K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING

AND

TECHNOLOGY

Bachelor of Computer Applications
BCA

Programme Code: 06

2021-23

Approved in the 26th Meeting of Academic Council Held on 11 August 2021

Academic Council
Member Secretary
K.R. Mangalam University

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

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PREFACE

In consultation with Deans, Faculty Members, Industry Experts, and University Alumni, the Academic council constituted school-wise committees to draft the model curriculum of postgraduate computer application course. Increasing applications of computers in almost all areas of human endeavor has led to a vibrant industry with concurrent rapid change in technology. The primary emphasis in BCA is on designing computer applications for various organizations including business. finance, service and industry.

The BCA program is spread over three years in four semesters. The total number of credits in B.C.A is 138. The current program focuses on Artificial Intelligence, Machine Language and Data Science. The first year of courses focuses on strengthening the fundamental of the students. Subjects like Clean coding in Python, Overview of AI, Data Science, and Basics of Mathematics. The second year lays the programming and mathematical foundation for machine learning. The third semester is dedicated to Big Data Analytics, Data Visualization and Story Telling, Neural Network, and Deep Learning. The course includes ability enhancement courses like communication skills, presentation skills and aptitude reasoning to prepare the students for industry. A strong laboratory component is a part of the curriculum. The laboratories, besides supplementing the theory course should also expose the student to the use of the latest software tools.

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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.

Programmes 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.

Bachelors in Computer Applications with specialization in AI &Data Science (in collaboration with Samatrix and IBM)

Bachelor of Computer Applications is a three-year undergraduate course which deals with information technology and computer applications. The current course is designed in collaborationwith IBM and Samatrix to provide with specialization in Data Science. IB and Samatrix will provide training, knowledge expertise and resources on new technologies leveraging its expertise in the field of AI and Data Science. The students will be provided learning opportunities in real world work situations that will keep them abreast of the latest skills and knowledge. The programme aims to prepare the students to analyze problems and generate solutions in the areas of data science.

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 with Mathematics / Computer Science / Information Practice as one of the subjects and with an overall aggregate of 50% or more.

Course Outline: Python Programming / Data Analysis and Data Visualization / Probabilistic Modelling and Reasoning with Python / Foundations of Machine Learning / Data Visualization and Storytelling / Neural Networks / Deep Learning.

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

Program Educational Objectives (PEO)

PEO 1: To develop graduates who have strong foundation of knowledge and skills in the field of computer science and engineering.

PEO 2: To develop graduates who are employable in industries/public sector/research organizations or work as an entrepreneur.

PEO 3: To foster graduates who can provide solutions to challenging problems in their profession by applying computer engineering theory and practices.

PEO 4: To encourage graduates who can provide leadership and are effective in multidisciplinary environment.

PEO 5: To develop ability to demonstrate team work with the ability of leadership, analytical reasoning for solving time critical problems and strong human values for responsible professional.

PEO 6: To impart knowledge and skills to analyze, design, test and implement diverse range of technology.

Program Outcomes (PO)

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

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

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

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

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

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

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

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

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

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

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

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

Program Specific Outcomes (PSO)- Bachelors in Computer Applications (BCA)

PSO 1 Application of Concepts: Explore technical comprehension in varied areas of Computer Applications and experience a conducive environment in cultivating skills for thriving career and higher studies.

PSO 2 Project Management: Apply standard software engineering practices and strategies in software project development to deliver a quality of product for business success.

PSO 3 Ethical and Professional Issues: Accept cross cultural, social, professional, legal and ethical issues prevailing in local and global industry.

Program Duration: The maximum completion period of the BCA Programme offered by the University shall be three 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 BCA with specialization in AI &Data Science (in collaboration with IBM and Samatrix) 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.

Three Years Bachelor in Computer Applications Program at a Glance

	Semester I	Semester II	Semester III	Semester IV	Semester V	Semester VI	Total
Course	10	7	11	11	11	9	**59**
Credit	22	20	21	26	20	29	**138**

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

SEMESTER I

SNo	Category	CourseCode	Course Title	L	T	P	C	EMP/ENT/SE/OP
1	PCC	ETCS105A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis	2	0	0	2	EMP
2	PCC	UCIT 131A	Introduction to Computers & IT, Office Automation	3	1	-	4	SE/OP
3	PCC	ETCS106A	Clean Coding with Python	3	0	0	3	EMP
4	BS	ETMA163A	Basics of Mathematics	3	1	-	4	SE
5	MC	UCES125A	Environmental Studies	3	-	-	3	SE
6	MC	UCDM301A	Disaster Management	3	-	-	3	SE
7	PCC	UCIT 161A	Introduction to Computers & IT, Office Automation Lab	-	-	2	1	SE/OP
9	PCC	ETCS155A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis Lab	0	0	2	1	EMP
10	PCC	ETCS157A	Clean Coding with Python Lab	0	0	2	1	EMP
TOTAL				**17**	**2**	**6**	**22**	

SEMESTER II

SNo	Category	Course Code	Course Title	L	T	P	C	EMP/ENT/SE/OP
1	HSMC	UCCS 155A	Communication Skills	4	-	-	4	SE/OP

2	PCC	ETCS112A	Object Oriented Programming	3	1	-	4	SE/OP
3	PCC	ETCS316A	Web Technologies	3	1	-	4	SE/EMP/OP
4	PCC	ETCS108A	Data Analysis and Data Visualization using Python	2	0	0	2	EMP
5	PCC	ETCA 164A	Web Technologies Lab	-	-	2	1	SE/EMP/OP
6	PCC	ETCS166A	Object Oriented Programming Lab	-	-	2	1	SE/OP
7	OEC	ETCS156A	Data Analysis and Data Visualization using Python Lab	0	0	2	1	EMP
			Open Elective	3	-	-	3	SE
TOTAL				**15**	**2**	**6**	**20**	

SEMESTER III

1	PCC	ETCS217A	Data Structures	3	1	-	4	SE/EMP
2	PCC	ETCS203A	Probabilistic Modelling and Reasoning with Python	2	-	-	2	SE
3	PCC	ETCS208A	R Programming for Data Analytics and Data Analytics	2	-	-	2	EMP
4	PCC	ETCS211A	Operating Systems	3	1	-	4	EMP/ENT/OP
5	PCC	ETCS321A	Java Programming	3	1	-	4	SE/EMP/OP
6	PCC	ETCS 257A	Data Structures Lab	-	-	2	1	SE/EMP
7	PCC	ETCS367A	Java Programming Lab	-	-	2	1	SE/EMP/OP
8	PCC	ETCS255A	Operating System Lab	-	-	2	1	EMP/ENT/OP
9	PCC	ETCS259A	Probabilistic Modelling and Reasoning with Python Lab	-	-	2	1	SE
10	PCC	ETCS261A	R Programming for Data Science and Data Analytics Lab	-	-	2	1	EMP

TOTAL				**16**	**3**	**10**	**21**	

SEMESTER IV

1	PCC	ETCS222A	Computer Organization & Architecture	3	1	-	4	SE
2	PCC	ETCS307A	Database Management Systems	3	1	-	4	EMP/ENT/OP
3	PCC	ETCA326A	Enterprise Computing in JAVA	3	1	-	4	EMP/ENT
4	PCC	ETCS209A	Foundation of Machine Learning	3	-	-	3	EMP
5	PCC	ETCA228A	Mobile Application Development	4		-	4	EMP/ENT
6	PCC	ETCA366A	Enterprise Computing in JAVA Lab	-	-	2	1	EMP/ENT
7	PCC	ETCS 355A	Database Management Systems Lab	-	-	2	1	EMP/ENT/OP
8	PCC	ETCA264A	Mobile Application Development Lab	-	-	2	1	EMP/ENT
9	PCC	ETCS274A	Foundation of Machine Learning Lab	-	-	4	2	EMP
10	HSMC		MOOC/Online Certification course	1	-	-	2	SE
TOTAL				**20**	**3**	**10**	**26**	

SEMESTER V

1	PCC	ETCS308A	Big Data Analytics	3	-	-	3	EMP/ENT
2	PCC	ETCA227A	Web Based Programming using PHP	3	1	-	4	EMP
3	PCC	ETCS332A	Data Visualization and Story Telling	2	-	-	2	SE
4	PCC	ETCS304A	Computer Networks	3	1	-	4	EMP/OP
5	PCC	ETCS315A	Foundation of Neural Network and Deep Learning	2	-	-	2	EMP

6	PCC	ETCA267A	Web Based Programming Using PHP Lab	-	-	2	1	EMP
8	PCC	ETCS364A	Big Data Analytics Lab	-	-	2	1	EMP/ENT
9	PROJ	ETCA367A	Practical Training	-	-	2	1	EMP
10	PCC	ETCS461A	Data Visualization and Story Telling Lab	-	-	2	1	SE
11	PCC	ETCS359A	Foundation of Neural Network and Deep Learning Lab	-	-	2	1	EMP
TOTAL				**16**	**2**	**10**	**20**	

SEMESTER VI

1	PCC	ETCS314A	Mobile Computing	3	1	-	4	SE/PCC
2	PCC	ETCS422A	Cloud Computing	4	-	-	4	EMP/ENT/PCC
3	PCC	ETCS 202A	Software Engineering	3	1	-	4	EMP/ENT/OP/PCC
4	PCC	ETCS401A	Artificial Intelligence	3	1	-	4	EMP/ENT/PCC
5	PCC	ETCA362A	Cloud Computing Lab	-	-	2	1	EMP/ENT/PCC
6	PCC	ETCS451A	Artificial Intelligence Lab	-	-	2	1	EMP/ENT/PCC
7	PROJ	ETCS464A	Major Project	-	-	-	6	EMP/PROJ
8		**Elective (with Lab)**						
(i)	PEC	ETCA328A	Multimedia Technologies	3	1	-	4	SE
	PEC	ETCA370A	Multimedia Technologies Lab	-	-	2	1	SE
(ii)	PEC	ETCA 330A	Network Security & Cryptography	3	1	-	4	EMP/ENT
	PEC	ETCA372A	Network Security & Cryptography Lab	-	-	2	1	EMP/ENT

(iii)	PEC	ETCA 332A	Software Testing	3	1	-	4	EMP/ENT
	PEC	ETCA374A	Software Testing Lab	-	-	2	1	EMP/ENT
TOTAL				**16**	**4**	**6**	**29**	
Total Credits [C]				**138**				

OE	OPEN ELECTIVE
CC	CORE COURSE
SE	SKILL ENHANCEMENT

Semester I

ETCS105A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the concepts of current main conceptual frameworks at use in AI

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Uses of AI, Ethics present and future.
CO2. Introduction to Machine Learning.
CO3. Application of AI by domain, Role of AI in society.

Catalog Description

The course begins with the theoretical understanding of AIML and usage, Ethics present and future.

Course Content

Unit I: **06 lecture hours**

Introduction to Data Science: Defining Data Science and Big Data, Benefits and Uses of Data Science and Big Data, Facets of Data, Structured Data, Unstructured Data, Natural Language, Machine generated Data, Graph based or Network Data, Audio, Image, Video, Streaming data, Data Science Process, Big data ecosystem and data science, distributed file systems, Distributed programming framework, data integration framework, machine learning framework, No SQL Databases, scheduling tools, benchmarking tools, system deployments.

Unit II: **06 lecture hours**

Data Science Processes: Six steps of data science processes, define research goals, data retrieval, cleansing data, correct errors as early as possible, integrating – combine data from different sources, transforming data, exploratory data analysis, Data modelling, model and variable selection, model execution, model diagnostic and model comparison, presentation and automation

Unit III: **06 lecture hours**

Introduction to Machine Learning: What is Machine Learning, Learning from Data, History of
Machine Learning, Big Data for Machine Learning, Leveraging Machine Learning, Descriptive vs Predictive Analytics, Machine Learning and Statistics, Artificial Intelligence and Machine Learning, Types of Machine Learning – Supervised, Unsupervised, Semi-supervised, Reinforcement Learning, Types of Machine Learning Algorithms, Classification vs Regression Problem, Bayesian, Clustering, Decision Tree, Dimensionality Reduction, Neural Network and Deep Learning, Training machine learning systems.

Unit IV: **06 lecture hours**

Introduction to AI: What is AI, Turing test, cognitive modelling approach, law of thoughts, the relational agent approach, the underlying assumptions about intelligence, techniques required to solve AI problems, level of details required to model human intelligence, successfully building an intelligent problem, history of AI.

Unit V: **06 lecture hours**

Introduction to Data Analytics: Working with Formula and Functions, Introduction to Power BI & Charts, Logical functions using Excel, Analyzing Data with Excel.

Text Books

1.Stuart J Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach"3rd edition. Pearson.

