-ups and other avenues for higher studies.

About K.R Mangalam University

The K.R. Mangalam Group has made a name for itself in the field of education. 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.

K.R. Mangalam University is the fastest-growing higher education institute in Gurugram, India. K. R. Mangalam University was established under the Haryana Private University Act 2006, received the approval of Haryana Legislature vide Amendment Act # 36 of 2013 and consent of the Hon'ble Governor of Haryana on 11th April 2013, which was published in the Gazette notification vide Leg. No.10/2013, dated 3rd May 2013.

Since its inception in 2013, the University has been striving to fulfil its prime objective of transforming young lives through ground-breaking pedagogy, global collaborations, and world-class infrastructure. Resources at K.R Mangalam University have been continuously upgraded to optimize opportunities for the students. Our students are groomed in a truly interdisciplinary environment where they grow up with integrative skills through interaction with students from engineering, social sciences, management and other study streams.

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 Indian student community with particular focus on Haryana.

About School of Engineering & Technology (SOET)

School of Engineering and Technology (SOET), K.R. Mangalam University is dedicated to fostering innovation, excellence, and advancement in engineering and technology. Empowering the new generation of change-makers by imparting exceptional understanding and intellect to facilitate the creation of highly sophisticated futuristic solutions. Our well-qualified academicians, accomplished researchers and industry insiders are focused on imparting their extensive knowledge and expertise to students through various lectures, workshops, industrial visits, projects, and competitions throughout the year ensuring that students receive a comprehensive education that blends theory with practical application.

These programs offered at SOET have the distinct objective of equipping the students with knowledge, skills and attitudes 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, and experienced researchers to deliver a unique hands-on and multi-disciplinary learning experience.

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

School Vision

To create, disseminate, and apply knowledge in science and technology to meet the higher education needs of India and the global society, To serve as an institutional model of excellence in scientific and technical education characterized by integration of teaching, research and innovation.

School Mission

M1: To create an environment where teaching and learning are prioritized, with all support activities being held accountable for their success.

M2: To strengthen the institution's position as the school of choice for students across the State & Nation.

M3: To promote creative, immersive, and lifelong learning skills while addressing societal concerns.

M4: To promote co- and extra-curricular activities for overall personality development of the students.

M5: To promote and undertake all-inclusive research and development activities.

M6: To instill in learners an entrepreneurial mindset and principles.

M7: Enhance industrial, institutional, national, and international partnerships for symbiotic relationships.

M8: To help students acquire and develop knowledge, skills and leadership qualities of the 21st Century and beyond.

Programs Offered by the School

School offers undergraduate B. Tech Program, B.Sc. (Hons) Program, postgraduate M. Tech Program, and Doctoral Program. All these programs are designed to impart scientific knowledge to the students and provide theoretical and practical training in their respective fields.

B.Tech. Computer Science & Engineering

This program 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 systems. An initiative to make the teaching-learning framework better and enhance the student learning outcomes, the school 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.

Program Duration

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

Class Timings

The classes will be held from Monday to Friday from 09:10 am to 04:00 pm.

Scheme of Studies and Syllabi

The scheme of studies and syllabi of B.Tech. (CSE) program 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 and modes of evaluation/examination scheme.

B.Tech (Computer Science and Engineering) Programme at a Glance

	Semester I	**Semester II**	**Semester III**	**Semester IV**	**Semester V**	**Semester VI**	**Semester VII**	**Semester VIII**
Course	8	10	8	7	10	9	5	1
Credit	24	28	23	18	21.5	22.5	18	6

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

SEMESTER I

S.No		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	SE	ETEL155A	Communication Skills	4	0	0	4
2	SE	ETDM301A	Disaster Management	3	0	0	3
3	SE	ETCH125A	Environmental Studies	3	0	0	3
4	SE	ETPH109A	Engineering Physics	3	1	0	4
5	SE	ETPH161A	Engineering Physics lab	0	0	2	1
6	SE	ETMA105A	Applied Mathematics-I	3	1	0	4

7	SE	ETME101A	Basics of Mechanical Engineering	3	1	0	4
8	SE	ETME151A	Basics of Mechanical Engineering Lab	0	0	2	1
				19	**3**	**2**	**24**

SEMESTER II

S.No		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	SE	ETMA104A	Applied Mathematics-II	3	1	0	4
2	SE	ETEC101A	Basics of Electrical & Electronics Engineering	3	1	0	4
3	SE	ETCH119A	Engineering Chemistry	3	1	0	4
4	CC	ETCS103A	Programming for Problem Solving	3	1	0	4
5	SE	ETME 155A	Engineering Graphics Lab	0	0	3	1.5
6	SE	ETEC151A	Basics of Electrical & Electronics Engineering Lab	0	0	2	1
7	SE	ETCH159A	Engineering Chemistry Lab	0	0	2	1
8	SE	ETME 157A	Workshop Practices	0	0	3	1.5
9	SE	ETCS153A	Programming for Problem Solving Lab	0	0	2	1
10	OE		Open Elective	4			6
				16	**4**	**12**	**28**

SEMESTER III

S.No		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	SE	ETMA 201A	Applied Mathematics–III	3	1	-	4

2	CC	ETEC 233A	Analog Electronics	3	1	-	4
3	CC	ETEC 210A	Digital Electronics	4		-	4
4	CC	ETCS219A	Foundation of Computer Systems	3	1	-	4
5	CC	ETCS217A	Data Structures	4		-	4
6	SE	ETEC 263A	Analog Electronics Lab	-	-	2	1
7	SE	ETEC 256A	Digital Electronics Lab	-	-	2	1
8	SE	ETCS257A	Data Structures Lab	-	-	2	1
				15	**5**	**8**	**23**

SEMESTER IV

SNo		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CC	ETCS222A	Computer Organization & Architecture	4	-	-	4
2	CC	ETCS220A	Analysis and Design of Algorithms	4	-	-	4
3	CC	ETCS307A	Database Management Systems	4	-	-	4
4	CC	ETMC 226A	Fundamentals of Management	3	-	-	3
5	SE	ETCS260A	Computer Organization & Architecture Lab	-	-	2	1
6	SE	ETCS 355A	Database Management Systems Lab	-	-	2	1
7	SE	ETCS262A	Analysis and Design of Algorithms Lab	-	-	2	1
				15	**0**	**6**	**18**

SEMESTER V

SNo		Course Code	Course Title	L	T	P	C
1	CC	ETCS323A	Java Programming	4	-	-	4
2	CC	ETCS 214A	Theory of Computation	3	1	-	4
3	CC	ETCS211A	Operating Systems	4	-	-	4
4	CC	ETCS304A	Computer Networks	4	-	-	4
5	SE	ETCS365A	Computer Networks Lab	-	-	2	1
6	SE	ETCS361A	Java Programming Lab	-	-	2	1
7	SE	ETCS363A	Fundamentals of iOS Development Lab	-	-	3	1.5
8	SE	ETCS255A	Operating System Lab	-	-	2	1
9	SE	ETCS381A	Practical Training I	-	-	-	1
				18	**1**	**9**	**21.5**

SEMESTER VI

SNo		Course Code	Course Title	L	T	P	C
1	CC	ETCS412A	Compiler Design	4	-	-	4
2	CC	ETCS401A	Artificial Intelligence	4	-	-	4
3	CC	ETCS 202A	Software Engineering	4	-	-	4
4	CC	ETCS454A	Compiler Design Lab	-	-	2	1
5	SE	ETCS374A	Advanced iOS Development Lab	-	-	3	1.5
6	CC	ETCS417A	Data Warehousing and Data Mining	4	-	-	4

7	SE	ETCS456A	Data Warehousing and Data Mining Lab	-	-	2	1
8	**DE**	**Elective**					
(i)	DE	ETCS308A	Web Technologies	3	-	-	3
(ii)	DE	ETCS309A	Distributed Computing Systems	3	-	-	3
(iii)	DE	ETCS310A	Advanced Computer Architecture	3	-	-	3
				22	**3**	**7**	**22.5**

SEMESTER VII

SNo.		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	CC	ETMC310A	Chasing The Rainbow: The Entrepreneurial Streak	3	-	-	3
2	SE	ETCS462A	Project	-	-	10	5
3	SE	ETCS481A	Practical Training II	-	-	-	2
4		**Elective (without Lab)**					
(i)	CC	ETCS402A	Natural Language Processing	4	-	-	4
(ii)	C	ETCS403A	Digital Image Processing	4	-	-	4
(iii)	CC	ETCS404A	Advanced Database Management Systems	4	-	-	4
(iv)	CC	ETCS408A	Neural Network	4	-	-	4
5		**Elective (with Lab)**					
(i)	CC	ETCS416A	Cloud Computing	4	-	-	3
	SE	ETCA362A	Cloud Computing Lab	-	-	2	1

(ii)	CC	ETCS418A	Internet of Things	4	-	-	4
	SE	ETCS457A	Internet of Things Lab	-	-	2	1
(iii)	CC	ETCS411A	Machine Learning	4	-	-	4
	SE	ETCS455A	Machine Learning Lab	-	-	2	1
				9	-	**14**	**18**

SEMESTER VIII

S.No		**Course Code**	**Course Title**	**L**	**T**	**P**	**C**
1	SE	ETCS490A	Six Months Industrial Internship				6
				-	-	-	6
				161			

OE	OPEN ELECTIVE
CC	CORE COURSE
SE	SKILL ENHANCEMENT
DE	DEPARTMENTAL ELECTIVE

Semester-I

ETEL155A	Communication Skills	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Understand the basics of Grammar to improve written and oral communication skills.
2. Understand the correct form of English with proficiency
3. Improve student's personality and enhance their self-confidence.
4. Improve professional communication.
5. Enhance academic writing skills.