Reference Books/Materials

1. Kevin Knight, Elaine Rich, B. Nair," Artificial Intelligence" 3rd edition. McGraw Hill.O'Reilly Media.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Uses of AI, Ethics present and future.	**PO2**
CO2	Introduction to Machine Learning.	**PO1**
CO3	Application of AI by domain, Role of AI in society.	**PO6**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of	PO4 Conduct investigations	PO5 Modern tool usage	PO6 The engineer and	PO7 Environment and	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Project Management	PSO3 Ethical and Professional Issues
ETCS-315A	Ethics and	3	3				3							3		

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

UCIT131A	Introduction to Computers & IT, Office Automation	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer				
Co-requisites	--				

Course Objectives

1. To introduce IT in a simple language to all undergraduate students, regardless of their specialization.
2. To pursue specialized programs leading to technical and professional careers and certifications in the IT industry.
3. To introduce skills relating to IT basics, computer applications, programming, interactive media, Internet basics, etc.
4. To develop good programming skills and to develop problem solving skills.
5. Clearly formulate a program's requirements and develop an algorithm for solving a problem Identify functions for solution of a problem, and identify and classify the parameters.
6. Build sets of test data in order to evaluate computer programs and thoroughly test a program

Course Outcomes

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

CO1.Understand basic concepts and terminology of information technology.

CO2. Have a basic understanding of personal computers and their operations.

CO3. Understand the process of algorithm development and documentation.

CO4.Identify the basic elements required in a computer system.

CO5.Illustrate the role of the computer for personal and professional uses.

CO6.Students should develop fundamental skills such as problem solving and abstract reasoning through computer programming.

CO7.understand the fundamental hardware components that make up a computer's hardware and the role of each of these components.

CO8.understand the difference between an operating system and an application program, and what each is used for in a computer.

Catalog Description

Computing and programming is essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. The course of Information Technology Fundamentals has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives.

Course Content

Unit I: 12 lecture hours

Introduction to Computers: The evolution of computers: Computer Generation from First Generation to Fifth Generation. Classifications of Computers: Micro, Mini, Mainframe and super computers, Distributed Computer System, Parallel Computers. Computer Hardware: Major Components of a digital computer, Block Diagram of a computer Input devices, Output Device. Computer Memory: Memory Cell, Overview of Memory Organization, Primary Memory: RAM & ROM, Secondary memory: Magnetic tapes, Magnetic disk, CD-ROM, DVD.

Unit II: 8 lecture hours

Introduction to System Software and Operating System: Computer Software: Machine language, assembly language, high-level languages, fourth generation language, assemblers, compilers, interpreters, linkers, loaders. Operating System concepts: different types of operating systems, functions of operating system, concept of multiprogramming, multitasking, multithreading, multiprocessing, timesharing, real time, single-user & multi-user operating system.

Unit III: 12 lecture hours

Programming Concepts & Techniques: Algorithms, flow chart, decision tables, pseudo code, characteristics of a good programming language, Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation. Structured programming concepts, Programming methodologies viz. top-down and bottom up programming, Advantages and disadvantages of Structured programming.

Unit IV: 8 lecture hours

Computer Networks & The Internet: Basic elements of a communication system, Data transmission modes, Data transmission media, Network topologies, Network Types (LAN, WAN and MAN), Client and Servers, Intranet, Extranet. Internet: Terminology related to Internet: Protocols, TCP/IP, HTTP, Internet addressing, Domain Names, DNS, URL, World Wide Web. Overview of various services on Internet: Webservers, E-mail, FTP, Telnet.

Text Books

1. P. K. Sinha &PritiSinha , "Computer Fundamentals", BPB Publications.
2. Anita Goel "Computer Fundamentals", Pearson.

Reference Books/Materials

1. B.Ram Computer fundamentals Architecture and Organization,New Age Intl.
2. Alex Leon & Mathews Leon, "Introduction to Computers", Vikas Publishing.
3. Norton Peter, "Introduction to computers", TMH.
4. Vikas Gupta, "Comdex Computer Kit", Wiley Dreamtech, 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	Understand basic concepts and terminology of information technology.	PO2
CO2	Have a basic understanding of personal computers and their operations.	PO3
CO3	Understand the process of algorithm development and documentation.	PO4
CO4	Identify the basic elements required in a computer system.	PO5

CO5	Illustrate the role of the computer for personal and professional uses.	**PO4**
CO6	Students should develop fundamental skills such as problem solving and abstract reasoning through computer programming.	**PO4**
CO7	Understand the fundamental hardware components that make up a computer's hardware and the role of each of these components.	**PO9**
CO8	Understand the difference between an operating system and an application program, and what each is used for in a computer.	**PSO1**

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

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

ETCS106A	Clean Coding with Python	L	T	P	C
Version 1.0	--	3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To understand why Python is a useful scripting language for developers.
2. To learn how to design and program Python applications.
3. To learn how to use lists, tuples, and dictionaries in Python programs.
4. To learn how to identify Python object types.
5. To learn how to use indexing and slicing to access data in Python programs.
6. To define the structure and components of a Python program.
7. To learn how to write loops and decision statements in Python.

Course Outcomes

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

CO1. Learn how to write functions and pass arguments in Python.
CO2. Learn how to build and package Python modules for reusability.
CO3. Learn how to read and write files in Python.
CO4. Learn how to design object-oriented programs with Python classes.
CO5. Learn data handling and use cases diagrams.
CO6. Learn how to use class inheritance in Python for reusability.
CO7. Learn how to use exception handling in Python applications for error.

Course Overview: Python is a language with a simple syntax, and a powerful set of libraries. It is an interpreted language, with a rich programming environment, including a robust debugger and profiler. While it is easy for beginners to learn, it is widely used in many scientific areas for data exploration. This course is an introduction to the Python programming language for students without prior programming experience. We cover data types, control flow, object-oriented programming, and graphical user interface-driven applications. The examples and problems used in this course are drawn from diverse areas such as text processing, simple graphics creation and image manipulation, HTML and web programming, and genomics.

Course Content

Unit I: **8 lecture hours**

Introduction to Clean Code: What is Bad Code? Example 1: Avoid, Example 2: for each code, What is Clean Code? , Purpose of Clean Code, Thought of experienced programmers,

Intention Revealing Names, Example 1: Poor Variable Names, Example 2: Poor Method Names, Example 3: Variable Name, Make Meaningful Distinctions, Example 1: Usage of Different Words, Example 2: Distinct Names, Use Pronounceable Names, Example 1: Vocal Names, Example 2: Short Form Names, Example 3: Non-Pronounceable Names, Example 4: Compare, Avoid Encodings and Mental Mappings, Difference between smart and professional programmer, Class and Method Names, Function Size Matters, Blocks and Indenting, Do only one thing within a function, One level of abstraction per function, Use Descriptive Name, Example 1: Verbal Names, Function Arguments, Advantages of Having Less Arguments, Command Query Separation, Prefer Exceptions to Returning Error Codes, Extract Try/Catch Blocks, Error Handling Is One Thing, Good Comments, Good Names Can Obviate Comments, Types of Good Comments, Legal Comment, Informative Comment, Explanation of Intent Comment, Clarification Comment, Warning of Consequences Comment, TODO Comments, Amplification Comment, Bad Comments , Mumbling Comments, Redundant Comments, Misleading Comments, Mandated Comments, Journal Comments, Noise Comments, Scary Noise, Commented-Out Code, Too Much Information, Test Your Knowledge, The Purpose of Formatting, Vertical Formatting, Horizontal Formatting, Team Rules, Exercise 1: Comments and Formatting, Test Your Knowledge, Data Abstraction, Example 1: Concrete Point, Example 2: Abstract Point, Data/Object Ant symmetry, Law of Demeter, Data Transfer Objects.

Unit II: **12 lecture hours**

Introduction to Python: What is Python?, Advantages and disadvantages, Downloading and installing, Which version of Python, Running Python Scripts, Using the interpreter interactively, Using variables, String types: normal, raw and Unicode String operators and expressions, Math operators and expressions, Writing to the screen, Reading from the keyboard, Indenting is significant, The if and elif statements, While Loops, Using List, Dictionaries, Using the for statement, Opening, reading and writing a text file, Using Pandas, the python data analysis library and data frames, Grouping, aggregating and applying, merging and joining, Dealing with syntax errors, Exceptions, Handling exceptions with try/exception.

Unit III: **12 lecture hours**

Data Handling and Use Cases: re Pattern Matching, Parsing Data, Introduction to Regression, Types of Regression, Use Cases, Exploratory data analysis, Correlation Matrix, Visualization using Matplotlib, Implementing linear regression.

Unit IV: **8 lecture hours**

Object Oriented Concepts: Class, Object , Functions, Inheritance, Types of Inheritance, Encapsulation, Polymorphism, Method Overloading and Method Overriding, Data Abstraction, Abstract Classes.

Text Books

1. IBM Material

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Learn how to write functions and pass arguments in Python.	PO1
CO2	Learn how to build and package Python modules for reusability.	PO4
CO3	Learn how to read and write files in Python.	PO5
CO4	Learn how to design object-oriented programs with Python classes.	PO2
CO5	Learn data handling and use cases diagrams.	PO3
CO6	Learn how to use class inheritance in Python for reusability.	PO3
CO7	Learn how to use exception handling in Python applications for error.	PO2

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS106A	**Clean Coding with Python**	2	3	3	3	3								3		

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

ETMA 163A	Basics of Mathematics	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	-				
Co-requisites	--				

Course Objectives

After completion of this course the students may capable to investigate the structure of real-world problems and plan solution strategies. They might be able to solve the problems using appropriate tools and develop a mathematical vocabulary by expressing mathematical ideas orally and in writing. Enhance and reinforce the student's understanding of concepts through the use of technology when appropriate.

Course Outcomes

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

CO1. Familiar with Determinant and Matrices
CO2. Identify an ordinary differential equation and classify it by order or linearity
CO3.To determine general term of series in AP and GP, Calculate sum of n terms of series
CO4.Demonstrate a working knowledge Definite and Indefinite Integrals.

Catalog Description

This course is to enable students to understand concepts of determinants and matrices such as addition, subtraction, multiplication, system of linear equation by Cramer's rule. This course is also designed to develop and solidify basic arithmetic series like Arithmetic Progression (A.P), Geometric Progression (G.P), and algebra skills that will be required in future math courses.

In this course also include differentiation topics: derivative of a function, polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions and Logarithmic Differentiation. Integration topics includes: Indefinite integrals, Methods of integration: by substitution, by parts, by partial fractions, Integration of algebraic and transcendental functions. Because of the basic concepts of differentiation and integration are very useful for solving simple application problems related to computer science based on these.

Course Content

Unit I: **8 lecture hours**

Determinants: Definition, Minors, Co-factors, Properties of Determinants, Applications of determinants in finding area of triangle.

Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Solution of system of linear equation by Cramer's Rule.

Unit II: 12 lecture hours

Sequence and Series: Introduction, Sequences, Series, Arithmetic Progression (A.P), Geometric Progression(G.P), Relationship Between A. M. and G.M., Sum to N terms of Special Series, Principle of Mathematical Induction.

Unit III: 12 lecture hours

Differentiation: Derivative of a function, Derivatives of sum, differences, product, and quotient of functions, Derivative of polynomial, trigonometric, exponential, logarithmic, inverse trigonometric and implicit functions, Logarithmic Differentiation, Derivatives of functions in parametric forms, Differentiation by substitution.

Unit IV: 8 lecture hours

Integration: Indefinite integrals, Methods of integration: by substitution, by parts, by partial fractions, Integration of algebraic and transcendental functions.

Text Books

1. A Textbook of Mathematics for XI-XII Students, NCERT Publication Vol. I-II.
2. Shanti Narayan, Integral calculus, Sultan Chand & Co.
3. Shanti Narayan, Differential calculus, Sultan Chand & Company.
4. Babu Ram, Engineering Mathematics, Pearson Education.

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	Familiar with Determinant and Matrices	**PO5**
CO2	Identify an ordinary differential equation and classify it by order or linearity	**PO2**
CO3	To determine general term of series in AP and GP, Calculate sum of n terms of series	**PO4**
CO4	Demonstrate a working knowledge Definite and Indefinite Integrals.	**PO3**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETMA163A	Basic of Mathematics		3	3	2	1										

1=weakly mapped

2= moderately mapped

3=strongly mapped

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

Course Objectives

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

Course Outcomes

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

CO1. To comprehend and become responsive regarding environmental issues.

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

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

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

CO5. Become consciousness about healthy and safe environment.