Course Outcomes

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

CO1. Understand the basics of Grammar to improve written and oral communication skills

CO2. Understand the correct form of English with proficiency

CO3. Improve student's personality and enhance their self-confidence

CO4. Improve professional communication

CO5. Enhance academic writing skills

Catalog Description

This learning program with its practice-based learning tasks will facilitate the learners to enhance their communication skills in a modern and globalized context, enhance their linguistic and communicative competence and hone their interpersonal skills.

Course Content

UNIT I **10 lecture hours**

Introduction to Communication: Importance of Communication Skills, Meaning, Forms & Types of Communication; Process of Communication; Principles of Effective Communication/7Cs, Barriers in Communication (Interpersonal, Intrapersonal and Organizational).

UNIT II **10 lecture hours**

Academic Writing: Précis (Summary – Abstract – Synopsis – Paraphrase – Précis: Methods), Letter & Résumé (Letter Structure & Elements – Types of letter: Application & Cover - Acknowledgement – Recommendation – Appreciation – Acceptance – Apology – Complaint –Inquiry).Writing a proposal and synopsis. Structure of a research paper. Citations and plagiarism.

UNIT III **10 lecture hours**

Technology-Enabled Communication: Using technology in communication tasks, E-mails, tools for constructing messages, Computer tools for gathering and collecting information; Different virtual medium of communication.

UNIT IV **10 lecture hours**

Building Vocabulary: Word Formation (by adding suffixes and prefixes); Common Errors; Words Often Confused; One word substitution, Homonyms and Homophones; Antonyms &Synonyms, Phrasal Verbs, Idioms & Proverbs (25 each); Commonly used foreign words(15 in number);

UNIT V **10 lecture hours**

Personality Development: Etiquettes& Manners; Attitude, Self-esteem & Self-reliance; Public Speaking; Work habits (punctuality, prioritizing work, bringing solution to problems), Body Language: Posture, Gesture, Eye Contact, Facial Expressions; Presentation Skills/ Techniques.

Text book [TB]:

1. Kumar, Sanjay and Pushplata. Communication Skills. Oxford University Press, 2015.

Reference Books/Materials

1. Mitra, Barun K. Personality Development and Soft Skills. Oxford University Press, 2012.
2. Tickoo, M.L., A. E.Subramanian and P.R.Subramaniam. Intermediate Grammar, Usage and Composition. Orient Blackswan, 1976.
3. Bhaskar, W.W.S., AND Prabhu, NS., " English Through Reading", Publisher: MacMillan,1978
4. Business Correspondence and Report Writing" -Sharma, R.C. and Mohan K. Publisher: Tata McGraw Hill1994
5. Communications in Tourism & Hospitality- Lynn Van Der Wagen, Publisher: HospitalityPress
6. Business Communication-K.K.Sinha
7. Essentials of Business Communication By Marey Ellen Guffey, Publisher: ThompsonPress
8. How to win Friends and Influence People By Dale Carnegie, Publisher: Pocket Books

9. Basic Business Communication By Lesikar&Flatley, Publisher Tata McGraw Hills
10. Body Language By Allan Pease, Publisher SheldonPress

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 basics of Grammar to improve written and oral communication skills	PO10
CO2	Understand the correct form of English with proficiency	PO10
CO3	Improve student's personality and enhance their self-confidence	PO12
CO4	Improve professional communication.	PO10
CO5	Enhance academic writing skills	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
ETEL 155A	Communication Skills										3		3			3

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

ETDM301	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.
- 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
ETDM301A	Disaster Management			2			3						2			2

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

ETCH125A	**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	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
ETCH125A	Environmental Studies						2	3	3		3				1	2

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	E c a C n u a n S ls
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	F
ETPH109 A	Engineering Physics	2	2		3	3								3		

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

ETPH161A	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.
1. Consolidate the understanding of fundamental concepts in mechanics more rigorously as needed for further studies in physics, engineering and technology.
2. 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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team 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	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETPH161A	Engineering Physics Lab	2	3		3	3	3							3		

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

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-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: **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

3. B.S.Grewal, " Higher Engineering Mathematics", Khanna Publishers.
4. 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
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2

ETMA 105A	Applied Mathematics - I	3	3	3	3				1					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:

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 andworkshop 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	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETME 101A	Basics of Mechanical Engineering	2	2	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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETME 151A	Basics of Mechanical Engineering Lab	2	2		3	3								3		

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

SEMESTER-2

ETMA104A	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 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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
ETMA104A	Applied Mathematics-II	2	3	2	3				2

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:
   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	PO 1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2										3	3		

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

ETCH119	**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 andtheir 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

ETCS103A	Programming for Problem Solving	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 codes.

3. Learn programming languageto solve simple numerical method problems, namely rot finding

of function, differentiation of function and simple integration.

4. Discover how to work with arrays, functions, structures

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
CO1.To formulate simple algorithms for arithmetic and logical problems.

CO2. To translate the algorithms to programs (in C language).

CO3.To test and execute the programs and correct syntax and logical errors.

CO4. To implement conditional branching, iteration and recursion.

CO5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

Catalog Description

Computer software plays an important role in our daily lives: Our mobile phones, laptop computers,online banking, Internet applications such as YouTube, video games and movies, cars, and almost all aspects of daily life are touched by software. In your personal and professional life, you will utilize computer software. It is also likely that you will select, or even influence the design of, software that is used in your professional or personal life. This thematic sequence will give you a deep understanding of how software works and is created, its limitations, and its potential. You will be able to read software and therefore be able to make informed decisions when selecting or participating in the design of business, scientific, or information systems that utilize computer software. This is a course in which you learn computer programming concepts that are fundamental in nearly any computer programming language. These concepts can then be used in other courses to help you create computer applications that can be used to solve real-world problems

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**

Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops. Arrays: Arrays (1-D, 2-D), Character arrays and Strings

UNIT III **10 LECTURE HOURS**

Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required) Function: Functions (including using built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference. Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function, Quick sort or Merge sort.

UNIT IV **10 LECTURE HOURS**

Structure: Structures, Defining structures and Array of Structures Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

TEXT BOOKS:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

2. E. Balaguru swamy, Programming in ANSI C, Tata 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	To formulate simple algorithms for arithmetic and logical problems.	**PO1, PO2**
CO2	To translate the algorithms to programs (in C language).	**PO3, PO4**
CO3	To test and execute the programs and correct syntax and logical errors.	**PO10**
CO4	To implement conditional branching, iteration and recursion.	**PSO1**
CO5	To decompose a problem into functions and synthesize a complete program using divide and conquer approach	**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

ETCS103 A	Programming for problem solving	2	2	2	2						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 oforthographic, 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

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

Course Objectives

6. To understand the DC and AC circuit behavior by application of network theorems.
7. To elaborate complex signals over oscilloscope devices with reading.
8. To be able to perform analysis of forward and reverse V-I characteristics of diode circuits.

9. To analyses the BJT in build circuits as per practical application point of view.
10. 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:
   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	PO 1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2	PSO3
ETEC 151A	BASICS OF ELECTRICAL & ELECTRONICS ENGINEERING LAB	3	2										3	3		

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

ETCS153A	**Programming for problem solving 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	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
ETCS150A	Programming for problem solving Lab		2	3		3				3				3		

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

ETCH159	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 mixtureof 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:

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

Semester III

ETMA 201A	Applied Mathematics - III	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basic of Mathematics				
Co-requisites	--				

Course Objectives

1. Obtain the Fourier series and Fourier transform for a given function
2. Evaluate real integrals using residue theorem
3. Express analytic functions in terms of Taylor's series and Laurent series
4. Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus
5. Express any periodic function in term of sines and cosines
6. Analyze one dimensional wave and heat equation

Course Outcomes

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

CO1. Obtain the Fourier series and Fourier transform for a given function
CO2. Evaluate real integrals using residue theorem
CO3. Express analytic functions in terms of Taylor's series and Laurent series.
CO4. Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus;

- Express any periodic function in term of sines and cosines
- Analyze one dimensional wave and heat equation

Catalog Description

The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of engineering and technology. The first part of this module extends the theory of Fourier series and Fourier integral transform.

The second part of the module covers a complex variable which includes complex variable, analytic function, Cauchy-Riemann equations, and Residue theorem with their application.

Course Content

Unit I: **8 lecture hours**

Fourier series and its applications: Euler's formulae, Dirichlet's conditions, Change of interval, Fourier expansion of even and odd functions, Fourier expansion of square wave, Rectangular wave; Saw-toothed wave; half & full rectified wave functions, Harmonic analysis.

Unit II: **12 lecture hours**

Fourier integrals and Transforms: Fourier integral theorem, Fourier sine integral, Fourier cosine integral, Fourier sine Transform, Fourier cosine transform, Fourier transform and its properties, Finite Fourier sine transform, Finite Fourier cosine transform, Fourier transforms of derivatives.

Unit III: **12 lecture hours**

Complex Numbers and Functions of Complex Variables: De Moivre's theorem, Roots of complex numbers, Euler's theorem, Logarithmic Functions, Circular and Hyperbolic Functions, Limit, Continuity and Derivatives of complex functions, Cauchy-Riemann equations, necessary and sufficient conditions for a function to be analytic, polar form of the Cauchy-Riemann equations. Harmonic functions, application to flow problems

Unit IV: **8 lecture hours**

Complex Integration and Conformal mapping: Standard mappings (linear, square, inverse and bilinear), Complex line integral, Cauchy's integral theorem, Cauchy's integral formula, Zeroes and Singularities, Taylor series, Laurent's series, Calculation of residues, Residue theorem, Application of residue theorem to solve real integrals.