Catalog Description

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

Course Content

UNIT I **10 Lectures**

Environment and Natural Resources:

Multidisciplinary nature of environmental sciences; Scope and importance; Need for public awareness.
Land resources; land use change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
Energy resources: Renewable and non- renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

UNIT II **10 Lectures**

Ecosystems and Biodiversity:

Ecosystem: Definition and Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.
Case studies of the following ecosystems:
a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

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

UNIT III **10 Lectures**

Environmental Pollution and Environmental Policies:

Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution Nuclear hazards and human health risks; Solid waste management: Control measures of urban and industrial waste; Pollution case studies.
Sustainability and sustainable development; Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture; Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

UNIT IV **10 Lectures**

Human Communities and the Environment and Field work:

Human population growth: Impacts on environment, human health and welfare; Resettlement and rehabilitation of project affected persons; case studies; Disaster management: floods, earthquake, cyclones and landslides; Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan; Environmental ethics: Role of Indian and other religions and cultures

in environmental conservation; Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).
Visit to an area to document environmental assets: river/ forest/ flora/fauna, etc.
Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds and basic principles of identification. Study of simple ecosystems-pond, river, Delhi Ridge, etc.

Text Books

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

Reference Books/Materials

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

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	The learners will be able to comprehend and become responsive regarding environmental issues.	PO7
CO2	Students will acquire the techniques to protect our mother earth, as without a clean, healthy, aesthetically beautiful, safe and secure environment no specie can survive and sustain.	PO8
CO3	It enables the students to discuss their concern	PO10

	at national and international level with respect to formulate protection acts and sustainable developments policies.	
CO4	Students come to know that the rapid industrialization, crazy consumerism and over-exploitation of natural resources have resulted in degradation of earth at all levels.	**PO6**
CO5	Students become consciousness about healthy and safe environment.	**PO7**

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

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

UCDM301	Disaster Managment	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objective:

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

Course Outcomes:

After completing the program, the student will able to understand

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 Instit

Unit IV: **10 lecture hours**

Disaster Management in India

- **Disaster Management Act, 2005:**

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

- **Liability for Mass Disaster**
  - Statutory liability
  - Contractual liability
  - Tortiousliability
  - Criminal liability
  - Measure of damages

- **Epidemics Diseases Act, 1897: Main provisions, loopholes.**

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

Reference Books:

- Government of India, Department of Environment, Management of Hazardous Substances Control
- Act and Structure and Functions of Authority Created There under.
- Indian Chemical Manufacturers' Association & Loss Prevention Society of India, Proceedings of the National Seminar on Safety in Road Transportation of Hazardous Materials: (1986).
- Author Title Publication Dr.Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
- Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
- Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
- J. P. Singhal Disaster Management Laxmi Publications.
- Shailesh Shukla, ShamnaHussain Biodiversity, Environment and Disaster Management Unique Publications
- C. K. Rajan, NavalePandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication
- IndianlawInstitute(UpendraBaxiandThomasPaul(ed.),MassDisastersandMultinational Liability: The Bhopal Case(1986)
- IndianLawInstitute,UpendraBaxi(ed.),EnvironmentProtectionAct:AnAgendaforImplementation (1987)
- Asian Regional Exchange for Prof.Baxi.,Nothing to Lose But our Lives: Empowerment to Oppose
- Industrial Hazards in a Transnational world(1989)

- Guru dip Singh, Environmental Law: International and National Perspectives(1995), Lawman (India)Pvt.Ltd.
- Leela Krishnan, P, The Environmental Law in India, Chapters VIII,IX and X(1999),Butter worths, New Delhi

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

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

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

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

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

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

UCIT161A	Introduction to Computers & IT, Office Automation Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

1. To introduce IT in a simple language to all undergraduate students, regardless of their

specialization.

2. To help students to pursue specialized programs leading to technical and professional careers and certifications in the IT industry.
3. To introduce skills related to IT basics, computer applications, programming, interactive media, Internet basics, etc.

Course Outcomes

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

CO1.To understand the basic concepts and terminology of information technology.
CO2.To have a basic understanding of personal computers and their operations.
CO3.To apply general problem-solving strategies to the development of computer algorithms and write computer programs to express and implement algorithms to solve problems.

Catalog Description

Computing and programming is essential to leverage the technical skills of a student. These techniques equip the students with know-how of the latest technologies and reduce considerable time in solving problems. The course of Information Technology Fundamentals has become essentially the present age of computer technology and information, as the applications of information technology can be found in all aspects of our lives

List of Experiments (Indicative)

1	MS-Windows: Operating system-Definition & functions, basics of Windows. Basic components of windows, icons, types of icons, taskbar, activating windows, using desktop, title bar, running applications, exploring computer, managing files and folders, copying and moving files and folders. Control panel – display properties, adding and removing software and hardware, setting date and time, screensaver and appearance. Using windows accessories.	**6 lab hours**
2	Documentation Using MS-Word - Introduction to Office Automation, Creating & Editing Document, Formatting Document, Auto-text, Autocorrect, Spelling and Grammar Tool, Document Dictionary, Page Formatting, Bookmark, Advance Features of MS-WordMail Merge, Macros, Tables, File Management, Printing, Styles, linking and embedding object, Template.	**6 lab hours**
3	Electronic Spread Sheet using MS-Excel - Introduction to MS-	**8 lab hours**

	Excel, Creating & Editing Worksheet, Formatting and Essential Operations, Formulas and Functions, Charts, Advance features of MS-Excel-Pivot table & Pivot Chart, Linking and Consolidation, Database Management using Excel-Sorting, Filtering, Table, Validation, Goal Seek, Scenario.	
4	Presentation using MS-PowerPoint: Presentations, Creating, Manipulating & Enhancing Slides, Organizational Charts, Excel Charts, Word Art, Layering art Objects, Animations and Sounds, Inserting Animated Pictures or Accessing through Object, Inserting Recorded Sound Effect or In-Built Sound Effect.	**8 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 understand the basic concepts and terminology of information technology.	**PO2**
CO2	To have a basic understanding of personal computers and their operations.	**PO3**
CO3	To apply general problem-solving strategies to the development of computer algorithms and write computer programs to express and implement algorithms to solve problems.	**PO5, PSO1, PO9**

Ethics and Communication Skills	PSO3	
Innovation and Industry Friendly	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	3
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	
Design/development of solutions	PO3	3
Problem analysis	PO2	2
Engineering Knowledge	PO1	
	Course Title	COMPUTERS & IT, OFFICE AUTOMATION LAB
	Course Code	UCIT161A

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

ETCS155A	Overview of AI, Data Science, Ethics and Foundation of Data Analysis Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				

Co-requisites	--

Course Objectives

The objective of this course is to teach students the concepts of current main conceptual frameworks at use in AI

Course Outcomes

On completion of this course, the students will be able to implement:-
CO1. No SQL Database queries.
CO2. Basic machine learning algorithms such as regression, classification etc.
CO3. Unsupervised algorithms.

Catalog Description

This course complements ETCS105A. It enables them to write algorithms for solving basic machine learning algorithms. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS105A.

Text Books

1.Stuart J Russell & Peter Norvig, "Artificial Intelligence: A Modern Approach"3rd edition. Pearson.

Reference Books/Materials

1. Kevin Knight, Elaine Rich, B. Nair,"Artificial Intelligence" 3rd edition. McGraw Hill.

O'Reilly Media.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	No SQL Database queries.	**PO2**
CO2	Basic machine learning algorithms such as regression, classification etc.	**PO3**
CO3	Unsupervised algorithms.	**PO5**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS155A	Foundation of Data Science, Ethics and		3	3		3								3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCS157A	**Clean Coding with Python Lab**	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Be fluent in the use of procedural statements — assignments, conditional statements, loops, function calls — and sequences.
2. Be able to design, code, and test small Python programs.
3. Understand the concepts of object-oriented programming as used in Python: classes, subclasses, inheritance, and overriding.
4. Understand the basics of Object Oriented Design.
5. Implement the data structures and use the built-in libraries for efficient codes.

Course Outcomes

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

CO1. Develop solutions to simple computational problems using Python programs.
C02. Solve problems using conditionals and loops in Python. Develop Python programs by defining functions and calling them.
CO3. Use Python lists, tuples and dictionaries for representing compound data.
CO4. Develop Python programs using files.

Catalog Description

Clean coding with python emphasize on principles of software development, style, and testing. Topics include procedures and functions, iteration, recursion, arrays and vectors, strings, an operational model of procedure and function calls, algorithms, exceptions, object-oriented programming, and GUIs (graphical user interfaces). Weekly labs provide guided practice on the computer, with staff present to help. Assignments use graphics and GUIs to help develop fluency and understanding.

Course Content

LIST OF EXPERIMENTS

1. Develop programs to understand the control structures of python

2. Develop programs to implement list

3. Develop programs to implement Dictionary

4. Develop programs to implement tuples

5. Develop programs to implement function with stress on scoping

6. Develop programs to implement classes and objects

7. Develop programs to implement exception handling.

8. Develop programs to implement linear search and binary search.

9. Develop programs to implement insertion sort

10. Develop programs to implement bubble sort.

11. Develop programs to implement quick sort.

12. Develop programs to implement heap sort.

Text Books

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

Reference Books/Materials

1. R. Nageswara Rao, "Core Python Programming", Dreamtech
2. Wesley J. Chun. "Core Python Programming, Second Edition", Prentice Hall
3. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, "Data Structures and Algorithms in Python", Wiley
4. Kenneth A. Lambert, "Fundamentals of Python,First Programs", CENGAGE Publication

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Develop solutions to simple computational problems using Python programs	PO3
CO2	Solve problems using conditionals and loops in Python. Develop Python programs by defining functions and calling them	PO4
CO3	Use Python lists, tuples and dictionaries for representing compound data	PO2
CO4	Develop Python programs using files	PO3

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS157A	Clean Coding with Python Lab		3	2	3									2		3

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

Semester II

UCCS 155A	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: Hospitality Press
6. Business Communication-K.K.Sinha
7. Essentials of Business Communication ByMarey Ellen Guffey, Publisher: Thompson Press
8. How to win Friends and Influence People By Dale Carnegie, Publisher: Pocket Books

9. Basic Business Communication ByLesikar & 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**

Ethical and Professional Issues	PSO3	3
Project Management	PSO2	
Application of Concepts	PSO1	
Life-long Learning	PO12	3
Project management and finance	PO11	
Communication	PO10	3
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	
Conduct investigations of complex problems	PO4	
Design/development of solutions	PO3	
Problem analysis	PO2	
Engineering Knowledge	PO1	
	Course Title	Communication Skills
	Course Code	UCCS155A

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

ETCS112A	Object Oriented Programming	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

This course introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a brief review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting techniques, event-driven programming, memory management and an introduction to software engineering issues.

Course Outcomes

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

CO1 Explain the steps in creating an executable program for a computer, including the intermediate representations and their purpose.
CO2. Manipulate binary patterns and understand the use of binary to represent numbers. CO 3. Apply good programming style and understand the impact of style on developing and maintaining programs. CO4. Effectively use a version control system and the Linux command line tools for incremental development.
CO5. Explain the benefits of object-oriented design and understand when it is an appropriate methodology to use.
CO6. Design object-oriented solutions for small systems involving multiple objects.
CO7. Identify the relative merits of different algorithmic designs.

Catalog Description

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: Introducing Object-Oriented Approach related to other paradigms (functional, data decomposition), Characteristics of Object-Oriented Languages.
Basic terms and ideas: Abstraction, Encapsulation, Information hiding, Inheritance, Polymorphism, Review of C, Difference between C and C++, Cin, Cout, new, delete operators.

Unit II: **8 lecture hours**

Classes and Objects: Abstract data types, Object & classes, attributes, methods, C++ class declaration, State identity and behavior of an object, Constructors and destructors, instantiation of objects, Default parameter value, Copy Constructor, Static Class Data, Constant Classes, C++ garbage collection, dynamic memory allocation.

Unit III: **12 lecture hours**

Inheritance and Polymorphism: Inheritance, Types of Inheritance, Class hierarchy, derivation – public, private & protected, Agrégations, composition vs classification hiérarchies, Polymorphism, Type of Polymorphism – Compile time and runtime, Method polymorphism, Polymorphism by parameter, Operator overloading, Parametric polymorphism, Generic function – template function, function name overloading, Overriding inheritance methods.

Unit IV: **8 lecture hours**

Files and Exception Handling: Persistent objects, Streams and files, Namespaces, Exception handling, Generic Classes Standard Template Library: Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterates, Other STL Elements, The Container Classes, General Theory of Operation, Vectors.