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	Obtain the Fourier series and Fourier transform for a given function	**PO1**
CO2	Evaluate real integrals using residue theorem	**PO2**
CO3	Express analytic functions in terms of Taylor's series and Laurent series.	**PO3**
CO4	Calculate complex line integrals and some infinite real integrals using Cauchy's integral theorem or residue calculus; Express any periodic function in term of sines and cosines Analyze one dimensional wave and heat equation	**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	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
ETMA201 A	Applied Mathematics -III	2	3	3	3									3		

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

ETEC 233A	**Analog Electronics**	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To understand operation of semiconductor devices.
2. To understand DC analysis and AC models of semiconductor devices.
3. To apply concepts for the design of Regulators and Amplifiers
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To implement mini projects based on concept of electronics circuit concepts

Course Outcomes

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

CO1. Understand the current voltage characteristics of semiconductor devices.

CO2. Analyze dc circuits and relate ac models of semiconductor devices with their physical operation.

CO3. Design and analyze of electronic circuits

CO4. Evaluate frequency response to understand behavior of Electronics circuits

Catalogue Description

The course is to provide knowledge of Analog Electronics to students of various engineering disciplines. The course module includes basic diodes, basic knowledge of transistors and its biasing techniques and stabilization

Course Contents

Unit I: **10 lecture hours**

UNIT – I

Semiconductor Diodes and Rectifiers: Types of semiconductors, energy band diagrams, ideal diode, DC & AC resistance, drift & diffusion currents, transition & diffusion capacitance, reverse recovery time, temperature effects.
Some Special Devices: P-N junction diode, zener diode, Light emitting diode, Tunnel Diode, Photodiodes.
Rectifiers: Half-Wave Diode Rectifiers, Full-Wave Rectifier, Clippers and clampers circuits

Unit II: **10 lecture hours**

Bipolar junction transistor: Introduction, transistor operations & characteristics, CB, CE, CC configurations, comparisons of different configurations, load line concept, leakage currents, modes of operations, Eber-moll's model, transistor applications: as a Switch and Amplifier.

Bias stabilization: Need for stabilization, fixed Bias, emitter bias, self-bias, bias stability with respect to variations in Ico, VBE &βStabilization factors.

Unit III: **10 lecture hours**

Small signal amplifiers: Hybrid model for transistor at low frequencies, RC coupled amplifiers, frequency response, gain & impedance.

Unit IV: **10 lecture hours**

Field Effect Transistor: Introduction to JFET, MOSFET, FET Biasing, FET characteristics

Text Books:

1. J. Millman and Halkias, "Integrated Electronics" TMH.

Reference Books:

1. Boylestad & Nashelsky, "Electronic Devices & Circuit Theory" PHI – VI Edition.
2. Sedra & Smith, "Micro Electronic Circuits" Oxford University Press.
3. Salivahanan, Suresh Kumar, Vallavaraj, "Electronic devices and circuits" TMH

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 current voltage characteristics of semiconductor devices.	**PO1**
CO2	Analyze dc circuits and relate ac models of semiconductor devices with their physical operation.	**PO2, PO4**
CO3	Design and analyze of electronic circuits	**PO3,PO4**
CO4	Evaluate frequency response to understand behavior of Electronics circuits	**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	Employability	Ethics and Behaviour	Knowledge
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETEC233A	Analog Electronics	2	2	3	3	3							2	2		3

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

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 behavior.	**PO2**
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 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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
ETEC210 A	Digital Electronics	2	2	3	3	3								2		3

1=weakly mapped
2= moderately mapped
3=strngly mapped

ETCS219A	**Foundation of Computer Systems**	L	T	P	C
Version 1.0	--	3	1	0	4
Pre-requisites/Exposure	Some 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: **10 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: **10 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	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS219A	Foundation of Computer Systems	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

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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS217A	Data Structures	2	2		3	3								3		

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

ETEC263A	Analog Electronics Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To understand operation of semiconductor devices.
2. To understand DC analysis and AC models of semiconductor devices.
3. To apply concepts for the design of Regulators and Amplifiers
4. To verify the theoretical concepts through laboratory and simulation experiments.
5. To implement mini projects based on concept of electronics circuit concepts

Course Outcomes

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

CO1. Identify relevant information to supplement to the Analog Electronic ETEC233A course CO2. Analyze dc circuits and relate ac models of semiconductor devices with their physical operation.

CO3. To understand the basic analog circuits and to verify their operation.

CO4. Design and analyze of electronic circuits

CO5. Evaluate frequency response to understand behavior of Electronics circuits

---

Catalogue Description:

Hands-on experiments related to the course contents ETEC233A

Course Content

List of experiments:

- To study and plot the characteristics of a junction diode.
- To study Zener diode I-V characteristics.
- To study diode based clipping and clamping circuits
- To study half wave, full wave and bridge rectifier with filters
- To study the input and output characteristics of a transistor in its various configurations
- (CE and CB).
- To study and plot the characteristics of a JFET in its various configurations.
- To study and plot the characteristics of a MOSFET in its various configurations.
- To study various types of Bias Stabilization for a transistor.
- To study the gain and plot the frequency response of a single stage transistor amplifier.

- To measure gain and plot the frequency response of double stage RC coupled amplifier.
- To study Half & Full wave rectifier and measurement of ripple factor

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 Analog Electronic ETEC233A course	**PSO1, PSO3**
CO2	Analyze dc circuits and relate ac models of semiconductor devices with their physical operation.	**PO2**
CO3	To understand the basic analog circuits and to verify their operation.	**PO1**
CO4	Design and analyze of electronic circuits	**PO4**
CO5	Evaluate frequency response to understand behavior of Electronics circuits	**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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEC263A	Analog Electronics Lab	2	2	3	2									1		3

1=weakly mapped
2= moderately mapped
3=strongly 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 flipflops, 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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETEC256A	Digital Electronics Lab	2	2	3	2									1		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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS217 A	Data Structures	2	2		3	3								3		

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

Semester-IV

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

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 pro	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills

					ble ms											
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
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
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
ETCS307 A	Database Management Systems		2	3	3	3				3				3	

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

ETCS260A	**Computer Organization and Architecture Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	-				

Course Objectives

- How Computer Systems work & the basic principles?
- Instruction Level Architecture and Instruction Execution

- The current state of art in memory system design
- How I/O devices are accessed and its principles?
- To provide the knowledge on Instruction Level Parallelism
- To impart the knowledge on micro programming
- 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

Hands-on experiments related to the course contents ETCS222A by performing All laboratory assignments based on Hardware Description Language (VHDL or Verilog) Simulation.

List of experiments:

HDL introduction
- Basic digital logic base programming with HDL
- 8-bit Addition, Multiplication, Division
- 8-bit Register design
- Memory unit design and perform memory operations.
- 8-bit simple ALU design
- 8-bit simple CPU design
- Interfacing of CPU and Memory

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

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

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

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	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
ETCS 222A	Computer Organization and		2	3	3	2				3				3		

	Architecture Lab															

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

ETMC226A	**Fundamentals Of Management**	**L**	**T**	**P**	**C**
Version 1.0		**3**	**0**	**0**	**3**
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To be able to Provide understanding of management history and functions of planning, organizing, leading, and controlling. The role of a manager is examined in promoting change, providing effective leadership, motivation, team building, communication, and decision making.
2. To learn & obtain skills to manage production, operations, and inventory control.
3. Develop the 4 P's of marketing: Product, promotion, distribution (place), and pricing.
4. To develop &learn about the accounting, finance, and financial markets within the business world.

Course Outcomes

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

CO1. Analyze Attain management, leadership, and human resource management skills.
C02. Provide the students with an understanding of the theories, models, problems, issues, and techniques related to the management of production and operations management
CO3.Develop an integrated marketing communications plan for a product, concept, good and/or service based on an identified market need or target.
CO4. Provide the students with a tool for assessing the financial position of an organization

Catalog Description

This course imparts the basic understanding of management history and functions of planning,

organizing, leading, and controlling. The role of a manager is examined in promoting change, providing effective leadership, motivation, team building, communication, and decision making.
This subject also provides the students with an understanding of the theories, models, problems, issues, and techniques related to the management of production and operations management
, marketing & finance.

Course Content

Unit I: **8 lecture hours**

UNIT I

Meaning of management, Definitions of Management, Characteristics of management, Management vs. Administration. Management-Art, Science and Profession. Importance of Management. Development of Management thoughts. Principles of Management. The Management Functions, Inter-relationship of Managerial functions. Nature and Significance of staffing, Personnel management, Functions of personnel management, Manpower planning, Process of manpower planning, Recruitment, Selection; Promotion - Seniority Vs. Merit. Training - objectives and types of training.

Unit II: **12 lecture hours**

Production Management: Definition, Objectives, Functions and Scope, Production Planning and Control; its significance, stages in production planning and control. Brief introduction to the concepts of material management, inventory control; its importance and various methods.

Unit III: **12 lecture hours**

Marketing Management - Definition of marketing, marketing concept, objectives & Functions of marketing. Marketing Research - Meaning; Definition; objectives; Importance; Limitations; Process. Advertising - meaning of advertising, objectives, functions, criticism.

Unit IV: **8 lecture hours**

Introduction of Financial Management, Objectives of Financial Management, Functions and Importance of Financial Management. Brief Introduction to the concept of capital structure and various sources of finance.

Text book [TB]: Robbins S. P. (2009). Fundamentals of Management (6th Edition). Delhi Pearson.

Reference book(s) Text book [TB]: Robbins S. P. (2009). Fundamentals of Management (6th Edition). Delhi Pearson.

Reference book(s) [RB]:

Gupta R. S., Sharma B. D., & Bhalla N. S. (2011). Principles and Practice of Management (11th Edition), Kalyani Publishers.

Prasad L.M. (2016). Principles & Practices of Management (1st Edition). Sultan Chand & Sons.

Gupta C. B. (2013). Management: Principles and Practice (3rd Edition). Sultan Chand and Sons.