Text Books

A.R. Venugopal, Rajjkumar, T. Ravishanker “Mastering C++”, TMH
2. R. Lafore, “Object Oriented Programming using C++”, BPB Publications
3. Schildt Herbert, “C++ Programming”, 2nd Edition, Wiley DreamTech

Reference Books/Materials

1. D. Parasons, “Object Oriented Programming with C++”, BPB Publication
2. Steven C. Lawlor, “The Art of Programming Computer Science with C++”, Vikas Publication
3. YashwantKanethkar, “Object Oriented Programming using C++”, 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	CO1 Explain the steps in creating an executable program for a computer, including the intermediate representations and their purpose.	**PO2**
CO2	CO2. Manipulate binary patterns and understand the use of binary to represent numbers. CO 3. Apply good programming style and understand the impact of style on developing and maintaining programs. CO4. Effectively use a version control system and the Linux command line tools for incremental development.	**PO3**
CO3	CO5. Explain the benefits of object-oriented design and understand when it is an appropriate methodology to use.	**PO4**
CO4	CO6. Design object-oriented solutions for small systems involving multiple objects.	**PO5**
CO5	CO7. Identify the relative merits of different algorithmic designs.	**PO4**
CO6	CO1 Explain the steps in creating an executable program for a computer, including the intermediate representations and their purpose.	**PO4**
CO7	CO2. Manipulate binary patterns and understand the use of binary to represent numbers. CO 3. Apply good programming style and understand the impact of style on developing and maintaining programs. CO4. Effectively use a version control system and the Linux command line tools for incremental development.	**PO9, PSO 1**

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	3
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex problems	PO4	3
Design/development of solutions	PO3	3
Problem analysis	PO2	2
Engineering Knowledge	PO1	1
	Course Title	Object oriented programming
	Course Code	ETCS112A

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

ETCS316A	Web Technologies	L	T	P	C
Version 1.0		3	1	0	4
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**

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	2
Problem analysis	PO2	
Engineering Knowledge	PO1	2
	Course Title	WEB TECHNOLOGIES
	Course Code	ETCS316A

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

ETCS108A	Data Analysis and Data Visualization using Python	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Learn how to use Jupyter notebooks
2. Learn how to work with NumPy datatypes
3. Be proficient in pandas Series
4. Be proficient in pandas Data Frames
5. Understand how to use data visualization
6. Know how to import and clean data
7. Introduce statistical tools for working with data sets
8. An introduction to the problems of working with PDF data sources
9. Introduce machine learning tools for working with data sets
10. Work through a complete data analysis to understand how the tools interact with each other

Course Outcomes

On completion of this course, the students will be able to:-
CO1. Understand and use python data science libraries as a tool for data analytics.
CO2. Load, clean, transform, merge and reshape data.
CO3. Create visualizations using python.

Catalog Description

This course will help students learn python and effectively use it analyze and visualize data. Students will get a full understanding of how to program with Python and how to use it in conjunction with scientific computing modules and libraries to analyze data.

Course Content

Unit I: **10 lecture hours**

Python programming Basic: Python interpreter, IPython Basics, Tab completion, Introspection, %run command, magic commands, matplotlib integration, python programming, language semantics, scalar types. Control flow.

Unit II: **10 lecture hours**

Data Structure, functions, files: tuple, list, built-in sequence function, dict, set, functions, namescape, scope, local function, returning multiple values, functions are objects, lambda functions, error and exception handling, file and operation systems

Unit III: **10 lecture hours**

NumPy: Array and vectorized computation: Multidimensional array object. Creating ndarrays, arithmetic with numpy array, basic indexing and slicing, Boolean indexing, transposing array and swapping axes, universal functions, array-oriented programming with arrays, conditional logic as arrays operations, file input and output with array.

Unit IV: **10 lecture hours**

Pandas: Pandas data structure, series, Data Frame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format.

Unit V: **10 lecture hours**

Visualization with Matplotlib: Figures and subplots, colors, markers, line style, ticks, labels, legends, annotation and drawing on sublots, matplotlib configuration.
Plotting with pandas and seaborn: line plots, bar plots, histogram, density plots, scatter and point plots, facet grids and categorical data.

Text Books

1.McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition.O'Reilly Media.

Reference Books/Materials

1.O'Neil, C., &Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and use python data science libraries as a tool for data analytics.	**PO3**
CO2	Load, clean, transform, merge and reshape data.	**PO2**
CO3	Create visualizations using python.	**PO5**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of	PO4 Conduct investigations	PO5 Modern tool usage	PO6 The engineer and	PO7 Environment and	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Project Management	PSO3 Ethical and Professional Issues
ETCS108A	Data Analysis and Data Visualization using Python		3	3		3								3		

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

ETCA164A	Web Technologies Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of HTML				
Co-requisites	--				

Course Objectives

1. To understand best technologies for solving web client/server problems
2. analyze and design real time web applications
3. use Java script for dynamic effects and to validate form input entry
4. Analyze to Use appropriate client-side or Server-side applications

Course Outcomes

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

CO1. Analyze a web page and identify its elements and attributes. ·

CO2.Create web pages using XHTML and Cascading Style Sheets. ·

CO3.Build dynamic web pages using JavaScript (Client side programming). ·

CO4. Create XML documents and Schemas.

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.

List of Experiments (Indicative)

1	Write HTML/Java scripts to display your CV in Web Browser	**2 lab hours**
2	Creation and annotation of static web pages using any HTML editor.	**2 lab hours**
3	Write a program to use XML and JavaScript for creation of your homepage.	**2 lab hours**
4	Write a program in XML for creation of DTD which specifies a particular set of rules.	**4 lab hours**

5	Create a Stylesheet in CSS/XSL and display the document in Web Browser	**4 lab hours**
6	Create a Registration Form with Table	**3 lab hours**
7	CSS : Inline Style , Internal Style ,and External Style Sheets	**3 lab hours**
8	JavaScript & HTML: · Use user defined function to get array of values and sort them in ascending order · Demonstrate String and Math Object's predefined methods · Demonstrate Array Objects and Date Object's predefined methods · Exception Handling · Calendar Creation : Display all month · Event Handling · Validation of registration form · Open a Window from the current window · Change color of background at each click of button or refresh of a page · Display calendar for the month and year selected from combo box ·OnMouseover event	**10 lab hours**
9	XML · Create any catalog · Display the catalog created using CSS or XS	**4 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Analyze a web page and identify its elements and attributes. ·	**PO1**
CO2	Create web pages using XHTML and Cascading Style Sheets. ·	**PO4**
CO3	Build dynamic web pages using JavaScript (Client side programming). ·	**PO5**

CO4	Create XML documents and Schemas	PO2

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	
Problem analysis	PO2	
Engineering Knowledge	PO1	2
	Course Title	WEB TECHNOLOGIES LAB
	Course Code	ETCA164A

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

ETCS166A	Object Oriented Programming Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

Course Objectives

This course will give the learner an insight into how everything can be considered an object and how simply we can write code to implement it. It helps us in making programming relatable to real world, as everything around us can be an object (having properties and functionality) Object-oriented programming aims to implement real world entities like inheritance, hiding, polymorphism etc in programming. The main aim of OOP is to bind together the data and the functions that operates on them so that no other part of code can access this data except that function.

Course Outcomes

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

CO1 Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
CO2 Understand fundamentals of object-oriented programming including defining classes, invoking methods, using class libraries, etc.
CO3 Be aware of the important topics and principles of software development.
CO4 Develop the ability to write a computer program to solve specified problems.

Catalog Description

This course emphasizes solving problems using the language, and introduces standard programming techniques like alternation, iteration and recursion. It will briefly glimpse the basics of software engineering practices like modularization, commenting, and naming conventions which help in collaborating and programming in teams. This course is enabled the students to formulate algorithms for arithmetic and logical problems, convert these algorithms to C language programs. It also aims on using arrays, pointers and structures to formulate algorithms and programs. In addition to that, apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

Course Content

1	Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power ( ) that takes a double value for n and an int value for p, and returns theresult as double value. Use a default argument of 2 for p, so that if this	**2 lab hours**

	argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.	
2	A point on the two dimensional plane can be represented by two numbers: an X coordinate and a Y coordinate. For example, (4,5) represents a point 4 units to the right of the origin along the X axis and 5 units up the Y axis. The sum of two points can be defined as a new point whose X coordinate is the sum of the X coordinates of the points and whose Y coordinate is the sum of their Y coordinates. Write a program that uses a structure called point to model a point. Define three points, and have the user input values to two of them. Than set the third point equal to the sum of the other two, and display the value of the new point. Interaction with the program might look like this: Enter coordinates for P1: 3 4 Enter coordinates for P2: 5 7 Coordinates of P1 + P2 are : 8, 11	**2 lab hours**
3	Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this. Enter first number, operator, second number: 10/ 3 Answer = 3.333333 Do another (Y/ N)? Y Enter first number, operator, second number 12 + 100 Answer = 112	**2 lab hours**
4	A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this: Enter your area code, exchange, and number: 415 555 1212 My number is (212) 767-8900 Your number is (415) 555-1212	**2 lab hours**
5	Create two classes DM and DB which store the value of distances. DM stores distances in meters and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB object, depending on the units in which the results are required.	**2 lab hours**

	The display should be in the format of feet and inches or meters and centimeters depending on the object on display.	
6	Create a class rational which represents a numerical value by two double valuesNUMERATOR& DENOMINATOR. Include the following public member Functions: • constructor with no arguments (default). • constructor with two arguments. • void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator. • Overload + operator to add two rational number. • Overload >> operator to enable input through cin.• Overload << operator to enable output through cout. Write a main ( ) to test all the functions in the class.	**4 lab hours**
7	Consider the following class definition class father { protected : int age; public; father (int x) {age = x;} virtual void iam ( ) { cout<< "I AM THE FATHER, my age is : "<< age<< end1:} }; Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam( ) through the pointer to demonstrate polymorphism in action.	**4 lab hours**
8	Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.	**4 lab hours**
9	A hospital wants to create a database regarding its indoor patients. The information to store include a) Name of the patient b) Date of admissionDisease d) Date of discharge Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).	**4 lab hours**
10	Make a class Employee with a name and salary. Make a class Manager inherit from Employee. Add an instance variable, named department, of type string. Supply a method to toString that prints the manager's name, department and salary. Make a class Executive inherit from Manager. Supply a method to String that prints the string "Executive" followed by the information	**2 lab hours**

	stored in the Manager superclass object. Supply a test program that tests these classes and methods.	
11	Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.	**2 lab hours**
12	Write a function called reversit( ) that reverses a string (an array of char). Use for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit( ) as an argument. Write a program to exercise reversit( ). The program should get a string from the user, call reversit( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".	**2 lab hours**
13	. Create some objects of the string class, and put them in a Deque-some at the head of the Deque and some at the tail. Display the contents of the Deque using the forEach( ) function and a user written display function. Then search the Deque for a particular string, using the first That ( ) function and display any strings that match. Finally remove all the items from the Deque using the getLeft( ) function and display each item. Notice the order in which the items are displayed: Using getLeft( ), those inserted on the left (head) of the Deque are removed in "last in first out" order while those put on the right side are removed in "first in first out" order. The opposite would be true if getRight( ) were used.	**2 lab hours**
14	Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data( ) to initialize base class data Members and another member function display_area ( ) to compute and display the area of figures. Make display_area( ) as a virtual function and redefine this function in the derived classes to suit their requirements. Using these three classes, design a program that	**2 lab hours**

	will accept dimensions of a triangle or a rectangle interactively and display the area. Remember the two values given as input will be treated as lengths of two sides in the case of rectangles and as base and height in the case of triangles and used as follows: Area of rectangle = x * y Area of triangle = ½ * x * y	

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 fundamentals of programming such as variables, conditional and iterative execution, methods, etc.	**PO2**
CO2	Understand fundamentals of object-oriented programming including defining classes, invoking methods, using class libraries, etc.	**PO3**
CO3	Be aware of the important topics and principles of software development.	**PO5, PSO1,**
CO4	Develop the ability to write a computer program to solve specified problems.	**PO9**

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	3
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	
Design/development of solutions	PO3	3
Problem analysis	PO2	2
Engineering Knowledge	PO1	
	Course Title	Object oriented programming Lab
	Course Code	ETCS166A

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

ETCS156A	Data Analysis and Data Visualization using Python Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Learn how to use Jupyter notebooks
2. Learn how to work with NumPy datatypes
3. Be proficient in pandas Series
4. Be proficient in pandas DataFrames
5. Understand how to use data visualization
6. Know how to import and clean data
7. Introduce statistical tools for working with data sets
8. An introduction to the problems of working with PDF data sources
9. Introduce machine learning tools for working with data sets
10. Work through a complete data analysis to understand how the tools interact with each other

Course Outcomes

On completion of this course, the students will be able to:-
CO1. Understand and use python data science libraries as a tool for data analytics.
CO2. Load, clean, transform, merge and reshape data.
CO3. Create visualizations using python.

Catalog Description

This course complements ETCS108A. It enables them to write algorithms/programs for implementing python libraries such as NumPy, Seaborn etc. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS108A.

Text Books

1.McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython.2nd edition.O'Reilly Media.

Reference Books/Materials

1.O'Neil, C., &Schutt, R. (2013). Doing Data Science: Straight Talk from the Frontline O'Reilly Media.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand and use python data science libraries as a tool for data analytics.	**PO3**
CO2	Load, clean, transform, merge and reshape data.	**PO2**
CO3	Create visualizations using python.	**PO5**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of	PO4 Conduct investigations	PO5 Modern tool usage	PO6 The engineer and	PO7 Environment and	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Project Management	PSO3 Ethical and Professional Issues
6A	tion		3	3		3								3		

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

Semester III

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**

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

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

ETCS203A	Probabilistic Modelling and Reasoning with Python	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Basics of Statistics and Probability distributions.
CO2. Sampling theory and Theory of Estimation.
CO3. Various tests of Hypothesis and Significance.
CO4. Correlation and Regression and fitting of different types of curves.

Catalog Description

The course begins with the theoretical study of statistics and probability distributions which is widely used in ML, AI and all engineering applications. Topics include: basic combinatorics, random variables, probability distributions, Bayesian inference, hypothesis testing, and confidence intervals.

Course Content

Unit I: **08 lecture hours**

Introduction to Statistics: Introduction to Statistics. Role of statistics in scientific methods, current applications of statistics.
Scientific data gathering: Sampling techniques, scientific studies, observational studies, data management.
Data description: Displaying data on a single variable (graphical methods, measure of central tendency, measure of spread), displaying relationship between two or more variables, measure of association between two or more variables.

Unit II: **07 lecture hours**

Probability Theory: Sample space and events, probability, axioms of probability, independent events, conditional probability, Bayes' theorem.

Random Variables: Discrete and continuous random variables. Probability distribution of discrete random variables, binomial distribution, Poisson distribution. Probability distribution of continuous random variables, The uniform distribution, normal (Gaussian) distribution, exponential distribution, gamma distribution, beta distribution, t-distribution, χ" distribution. Expectations, variance and covariance. Probability Inequalities. Bivariate distributions

Unit III: **08 lecture hours**

Point Estimations: Methods of finding estimators, method of moments, maximum likelihood estimators, bayes estimators. Methods of evaluating estimators mean squared error, best unbiased estimator, sufficiency and unbiasedness

Interval Estimations: Confidence interval of means and proportions, Distribution free confidence interval of percentiles.

Unit IV: **07 lecture hours**

Test of Statistical Hypothesis and p-values: Tests about one mean, tests of equality of two means, test about proportions, p-values, likelihood ratio test, Bayesian tests.

Bayesian Statistics: Bayesian inference of discrete random variable, Bayesian inference of binomial proportion, comparing Bayesian and frequentist inferences of proportion, comparing Bayesian and frequentist inferences of mean.

Univariate Statistics using Python: Mean, Mode. Median, Variance, Standard Deviation, Normal Distribution, t-distribution, interval estimation, Hypothesis Testing, Pearson correlation test, ANOVA F-test

Text Books

1.AchimKlenke, Probability Theory A Comprehensive Course Second Edition, Springer

Reference Books/Materials

1. Christian Heumann, Michael SchomakerShalabh (2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer International Publishing.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Basics of Statistics and Probability distributions.	**PO1**
CO2	Sampling theory and Theory of Estimation.	**PO1**
CO3	Various tests of Hypothesis and Significance.	**PO2**
CO4	Correlation and Regression and fitting of different types of curves.	**PO3**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of	PO4 Conduct investigations	PO5 Modern tool usage	PO6 The engineer and	PO7 Environment and	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Project Management	PSO3 Ethical and Professional Issues
ETCS203A	and Reasoning with Python	3	3	3										3		

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

ETCS208A	R Programming for Data Science and Data Analytics	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Open Source, Platform Independent, Machine Learning Operations.
CO2. Exemplary support for data wrangling.
CO3. Quality plotting and graphing.
CO4. The array of packages, Statistics.

Catalog Description

The course begins with the study of R Programming.

Course Content

Unit I: **08 lecture hours**

Getting Started with R and R Workspace: Introducing R, R as a programming Language, the need of R, Installing R, RStudio, RStudio's user interface, console, editor, environment pane, history pane, file pane, plots pane, package pane, help and viewer pane, R Workspace, R's working directory, R Project in R Studio, absolute and relative path, Inspecting an Environment, Inspect existing Symbols, View the structure of object, Removing symbols, Modifying Global Options, Modifying warning level, Library of Packages, Getting to know a package, Installing a Package from CRAN, Updating Package from CRAN, Installing package from online repository, Package Function, Masking and name conflicts.

Unit II: **07 lecture hours**

Basic Objects and Basic Expressions: Vectors, Numeric Vectors, Logical Vectors, Character Vectors, subset vectors, Named Vectors, extracting element, converting vector, Arithmetic operators, create Matrix, Naming row and columns, subsetting matrix, matrix operators, creating and subsetting an Array, Creating a List, extracting element from list, subsetting a list, setting value, creating a value of data frame, subsetting a data frame, setting

values, factors, useful functions of a data frame, loading and writing data on disk, creating a function, calling a function, dynamic typing, generalizing a function. Assignment Operators, Conditional Expression, using if as expression and statement, using if with vectors, vectorized if: ifelse, using switch, using for loop, nested for loop, while loop.

Unit III: **08 lecture hours**

Working with Basic Objects and Strings: Working with object function, getting data dimensions, reshaping data structures, iterating over one dimension, logical operators, logical functions, dealing with missing values, logical coercion, math function, number rounding functions, trigonometric functions, hyperbolic functions, extreme functions, finding roots, derivatives and integration, Statistical function, sampling from a vector, Working with random distributions, computing summary statistics, covariance and correlation matrix, printing string, concatenating string, transforming text, Formatting text, formatting date and time, formatting date and time to string, finding string pattern, using group to extract data, reading data.

Unit IV: **07 lecture hours**

Working with Data – Visualize and Analyze Data: Reading and Writing Data, importing data using built-in-function, READR package, export a data frame to file, reading and writing Excel worksheets, reading and writing native data files, loading built-in data sets, create scatter plot, bar chart, pie chart, histogram and density plots, box plot, fitting linear model and regression tree.

Text Books

1.Garrett Grolemund, Hands-On Programming with R, O′Reilly.

Reference Books/Materials

1. Hadley Wickham & Garrett Grolemund, R for Data Science, O′Reilly.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Open Source, Platform Independent, Machine Learning Operations.	**PO1**
CO2	Exemplary support for data wrangling.	**PO1**
CO3	Quality plotting and graphing.	**PO2**
CO4	The array of packages, Statistics.	**PO3**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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
ETCS208A	R Programming for Data Science and Data Analytics	3	3	3										3

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

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

Course Objectives

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

Course Outcomes

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

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

Catalog Description

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

Course Content

Unit I: **6 lecture hours**

Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered,

Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Unit II: **12 lecture hours**

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

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

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

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

Unit III: **12 lecture hours**

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

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

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

Unit IV: **10 lecture hours**

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

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

Text Books

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

Reference Books/Materials

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

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

Examination Scheme:

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

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

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

	management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.	

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS211A	Operating Systems	2	2	3	2	3								3		

Engineering Knowledge	
Problem analysis	
Design/development of solutions	
Conduct investigations of complex	
Modern tool usage	
The engineer and society	
Environment and sustainability	
Ethics	
Individual or team work	
Communication	
Project management and finance	
Life-long Learning	
Application of Concepts	
Project Management	
Ethical and Professional Issues	

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

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

Course Objectives

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

Course Outcomes

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

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

Catalog Description

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

Course Content

Unit I: **12 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: 15 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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
21CS52A	Programming	2	3	3		2			2	3				3		

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

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

Course Objectives

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

Course Outcomes

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

Catalog Description

This course complements ETCS 217A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments helps organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques.

List of Experiments (Indicative)

1	Write a program for multiplication and transpose of array.	2 lab hours
2	Write a program to compute the transpose of a sparse matrix	2 lab hours

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

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

Examination Scheme:

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

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

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

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

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

ETCS361A	Java Programming Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

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

Course Outcomes

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

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

Catalog Description

This course complements ETCS 323A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments help organizing the data in variety of ways using data structures and to solve the given problem efficiently. It also discusses about daily problems like searching and sorting techniques

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**
3	Write a java program to implement various shapes using	**2 lab hours**

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

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

Examination Scheme:

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

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

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

	available in Java.	

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

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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	
ETCS255A	Operating Systems Lab	2	2	3	2	3								3	

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

ETCS259A	Probabilistic Modelling and Reasoning with Python Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of Statistics, Probability and probability distribution and other statistical methods to solve various engineering problems.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Applications of Sampling theory and Theory of Estimation.
CO2. Implementation of various tests of Hypothesis and Significance.
CO3. Implementation of Correlation and Regression and fitting of different types of curves.

Catalog Description

This course complements ETCS203A. It enables them to write algorithms/programs for solving various tests of Hypothesis and Significance and Correlation and Regression and fitting of different types of curves. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS203A.

Text Books

1.AchimKlenke, Probability Theory A Comprehensive Course Second Edition, Springer

Reference Books/Materials

1. Christian Heumann, Michael SchomakerShalabh (2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R, Springer International Publishing.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Applications of Sampling theory and Theory of Estimation	PO3
CO2	Implementation of various tests of Hypothesis and Significance.	PO2
CO3	Implementation of Correlation and Regression and fitting of different types of curves.	PO5

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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
ETCS259A	Modelling and Reasoning with Python Lab		3	3		3								3

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCS261A	R Programming for Data Science and Data Analytics Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

R is a programming language for statistical computing and graphics that you can use to clean, analyze, and graph your data. It is widely used by researchers from diverse disciplines to estimate and display results and by teachers of statistics and research methods.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Implement Open Source, Platform Independent, Machine Learning Operations.
CO2. Exemplary support for data wrangling.
CO3. Implement Quality plotting and graphing.
CO4. Implement the array of packages, Statistics.

Catalog Description

This course complements ETCS208A. It enables them to write algorithms/programs for Implementing Open Source, Platform Independent, Machine Learning Operations and Quality plotting and graphing. The list of experiments helps organizing the data in variety of ways using R and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS208A.

Text Books

1.Garrett Grolemund, Hands-On Programming with R, O′Reilly.

Reference Books/Materials

1. Hadley Wickham & Garrett Grolemund, R for Data Science, O′Reilly.

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

Examination Scheme:

Components	Quiz	Attendance	Mid Term	Presentation/	End Term

			Exam	**Assignment/ etc.**	**Exam**
Weightage (%)	**10**	**10**	**20**	**10**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Implement Open Source, Platform Independent, Machine Learning Operations.	**PO5**
CO2	Exemplary support for data wrangling.	**PO2**
CO3	Implement quality plotting and graphing.	**PO3**
CO4	Implement The array of packages, Statistics.	**PO3**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS261A	Data Science and Analytics		3	3		3								3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCH 285	Buisness Communication I	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To provide an overview of Prerequisites to Business Communication.
2. To put in use the basic mechanics of Grammar.
3. To provide an outline to effective Organizational Communication.
4. To underline the nuances of Business communication.
5. To impart the correct practices of the strategies of Effective Business writing.

Course Outcomes

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

CO1. To be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments
CO2. Understand the correct form of English with proficiency. CO3. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.

CO4. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.

Catalog Description

In this course, the focus will be on improving LSRW skills, i.e. listening, speaking, reading and writing. Students will learn how to communicate effectively though prescribed syllabus as well as classroom assignments/activities specifically designed to encourage students to play an active role for enhancing their knowledge and developing learning strategies.

List of Experiments (Indicative)

1	**Self- introduction:** Informal introduction & formal introduction'; Formal Introduction of oneself in front of the group.	**2 lab hours**
2	**Personal Branding:** Social media presence (Facebook, twitter and LinkedIn)**,**Networking**,** Digital Etiquettes	**2 lab hours**
3	**JAM:** Introduction to 'Just A Minute speech' and the	**2 lab hours**

	'Extempore speech'; Preparation of speech on given topic (different topic for each student); delivery of the speech; Feedback (on content, time management, body language etc. highlighting the positive aspects.)	
4	**Listening Comprehension:** Listen to online / downloaded oration by renowned Orators; write down the content in a precise form and give an oral presentation of that write up following all the etiquettes of public speaking.	**2 lab hours**
5	**Academic Language Skills,** Identify ways of emphasizing, signposting, organising, etc used in spoken (academic) English, Read and comprehend authentic English language publications, both print and electronic, such as newspapers, journals, brochures and catalogues, course materials and online blogs.	**2 lab hours**
6	**Turn Coat**: Speaking for and against on a topic by the same person with time specification; topics to assigned from the current events; feedback & suggestions for improvement.	**2 lab hours**
7	**Turn Coat**: Speaking for and against on a topic by the same person with time specification; topics to assigned from the current events; feedback & suggestions for improvement.	**2 lab hours**
8	**Conversation ability:** Characteristics of effective conversation; Listening to a few sample conversations; preparing conversation based on the given situation; enacting the situation through effective delivery of the script; feedback & suggestions for improvement	**2 lab hours**
9	**Role Play:** Characteristics of Role Play; assigning roles; developing the content to deliver; enacting the role with effective delivery; feedback & suggestions for improvement	**2 lab hours**
10	**Etiquettes and Manners:** Etiquette Basics: Emails and Spoken Words**,** Professional Appearance and Grooming**,** Office Etiquette: Workplace Behaviour	**2 lab hours**
11	**Public Speaking:** Characteristics of effective Public speaking; possible barriers; watching demo online; topic assignment, information gathering & recording; delivery in front of the class; feedback & suggestions for improvement. . (Different topic for each student)	**2 lab hours**
12	**Group Discussion:** Importance and characteristics; Dos & Don'ts in GD; Demo display; assign topic for the group, Preparation & performance; feedback & suggestions for improvement.	**2 lab hours**

13	**Debate**: Difference between Group Discussion & Debating; Watching demo of Debating; Topic for the group of 2 or 4; preparation and performance; feedback & suggestions for improvement	**2 lab hours**
14	**Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.	**3 lab hours**
15	**Interview:** Importance & purpose of Job Interview; Interview etiquettes; Watch demo interview; Appear for formal mock interview; feedback & suggestions for improvement.	**2 lab hours**

Text book [TB]:

Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.