Tripathi, P.C. & Reddy P. N. (5th Edition). Principles of Management (5th Edition). McGraw Hill 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	Analyze & Attain management, leadership, and human resource management skills.	**PO1**
CO2	Provide the students with an understanding of the theories, models, problems, issues, and techniques related to the management of production and operations management	**PO4**
CO3	Develop an integrated marketing communications plan for a product, concept, good and/or service based on an identified market need or target.	**PO5**
CO4	Provide the students with a tool for assessing the financial position of an organization	**PO2**

		Theoretical Knowledge	Problem analysis	Design/ development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMC226A	FUNDAMENTALS OF MANAGEMENT	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

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 soci	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills

							et y									
Course Code	Course Title	PO1	PO 2	PO3	PO4	P O 5	P O 6	PO7	P O 8	PO 9	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 Naïve String Matching Algorithm.	**1 Lab**
16	To implement Rabin Karp String Matching Algorithm	**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	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

ETCS262A	Analysis and design of algorithms Lab		2	3		3				3				3		

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

Semester V

ETCS 323A	Java Programming	L	T	P	C
Version 1.0		4	0	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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
ETCS323 A	Java Programmin g	2	3	3		2			2	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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
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		4	0	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, Typesof 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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3

ETCS211 A	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		4	0	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

ETCS304 A	Computer Networks		3		3	3						3	3	2	2	

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

ETCS363A	**Fundamental of 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
ETCS363A	Fundamental of 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

ETCS365 A	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	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
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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS381 A	Practical Training – I			3		3		2			3					

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

Semester VI

ETCS412A	Compiler Design	L	T	P	C
Version 1.0		4	-	-	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		4	0	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	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
ETCS401 A	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		4	0	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

ETCS374A	**Advanced iOS Develpoment Lab**	L	T	P	C
Version 1.0		0	0	3	1.5
Pre-requisites/Exposure	Java Programming				
Co-requisites	--				

Course Objectives

1. This course facilitates classroom and laboratory learning, letting students develop competence and confidence in android programming and understand the entire Android Apps Development Cycle, as well as it would also enable the students to independently create new Android Applications.

Course Outcomes

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

CO1. Design User Interface and develop activity for Android App.

CO2. Use Intent, Broadcast receivers and Internet services in Android App.

CO3. Design and implement Database Application and Content providers.

CO4. Use multimedia, camera and Location based services in Android App

Catalog Description

This course complements ETCA228A. The course acquaints the students with various features of Android programming. The aim of the course is to organizing the data in variety of ways using data structures and solve the given problem efficiently. Java is primary language for developing applications.

List of Experiments (Indicative)

1	Getting Started with Android Development.	**2 lab hours**
2	Activities and Views: Android Manifest.xml, Activity Class, Basic View Components: Layouts and Buttons	**2 lab hours**
3	Navigation with Data: Working with Intent, Sharing Data between Activities, Application Class.	**4 lab hours**
4	Android Resources: String Resources, Loading Strings in XML, Loading Strings in Code, the Resource Values Folder	**2 lab hours**
5	Drawables - Image Basics, Drawable Folders and Qualifiers, Dimensions, Image Padding, The ImageButton Widget	**2 lab hours**
6	Lists Implementing an Android List, ListView, ListActivity, Empty Lists, ListAdapter, Sorting the Adapter, Overriding ArrayAdapter, List Interaction	**4 lab hours**
7	Dialogs, New and Old: AlertDialog, Custom Dialog, Support Library, Fragments, DialogFragment.	**2 lab hours**
8	Menus: Options Menu, Modifying an Options Menu, Context Menu	**3 lab hours**
9	Saving Data with Shared Preferences: Shared Preferences, Getting Started with Shared Preferences, Preference Activity	**4 lab hours**
10	Saving Data with a Database: Setting Up SQLite, Creating a Helper , using the Helper, Cursor and Cursor Adapater	**2 lab hours**
11	Threading with AsyncTasks: Threading in Android, AsyncTask, Tracking Progress	**2 lab hours**
12	Styles and Themes: Introduction to Styling: Defining Styles, Defining Themes, Style Inheritance, Direct Theme References	**2 lab hours**
13	Develop an Android based Project	**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	Design User Interface and develop activity for Android App.	**PO1; PO5**
CO2	Use Intent, Broadcast receivers and Internet services in Android App.	**PO2; PO3**
CO3	Design and implement Database Application and Content providers.	**PO3; PO9**
CO4	Use multimedia, camera and Location based services in Android App	**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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
ETCS374 A	Advanced iOS Development Lab	2	2	3		3				2		3	2	3		

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

ETCS 417A	**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	E cs a C m io S s
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PS
ETCS417A	Data warehouse and data mining	3	3	2	3	3	1							3	3	

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

ETCS456A	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
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ETCS 456A	Data warehouse and data mining Lab	2	2	3	3	3								3	3

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

ETCS308A	Web Technologies	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure	Basics of HTML				
Co-requisites	--				

Course Objectives

1. Analyze a web page and identify its elements and attributes.
2. Create web pages using XHTML and Cascading Style Sheets.
3. Build dynamic web pages using JavaScript (Client side programming).
4. Create XML documents and Schemas.
5. Build interactive web applications using AJAX.