Reference Books

1. Professional Speaking Skills by ArunaKoneru, Oxford Publications, 2015 2. Soft Skills for everyone by Jeff Butterfield Cengage Learning 2011

E Books

1. https://www.britishcouncil.in/english/courses-business 27
2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3. http://www.bbc.co.uk/learningenglish/english/
4. http://www.antimoon.com/how/pronunc-soundsipa.htm
5. http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

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 be familiar with the complete course outline/Course Objectives/Learning Outcomes/ Evaluation Pattern & Assignments	**PO10, PSO3**
CO2	Understand the correct form of English with proficiency.	**PO9, PSO3**
CO3	To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.	**PO9, PSO3**
CO4	To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.	**PO10, PSO3**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
ETCH 285	Buisness Communication I									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: **8 lecture hours**

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

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

Unit IV: **10 lecture hours**

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

Text Books

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

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

Reference Books/Materials

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

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

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

Examination Scheme:

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

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

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

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

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,	PSO1

	and implementation of a database system project.	

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

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

ETCA 326A	Entrprise Computing in Java	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Java Programming				
Co-requisites	HTML				

Course Objectives

The objective of this course is to provide a foundation for the students to J2EE technology and advanced server-side programming with Servlet, Java Server Page, Socket Programming and Database Connectivity.

Course Outcomes

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

CO1. Design and Implement GUI based application using Swings

CO2. Implement basic networking based application using sockets

CO3. Able to apply database operations using J2EE .

CO4. Design web-based applications using Servlets and Java Server Page.

Catalog Description

It is imperious that programmers should be able to learn, practice and perfect the art and science of developing more advance and commercial software's. This course covers Java enabling technologies (based on Java Enterprise Edition) for developing and running portable, robust, scalable, reliable and secure server-side applications. Large organizations such as Multinational Corporation, educational institutes, hospitals, and government organizations have special requirements in terms of computing including operating systems, protocols, and network architecture.

Course Content

Unit I: **10 lecture hours**

Design of User Interfaces: Swing, Japplet, Icons and Labels, Text Fields, Buttons, Jbutton Class, CheckBox, Radio Buttons, The Container, Panel, Windows, and Frame Classes, Combo Box, Tabbed Panes, ScrollPanes, Trees, Tables, Custom Rendering of Jlist Cells

Unit II: **12 lecture hours**

Socket Programming: Connecting to a server, implementing a server, Sending E-mail, Making URL connections, Advance Socket Programming.

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL statements, working with Result Set Object & Result Set Meta Data.

Unit III: **10 lecture hours**

Servlets: Introduction to Servlets, Life cycle of Servlets, Creating, Compiling and running Servlets, Reading the Servlets Parameters, Reading Initialization parameter, Packages-javax.servlet Package, Handling HTTP Request and Response (GET / POST Request), Cookies and Session Tracking.

Unit IV: **9 lecture hours**

JSP: JSP Architecture, JSP Access Mode, JSP Syntax Basic (Directions, Declarations, Expression, Scriplets and Comments, JSP Implicit Object, Object Scope, Synchronization Issue, Session Management.

Text Book

1. Gary Cornell and Horstmann Cay S., "Core Java, Vol I and Vol II", Sun Microsystems Press.
2. Herbert Schildt, "Java: The Complete Reference", McGraw-Hill.

Reference Books/Materials

1. Philip Hanna, "JSP: The Complete Reference", McGraw-Hill.
2. Deital and Deital, "Java How to Program", Prentice Hall.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Design and Implement GUI based application using Swings	PO5

CO2	Implement basic networking based application using sockets.	**PO1, PO4**
CO3	Able to apply database operations using J2EE	**PO3, PO9**
CO4	Design web-based applications using Servlets and JavaServer Page.	**PO11, PO12**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS326A	Enterprise Computing In Java	2		3	2	3				2		2	2	3	3	

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

ETCS209A	Foundation of Machine Learning	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning.

Course Outcomes

On completion of this course, the students will be able tolearn:-
CO1. Basic Algorithms of Machine Learning.
CO2. Supervised and Unsupervised Learning.
CO3. Linear Regression, Classification, Tree, PCA, SVD, SVM.
CO4. Resampling Methods and Optimization Techniques

Catalog Description

The course begins with the key concepts of Machine Learning. The student gets an opportunity to learn Machine learning algorithms, analyze the results, and techniques to optimize them.

Course Content

Unit I: **10 lecture hours**

Introduction: Learning systems, real world applications of machine learning, why machine learning, variable types and terminology, function approximation
Types of machine learning: Supervised learning, unsupervised learning, reinforcement learning.

Unit II: **10 lecture hours**

Important concepts of machine learning: Parametric vs non-parametric models, the trade-off between prediction accuracy and model interpretability, the curse of dimensionality, measuring the quality of fit, bias-variance trade off, over fitting, model selection, no free lunch theorem

Unit III: **10 lecture hours**

Linear Regression: Linear regression, estimating the coefficients, accessing the accuracy of coefficient estimates, accessing the accuracy of the model, multiple linear regression, qualitative predictors.

Unit IV: **10 lecture hours**

Pandas: Pandas data structure, series, Data Frame, Index Object, Reindexing, dropping entities from an axis, indexing, selection and filtering, integer indexes, arithmetic and data alignment, function application and mapping, soring and ranking, correlation and covariance, unique values, values controls and membership, reading and writing data in text format.

Unit V: **10 lecture hours**

Classification: Logistic regression, estimating regression coefficients, making predictions, multiple logistic regressions, linear discriminant analysis, bayes' theorem of classification, LDA for p=1, LDA for p>1, quadratic discriminant analysis

Text Books

1.Machine Learning by Tom M. Mitchell - McGraw Hill Education; First edition.

Reference Books/Materials

1.Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop - Springer; 1st ed. 2006. Corr. 2nd printing 2011 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	Learn and Apply Basic Algorithms of Machine Learning.	**PO3**
CO2	Learn and Apply Supervised and Unsupervised Learning.	**PO2**
CO3	Learn and Apply Linear regression, classification, tree, pca, svd, svm.	**PO5**
CO4	Learn and Apply Resampling Methods and Optimization Techniques	**PO4**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS209A	Foundation of Machine Learning		3	3	2	3								3		

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

ETCA228A	Mobile Application Development	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	Java Programming				
Co-requisites	--				

Course Objectives

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. Explain functioning of different mobile technology

CO2. Demonstrate Android activities life cycle

CO3. Execute operations on GUI objects

CO4. Perform Event driven programming

.CO5 Apply various techniques on working with menu

Catalog Description

The Android operating system (OS) has the highest market share worldwide on mobile devices. Android held 71.93 percent of the market.It is therefore necessary for students to know that how to build mobile apps for android operating system. This course covers the necessary concepts which are required to understand mobile communication and to develop Android Applications.

Course Content

Unit I: **12 lecture hours**

Introduction to Mobile Computing: Concept of Mobile Communication, Different generations of wireless technology, Basics of cell, cluster and frequency reuse concept, Noise and its effects on mobile, Understanding GSM and CDMA, Basics of GSM architecture and services like voice call, SMS, MMS, LBS, VAS, Different modes used for Mobile Communication, Architecture of Mobile Computing(3 tier), Design considerations for mobile computing, Characteristics of Mobile Communication, Application of Mobile Communication, Security Concern Related to Mobile Computing, Middleware and Gateway

required for mobile Computing, Making Existing Application Mobile Enable, Mobile IP, Basic Mobile Computing Protocol

Unit II: **9 lecture hours**

Introduction to Android Programming: Overview of Android, Android Internals, Android for mobile apps development, Environment setup for Android apps Development, Framework -Android-SDK, Emulators - Android AVD, Android Emulation – Creation and set up, First Android Application

Unit III: **9 lecture hours**

Android Activities and GUI Design: Activity Lifecycle of Android, Design criteria for Android Application : Hardware Design Consideration, Design Demands For Android application, Intent, Activity, Activity Lifecycle and Manifest, Creating Application and new Activities, Simple UI -Layouts and Layout properties: Introduction to Android UI Design, Introducing Layouts, Fragments, Push Button , Text / Labels , Edit Text, Toggle Button , Padding

Unit IV: **10 lecture hours**

Background Tasks: Customizations: Floating hints and Auto Complete, Create Custom Layout, Create Custom Toast.

Save Data Locally on Phone: Save User Preferences, Save data using text files, Making use of Async Task class: Intro to Async Task Loader, load In Background() , Async Task Loader callbacks , Benefits of loaders . Connecting to data by SQL Lite Database: Overview of SQLite, Open Helper Android class, Querying (dev) Searching (user) databases, Best practices for using databases in Android, Best practices for testing your database

Permissions: The permissions model, Libraries: Using libraries, Widgets: What are widgets?, When to use them and how to implement them, Publishing your App: Different ways to monetize your app, Making and publishing APKs: Guidelines for publishing in Google Play , Make and sign the APK, Beta test your app , Publish your app to Google Play

Text Books

1. Reto Meier, “Professional Android Application Development”, Wiley India Pvt Ltd
2. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd
3. Sayed Y Hashimi and SatyaKomatineni, “Pro Android”, Wiley India Pvt Ltd

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam

Weightage (%)	**10**	**10**	**20**	**10**	**50**

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Explain functioning of different mobile technology	**PO1**
CO2	Demonstrate Android Activities Life Cycles	**PO2**
CO3	Execute Operations on GUI objects	**PO3, PO5**
CO4	Perform Event Driven Programming	**PO5, PO9**
CO5	Apply various techniques on working with menu	**PO6, PO11, PO12**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Project Management	PSO2 Ethical and Professional Issues
8A	Develop on	1	2	3		3	2			2		2	2	3	3	

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

ETCS366A	Entrprise Computing in Java	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Java Programming				
Co-requisites	HTML				

Course Objectives

The objective of this course is to provide a foundation forthe students to J2EE technology and advanced server-side programming withServlet, JavaServer Page, Socket Programming and Database Connectivity.

Course Outcomes

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

CO1. Design and implement programs in the Java programming language that make strong use of GUI components.

CO2. Communicate between two devices using Sockets.

CO3. Perform various database related information from the front end only.

CO4. Write server-side scripts using Java Servlets and Java Server Pages

Catalog Description

This course complements ETCS326A. It enables them to write algorithms for solving problems with the help of fundamental data structures. The list of experiments covers topics like Swings, Socket Programming, Database Connectivity, Java Servlets, and Java Server pages. The aim is to develop and run portable, robust, scalable, reliable and secure server-side applications.

List of Experiments (Indicative)

1	Create a java program to implement stack and queue.	**2 lab hours**
2	Write a java program to demonstrate dynamic polymorphism.	**2 lab hours**
3	Write a java program to implement various shapes using Abstract class	**2 lab hours**
4	Write a java program to demonstrate interfaces.	**2 lab hours**
5	Write a java program to show multithreaded producer and consumer application.	**2 lab hours**

6	Create a java programs that make use of all the 5 exception keywords.	**4 lab hours**
7	Convert the content of a given file into the uppercase content of the same file.	**4 lab hours**
8	Develop a scientific calculator using swings.	**4 lab hours**
9	Create a servlet that uses Cookies to store the number of times a user has visited your servlet.	**4 lab hours**
10	Create a simple java bean having bound and constrained properties.	**4 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and implement programs in the Java programming language that make strong use of GUI components.	**PO5**
CO2	Communicate between two devices using Sockets .	**PO1, PO4**
CO3	Perform various database related information from the	**PO3, PO9**

	front end only.	
CO4	Write server-side scripts using Java Servlets and Java Server Pages	**PO11, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS366A	Enterprise Computing in Java Lab	2		3	2	3				2		2	2	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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS355A	Database Management Systems Lab		3	3		2								3		

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

ETCS264A	Mobile Application Develpoment Lab	L	T	P	C
Version 1.0		0	0	2	1
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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS264A	Mobile Application Development Lab	2	2	3		3				2		3	2	3		

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

ETCS252A	Foundation of Machine Learning Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of machine learning, supervised learning, unsupervised learning, and reinforcement learning.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Basic Algorithms of Machine Learning.
CO2. Supervised and Unsupervised Learning.
CO3. Linear Regression, Classification, Tree, PCA, SVD, SVM.
CO4. Resampling Methods and Optimization Techniques

Catalog Description

This course complements ETCS209A. It enables them to write algorithms/programs for implementing supervised learning, unsupervised learning, PCA, SVM etc. The list of experiments helps organizing the data in variety of ways using python and to solve the given problem efficiently.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS209A.