Course Outcomes

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

CO1. Create a well-designed and well-formed, professional Web site utilizing the most current standards and practices
CO2. Demonstrate knowledge in web technologies including HTML, XHTML, CSS, image editing software, web authoring software, and client-side scripting
CO3. Create client-side scripts to add interactivity to Web pages
CO4. Select appropriate Web tools for a Web development project
CO5. Identify Web authoring obstacles created by the availability of various web browsers and markup language versions

Catalog Description

This course is an introduction to Web site development and the technologies behind it. Students will learn how to design and develop Web pages using current technologies and tools. Topics covered will include the World Wide Web, HTML, Cascading Style Sheets (CSS) and XML. The focus of this course is on dynamic HTML, a collection of web technologies such as HTML and scripting languages used together to create interactive and animated Web pages. Students will learn to program client-side scripts using JavaScript and the Document Object Model to transform static Web pages created with HTML and CSS into dynamic Web pages.

Course Content

Unit I: 8 lecture hours

Concept of WWW, Internet and WWW, HTTP Protocol: Request and Response, Web browser and Web servers, Features of Web 2.0, Common terminology: IP Addressing, URLs, Domain names. Website Creation and maintenance, Web Hosting and Publishing Concepts, Search Engines and

their working. HTML: Introduction to HTML, HTML Document structure tags, HTML comments, Text formatting, inserting special characters, anchor tag, adding images and sound, lists: types of lists, tables, frames and floating frames, Developing Forms, Image maps, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets,

Unit II: 12 lecture hours

Client-side scripting: JavaScript - Data Types, Control Statements, operators, Built-in and User Defined Functions, Objects in JavaScript, Handling Events. HTML Document Object Model. Page Styling: Separation of content and presentation in HTML, Cascading Style Sheets - Types of Style Sheets – Internal, inline and External style sheets, customizing common HTML elements, types of CSS selectors

Unit III: 12 lecture hours

Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation, Browser architecture and Web site structure

Unit IV: 8 lecture hours

XML: Introduction to XML-Mark up languages, Features of Mark-up languages, XML Naming rules, Building block of XML, Document, Difference between HTML & XML, Components of XML, XML Parser, DTD's Using XML with HTML and CSS.
Introduction to Web Services, UDDI, SOAP, WSDL, Web Service Architecture, Developing and deploying web services. AJAX –Introduction AJAX programming, Improving web page performance using AJAX.

Text Books

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson

Reference Books/Materials

1.Web Technologies, Uttam K. Roy, Oxford University Press

2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.

3. Web Technology, Rajkamal, Tata McGraw-Hill.

4. Web Technologies: A Computer Science Perspective, Jeffrey C. Jackson, Pearson.

5. XML: How to Program, Deitel & Deitel Nieto

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**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 a well-designed and well-formed, professional Web site utilizing the most current standards and practices	**PO1**
CO2	Demonstrate knowledge in web technologies including HTML, XHTML, CSS, image editing software, web authoring software, and client-side scripting	**PO4**
CO3	Create client-side scripts to add interactivity to Web pages	**PO5**
CO4	Select appropriate Web tools for a Web development project	**PO2**
CO5	Identify Web authoring obstacles created by the availability of various web browsers and markup language versions	**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	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
ETCS308A	WEB TECHNOLOGIES	2	2	2	3	3								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

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:

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
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12	PSO1	PSO2
ETCS 310A	Advanced Computer Architecture	3	3	2	3	3							2	3	2

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

Semester VII

ETCS462A	Project	L	T	P	C
Version 1.0		-	-	10	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 ProgressSeminars. At the end of the semester, assessment of the research/project work of each student will bemade by the board of

examiners including supervisors on the basis of a viva-voceexamination 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/ProblemSolving/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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS481 A	Practical Training – II			3		3		2			3					

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

ETCS 402A	**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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS 402A	Natural Language Processing	2	3	3						3				3		

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

ETCS408A	**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 networksduring 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 modelingwith the best performance.

Catalog Description

This course imparts the basic concepts of neural networkalgorithms. 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 feedforward, Basic feedback and basic competitive learning neural network, Feedforward 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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS408A	Neural Networks	2	3		3	3								3	3	

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

ETCS416A	Cloud Computing	L	T	P	C
Version 1.0		4	0	0	3
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. MapReduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of MapReduce, Relational operations using Map-Reduce, Enterprise batch processing using MapReduce.

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
ETCS416A	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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly
Course Code	Course Title	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2

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: **10lecture hours**

Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges. Home automation, Industry applications, Surveillance applications, Other IoT applications

Unit IV: **12lecture 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	WriteaprogramonArduino/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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS457A	Internet of Things Lab	2	3	3	3									3	3	

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

ETCS411A	**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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS411A	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	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
ETCS455A	Machine learning Lab		3	3		2			2					3		

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

Semester VIII

	Six Month Industrial Internship	L	T	P	C
Version 1.0		-	-	-	6
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	Six Month Industri		3	3		3	2							3		2

	al Internship															

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