Text Books

1.Machine Learning by Tom M. Mitchell - McGraw Hill Education; First edition.

Reference Books/Materials

1.Pattern Recognition and Machine Learning (Information Science and Statistics) by Christopher M. Bishop - Springer; 1st ed. 2006. Corr. 2nd printing 2011 edition.

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

Components	Quiz	Attendance	Mid Term	Presentation/ Assignment/ etc.	End Term Exam

			Exam		
Weightage (%)	**10**	**10**	**20**	**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 and Apply Basic Algorithms of Machine Learning.	**PO3**
CO2	Learn and Apply Supervised and Unsupervised Learning.	**PO2**
CO3	Learn and Apply Linear regression, classification, tree, pca, svd, svm.	**PO5**
CO4	Learn and Apply Resampling Methods and Optimization Techniques	**PO4**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS252A	Machine Learning Lab		3	3	2	3								3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCH286A	Buisness Communication II	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To apply business communication theory to solve workplace communication issues.
2. To demonstrate the communication skills required in the workplace.
3. To understand complex ideas in written and spoken formats.
4. To express complex ideas accurately in written and spoken formats.

Course Outcomes

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

CO1. To demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.
CO2. To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.
CO3. To draft effective business correspondence with brevity and clarity.
CO4. To stimulate their Critical thinking by designing and developing clean and lucid writing skills.

Catalog Description

In this course, the focus will be on improving LSRW skills, i.e. listening, speaking, reading and writing. Students will learn how to communicate effectively though prescribed syllabus as well as classroom assignments/activities specifically designed to encourage students to play an active role for enhancing their knowledge and developing learning strategies.

List of Experiments (Indicative)

1	Interpersonal Communication and Building Vocabulary	**2 lab hours**
2	Interpersonal Communication and Building Vocabulary	**2 lab hours**
3	Activities on Reading Comprehension	**2 lab hours**
4	Activities on Reading Comprehension	**2 lab hours**
5	Activities on Writing Skills	**2 lab hours**

6	Activities on Writing Skills	**2 lab hours**
7	Activities on Presentation Skills	**2 lab hours**
8	Activities on Presentation Skills	**2 lab hours**
9	Activities on Group Discussion and Interview Skills	**2 lab hours**
10	Activities on Group Discussion and Interview Skills	**2 lab hours**
11	Conflict Management	**2 lab hours**
12	Conflict Management	**2 lab hours**
13	Leadership Skills	**2 lab hours**
14	Team Building	**3 lab hours**
15	Social Media Engagement	**2 lab hours**

Text book [TB]:

Soft Skills & Employability Skills by Sabina Pillai and Agna Fernandez published by Cambridge University Press 2018.

Reference Books

1. Professional Speaking Skills by ArunaKoneru, Oxford Publications, 2015 2. Soft Skills for everyone by Jeff Butterfield Cengage Learning 2011

E Books

1. https://www.britishcouncil.in/english/courses-business 27
2. http://www.bbc.co.uk/learningenglish/english/features/pronunciation
3. http://www.bbc.co.uk/learningenglish/english/
4. http://www.antimoon.com/how/pronunc-soundsipa.htm
5. http://www.cambridgeenglish.org/learning-english/free-resources/write-and-improve/

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 demonstrate his/her ability to write error free while making an optimum use of correct Business Vocabulary & Grammar.	PO10, PSO3
CO2	To distinguish among various levels of organizational communication and communication barriers while developing an understanding of Communication as a process in an organization.	PO9, PSO3
CO3	To draft effective business correspondence with brevity and clarity.	PO9, PSO3
CO4	To stimulate their Critical thinking by designing and developing clean and lucid writing skills.	PO10, PSO3

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional
ETCH286A	Buisness Communication II									3	3					3

1=weakly mapped

2= moderately mapped

3=strongly mapped

Semester V

ETCS317A	Big Data Analytics	L	T	P	C
Version 1.0	--	3	0	0	3
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Understand analytics, what is leading to big data.
2. Understand Scientific techniques of analytics.
3. Develop an understanding of the complete open-source Hadoop ecosystem and its near term future directions.
4. Understand the major challenges of data.
5. Understand how the growth of interconnected devices helps big data.
6. Understand the functions and features of HDP.
7. Understand IBM value-add components.
8. Understand Explain IBM Watson Studio.

Course Outcomes

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

CO1. Understand the brief description of the purpose of each of the value-add components.
CO2. Understand Hortonworks Data Platform (HDP)
CO3. Understand Apache Ambari
CO4. Understand Hadoop and the Hadoop Distributed File System, MapReduce and Yarn, Apache Spark.
CO5. Understand Zoo Keeper, Slider, and Knox
CO6. Loading data with Sqooq

Course Overview:
The course explains Dataplane Service , Stream Computing, Data Science essentials, Drew Conway's Venn Diagram - and that of others, The Scientific Process applied to Data Science, The steps in running a Data Science project , Languages used for Data Science (Python, R, Scala, Julia, ...), Survey of Data Science Notebooks, Markdown language with notebooks, Resources for Data Science, including GitHub, Jupyter Notebook, Essential packages: NumPy, SciPy, Pandas, Scikit-learn, NLTK, BeautifulSoup, Data visualizations: matplotlib, , PixieDust, Using Jupyter "Magic" commands, Using Big SQL to access HDFS data, Creating Big SQL schemas and tables, Querying Big SQL tables, Managing the Big SQL Server, Configuring Big SQL security, Data federation with Big SQL, IBM Watson Studio , Analyzing data with Watson Studio.

Course Content

Unit I: **10 lecture hours**

Introduction to Big Data and Analytics: Overview of Big Data 5 Vs of Big data, Real time example of analytics with use cases ,Developing an understanding of the complete open-source Hadoop ecosystem and its near term future directions ,Comparing and evaluating the major Hadoop distributions and their ecosystem components, both their strengths and their limitations ,Gaining hands-on experience with key components of various big data ecosystem components and their roles in building a complete big data solution to common business problems, Learning the tools that will enable you to continue your big data education after the course, Describing the functions and features of HDP, Listing the IBM value-add components, Explaining what IBM Watson Studio is, Giving a brief description of the purpose of each of the value-add components, Exploring the lab environment, Launching Apache Ambari, Starting a variety of services using Apache GUI, Exploring some of the directory structure on the Linux system, Understanding the purpose of Apache Ambari in the HDP stack, Understanding the overall architecture of Am bari, and Am bari's relation to other services and components of a Hadoop cluster, Listing the functions of the main components of Am bari, Explaining how to start and stop services from Am bari Web Console, Managing Hadoop clusters with Apache Am bari, Start the Apache Am bari web console and perform basic start/stop services, Explore other aspects of the Am bari web server, Understanding the basic need for a big data strategy in terms of parallel reading of large data files and internode network speed in a cluster, Describing the nature of the Hadoop Distributed File System (HDFS), Explaining the function of the Name Node and Data Nodes in an Hadoop cluster, Explaining how files are stored and blocks ("splits") are replicated, Filing access and basic commands with HDFS, Describing the Map Reduce model v1, Listing the limitations of Hadoop 1 and Map Reduce 1, Reviewing the Java code required to handle the Mapper class, the Reducer class, and the program driver needed to access Map Reduce , Describing the YARN model, Comparing Hadoop 2/YARN with Hadoop 1, Run Map Resuce and YARN jobs, Creating and code a simple Map Reduce job, Understanding the nature and purpose of Apache Spark in the Hadoop ecosystem, Listing and describing the architecture and components of the Spark unified stack , Describing the role of a Resilient Distributed Dataset (RDD), Understanding the principles of Spark programming, Listing and describing the Spark libraries, Launching and using Spark's Scala and Python shells, Working with Spark RDD with Scala, Listing the characteristics of representative data file formats, including flat/text files, CSV, XML, JSON, and YAML, Listing the characteristics of the four types of NoSQL datastores, Describing the storage used by HBase in some detail, Describing and compare the open source programming languages, Pig and Hive, Listing the characteristics of programming languages typically used by Data Scientists: R and Python, Understanding the challenges posed by distributed applications and how Zoo Keeper is designed to handle them, Explaining the role of Zoo Keeper within the Apache Hadoop infrastructure and the realm of Big Data management, Exploring generic use cases and some real-world scenarios for Zoo Keeper, Defining the Zoo Keeper services that are used to manage distributed systems, Exploring and use the Zoo Keeper CLI to interact with Zoo

Keeper services, Understanding how Apache Slider works in conjunction with YARN to deploy distributed applications and to monitor them, Explaining how Apache Knox provides peripheral security services to an Hadoop cluster, Listing some of the load scenarios that are applicable to Hadoop, Understanding how to load data at rest, Understanding how to load data in motion, Understanding how to load data from common sources such as a data warehouse, relational database, web server, or database logs, Explaining what Sqoop is and how it works, Describing how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems, Briefing introduction to what Flume is and how it works, Moving data into HDFS with Sqoop, Explaining the need for data governance and the role of data security in this governance, Listing the Five Pillars of security and how they are implemented with HDP, Discussing the history of security with Hadoop, Identifying the need for and the methods used to secure Personal & Sensitive Information, Describing the function of the Horton works Data Plane Service (DPS), Defining streaming data, Describing IBM as a pioneer in streaming data - with System S IBM Streams, Explaining streaming data - concepts & terminology, Comparing and contrasting batch data vs streaming data, Listing and explaining streaming components & Streaming Data Engines (SDEs)

Unit II: **10 lecture hours**

Understanding Data Science and Notebooks: Working with Spark RDD with Scala, Listing the characteristics of representative data file formats, including flat/text files, CSV, XML, JSON, and YAML, Listing the characteristics of the four types of NoSQL data stores, Describing the storage used by HBase in some detail, Describing and compare the open source programming languages, Pig and Hive, Listing the characteristics of programming languages typically used by •Data Scientists: R and Python, Understanding the challenges posed by distributed applications and how Zoo Keeper is designed to handle them, Explaining the role of Zoo Keeper within the Apache Hadoop infrastructure and the realm of Big Data management, Exploring generic use cases and some real-world scenarios for Zoo Keeper, Defining the Zoo Keeper services that are used to manage distributed systems, Exploring and use the Zoo Keeper CLI to interact with Zoo Keeper services, Understanding how Apache Slider works in conjunction with YARN to deploy distributed applications and to monitor them, Explaining how Apache Knox provides peripheral security services to an Hadoop cluster, Listing some of the load scenarios that are applicable to Hadoop, Understanding how to load data at rest, Understanding how to load data in motion, Understanding how to load data from common sources such as a data warehouse, relational database, web server, or database logs, Explaining what Sqoop is and how it works, Describing how Sqoop can be used to import data from relational systems into Hadoop and export data from Hadoop into relational systems, Briefing introduction to what Flume is and how it works, Moving data into HDFS with Sqoop, Explaining the need for data governance and the role of data security in this governance, Listing the Five Pillars of security and how they are implemented with HDP, Discussing the history of security with Hadoop, Identifying the need for and the methods used to secure Personal & Sensitive Information, Describing the function of the Horton works Data Plane Service (DPS), Defining streaming data, Describing

IBM as a pioneer in streaming data - with System, Streams, Explaining streaming data - concepts & terminology, Comparing and contrasting batch data vs streaming data, Listing and explaining streaming components & Streaming Data Engines (SDEs), Data visualizations: matplotlib, PixieDust, Using Jupyter "Magic" commands, Start Jupyter - it will open in a web browser, Importing the lab file (all Jupyter files have a.ipynb suffix) into your default workspace, This is now a copy of the provided lab file and you can do anything with it, If you mess it up, you can re-import again later, Exploring the component panels - some are markdown, some are code, some are results of running the code (output data, visualizations, …), Learning how to run single panels - and then the whole script oYou may need to adjust the provided script to locate the data files that accompany the Jupyter.ipynb file, Add some additional panels, as described in the lab script

Unit III: **12 lecture hours**

BigSQL and Watson Studio: Overview of Big SQL, Understanding how Big SQL fits in the Hadoop architecture, Start and stop Big SQL using Ambari and command line, Connecting to Big SQL using command line, Connecting to Big SQL using IBM Data Server Manager, Configuring images, Starting Hadoop components, Start up the Big SQL and DSM services, Connecting to Big SQL using JSqsh, Executing basic Big SQL statements, Exploring Big SQL through Ambari using DSM, Describing and creating Big SQL schemas and tables, Describing and listing the Big SQL data types, Working with various Big SQL DDLs ,Loading data into Big SQL tables using best practices, Creating and dropping simple Big SQL table, Creating sample tables, Moving data into HDFS, Loading data into Big SQL tables Creating and working with views, Creating external tables, Describing Big SQL supported file formats, Query Big SQL tables using various DMLs, Connecting to Big SQL, Query data with Big SQL, Working with the ARRAY type, Working with Big SQL functions, Storing data in an alternate file format (Parquet), Configuring the Big SQL Server, Configuring the Big SQL Scheduler, Listing the registries for compiler and runtime performance improvement •Backup and restore Big SQL, Updating the database resource percentage for the Big SQL database instance, Inspecting the Big SQL scheduler configuration file, Viewing the registries for the compiler and runtime performance improvement, Configuring authentication for Big SQL, Managing security with Apache Ranger, Enabling SSL encryption, Configuring authorization of Big SQL objects, Configuring impersonation in Big SQL, Understanding the concept of Big SQL federation, Listing the supported data sources, Set up and configure a federation server to use different data sources, Configuring Fluid Query with Big SQL, What is Watson Studio?, Setting up a project, Working with collaborators, Managing data assets, Sign up for a Watson Studio account, Creating a new project, Managing a project, Adding collaborators, Loading data, Managing the object storage, Overview of Jupyter notebooks, Creating notebooks, Coding and running notebooks, Sharing and publishing notebooks, Creating a notebook , Using notebooks, Working with external data.

Text Books

1. IBM Material

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

Examination Scheme:

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

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

Mapping between COs and Pos		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the brief description of the purpose of each of the value-add components.	**PO1**
CO2	Understand Hortonworks Data Platform (HDP)	**PO4**
CO3	Understand Apache Ambari	**PO5**
CO4	Understand Hadoop and the Hadoop Distributed File System, MapReduce and Yarn, Apache Spark.	**PO2**
CO5	Understand Zoo Keeper, Slider, and Knox	**PO3**
CO6	Loading data with Sqooq	**PO3**

Ethical and Professional Issues	PSO3	2
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex problems	PO4	3
Design/development of solutions	PO3	3
Problem analysis	PO2	3
Engineering Knowledge	PO1	3
	Course Title	Big Data Analytics
	Course Code	ETCS317A

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

ETCA227A	Web Based Programming using PHP	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Learn about web-servers
2. Understanding the HTTP protocol
3. Understand scripting fundamentals
4. Introduction of PHP language and deployment
5. Understanding application architectures

Course Outcomes

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

CO1. Write simple applications in PHP

CO2. Learn and utilize databases with PHP

CO3. Learn PHP advanced features

CO4. Create full-fledged web-applications and deploy them

Course Overview:

This course aims at highlighting the features of different technologies involved in Web Development. It provides a ground-up look at web-servers, scripting languages (PHP), databases and a clear understanding on how to create web applications.

Course Content

Unit I: **8 lecture hours**

Introduction to web applications: HTML, Client-Side Scripting Vs Server-Side Scripting, Web Servers: Local Servers and Remote Servers, Installing Web servers, Internet Information Server (IIS) and Personal Web Server (PWS). Static website vs Dynamic website development.

Unit II: **12 lecture hours**

Introduction to PHP: Start and End Tags of PHP, Data types in PHP, Variables, Constants, operators and Expressions, printing data on PHP page, Control statements – if, switch case, for, while, do while.

Arrays: Initialization of an array, Iterating through an array, Sorting arrays, Array Functions

Functions: Defining and Calling Functions, Passing by Value and passing by references, Inbuilt Functions.

Unit III: 12 lecture hours

Working with Forms: Get and Post Methods, Query strings, HTML form controls and PHP

Maintaining User State: Cookies, Sessions and Application State.

Working with Files: Opening and Closing Files, Reading and Writing to Files, Getting Information on Files, OOP's – Instantiation, Modifiers, Inheritance, Interfaces, Exceptions, Static Methods and properties, Auto load, Reflection, Type Hinting and class constant.

Unit IV: 8 lecture hours

PHP Database Connectivity: Introduction to MYSQL, creating database and other operations on database, connecting to a database, use a particular database, sending query to database, Parsing of the query results, Checking data errors. MVC overview, security, Ajax basics, PHP with Ajax

Text Books

1. RasmusLerdorf and Kevin Tatroe, "Programming PHP", O'Reilly.

Reference Books/Materials

1. Robin Nixon, "PHP, MySQL, and JavaScript: A Step-By-Step Guide to Creating Dynamic Websites", O'Reilly Media

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Write simple applications in PHP	**PO1**
CO2	Learn and utilize databases with PHP	**PO4**
CO3	Learn PHP advanced features	**PO5**
CO4	Create full-fledged web-applications and deploy them	**PO2**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCA227A	PHP	2	3		3	3										

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

ETCS314A	Data Visualization and Story Telling	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Design and create data visualizations.
CO2. Conduct exploratory data analysis using visualization.
CO3. Craft visual presentations of data for effective communication.

Catalog Description

Designed to help you become a successful Data Analyst, this Subject is for those just starting their career in Analytics. It will teach you how to understand data fundamental, analyse the data methodology, techniques, powerful dashboards, Power BI & Visualization power of data along with a strong focus on case studies to ensure hands on learning. Once armed with analytics, you will also learn the powerful data visualization tool like Advanced version of Excel, Power Map, Power BI, Business Intelligence software, Tableau desktop version & other open source tools etc to present your analysis.

Course Content

Unit I: **10 lecture hours**

INTRODUCTION TO DATA HANDLING Overview of Data analysis, Introduction to Data visualization, Working with statistical formulas - Logical and financial functions , Data Validation & data models, Power Map for visualize data , Power BI-Business Intelligence , Data Analysis using statistical methods, Dashboard designing.

Unit II: **10 lecture hours**

INTRODUCTION TO DATA MANIPULATION USING FUNCTION: Heat Map, Tree Map, Smart Chart, Azure Machine learning , Column Chart, Line Chart , Pie, Bar, Area, Scatter Chart, Data Series, Axes, Chart Sheet , Trend line , Error Bars, Spark lines, Combination Chart, Gauge, Thermometer Chart, Gantt Chart , Pareto Chart etc , Frequency

Distribution, Pivot Chart, Slicers , Tables: Structured References, Table Styles , What-If Analysis: Data Tables| Correlation model |Regression model.

Unit III: **10 lecture hours**

Data Strategy & Consumer behaviour Analytics: Understanding Product & Category, Competitive Analysis, Market Share understanding- Market potential Index, Seasonality-Sales Trending, Consumer behaviour Analytics-MIND AND MARKET FACTORS, Budget planning & Execution- MIMI, Regression & Correlation Analysis for Sales trending, Forecasting method with predictive investment modelling, Cohort Analysis, Google Analytics(GA), Case Studies-Assignments.

Unit IV: **10 lecture hours**

TABLEAU SOFTWARE: GETTING STARTED WITH TABLEAU SOFTWARE: What is Tableau? What does the Tableau product suite comprise of? How Does Tableau Work? Tableau Architecture, What is My Tableau Repository? Connecting to Data & Introduction to data source concepts, Understanding the Tableau workspace, Dimensions and Measures, Data Types & Default Properties, Building basic views, Saving and Sharing your work-overview.

Text Books

1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

Reference Books/Materials

1. Julie Steele, Noah Iliinsky, Beautiful Visualization, Looking at Data Through the Eyes of Experts, O′Reilly.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and create data visualizations.	**PO3**
CO2	Conduct exploratory data analysis using visualization.	**PO4**
CO3	Craft visual presentations of data for effective communication.	**PO10**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional
ETCS314A	Data Visualization and Story Telling			3	3						3			3		

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

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

Course Objectives

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

Course Outcomes

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

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

Catalog Description

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

Course Content

Unit I: 8 lecture hours

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

Unit II: 12 lecture hours

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and

Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA

Unit III: **12 lecture hours**

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

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

Unit IV: **8 lecture hours**

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

Text Books

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	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	Project Management	Ethical and Professional Issues
ETCS304A	Computer Networks		3		3	3						3	3	2	2	

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

ETCS315A	Foundation of Neural Network and Deep Learning	L	T	P	C
Version 1.0		2	-	-	2
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.

Course Outcomes

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

CO1. Neural Network, Feed Forward and Backpropogation.
CO2. Tensorflow and Keras.
CO3. RNN, CNN, Autoencoders.

Catalog Description

The course begins with key concepts of neural networks, feed-forward neural network, and backpropogation. The student gets an opportunity to learn the programming languages (TensorFlow) to design the deep learning models. The student learns the concepts behind CNN, RNN, LSTM, Autoencoders, and GANs. The hands on learning will help build strong knowledge base for designing advanced deep learning models.

Course Content

Unit I: **10 lecture hours**

The neural network: The neuron, linear perceptron, feed-forward neural network, limitations of linear neurons, sigmoid, tanh, relu neurons, softmax output layer, information theory, cross entropy, Kullback-Leibler divergence.

Unit II: **10 lecture hours**

Training feed-forward neural network: Gradient Descent, delta rules and learning rates, gradient descent with sigmoidal neurons, the backpropagation algorithms, stochastic and minibatch gradient descent, test sets, validation sets and overfitting, preventing overfitting.

Unit III: **10 lecture hours**

TensorFlow: Computation graphs, graphs, sessions and fetches, constructing and managing graph, flowing tensors, sessions, data types, tensor arrays and shapes, names, variables, placeholders and simple optimization, linear regression and logistic regression using tensorflow.

Unit IV: **10 lecture hours**

Implement Neural Network: Introduction to Keras, Build neural network using Keras, Evaluating models, data preprocessing, feature engineering, feature learning, overfitting, underfitting, weight regularization, dropout, universal workflow of deep learning.

Text Books

1.Francois Chollet, Deep Learning with Python, Manning Publications.

Reference Books/Materials

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach, Deep Learning, MIT Press.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Neural Network, Feed Forward and Backpropogation.	PO1
CO2	Tensorflow and Keras.	PO3
CO3	RNN, CNN, Autoencoders.	PO2

Ethical and Professional	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and	PO7	
The engineer and	PO6	
Modern tool usage	PO5	
Conduct investigations	PO4	
Design/development of	PO3	3
Problem analysis	PO2	3
Engineering Knowledge	PO1	3
	Course Title	Foundation of Neural Network and Deep Learning
	Course Code	ETCS315A

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

ETCA 267A	WEB BASED PROGRAMMING USING PHP LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. Understand the fundamentals of web.
2. Develop basic WebPages.
3. Use different styles to the webpage elements
4. Create, modify and format the contents of webpage with CSS
5. Create dynamic., Interactive WebPages using JavaScript
6. Apply basic controls of elements with JavaScript
7. Use JavaScript to validate form entries
8. Study the server-side scripting language, PHP
9. Understand the PHP Get and Post methods working difference
10. Develop knowledge of MySQL commands
11. Use PHP to access a MySQL database.

Course Outcomes

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

CO1.Describe fundamentals of web.
CO2. Introduce the creation of static webpage using HTML.
CO3. Describe the importance of CSS in web development.
CO4. Describe the function of JavaScript as a dynamic webpage creating tool.
CO5. Distinguish PHP as a server-side programming language.
CO6. Outline the principles behind using MySQL as a backend DBMS with PHP.

Catalog Description

This course aims at highlighting the features of different technologies involved in Web Development. It provides a ground-up look at web servers, scripting languages (PHP), databases and a clear understanding on how to create web applications.

List of Experiments (Indicative)

1	WAP using Client side scripting to perform arithmetical tasks and display results.	**2 lab hours**
2	WAP in PHP to accept values from user and check the eligibility to vote, and print result on screen.	**2 lab hours**
3	WAP in PHP to display table of a given no.	**2 lab hours**

4	WAP to transfer data from one page to another using PHP. Working in forms and using get and post method.	**2 lab hours**
5	WAP to manage data and information across the pages like in shopping carts etc.	**2 lab hours**
6	WAP a program to count total numbers of hit (visitor no) on the site and also total no of users online.	**4 lab hours**
7	Make a page to store the data in file and reading the data from file.	**4 lab hours**
8	Make an application to upload image file to website and display on site. Image to be uploaded dynamically using PHP controls etc.	**4 lab hours**
9	Write SQL Commands to create database, create a table in it and store data in this table. Also write commands to search and delete the record.	**4 lab hours**
10	Write PHP code to connect to database (MySQL) , and perform following operations	**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	Describe fundamentals of web.	**PO2**
CO2	Introduce the creation of static webpage using HTML.	**PO3**
CO3	Describe the importance of CSS in web development.	**PO5**
CO4	Describe the function of JavaScript as a dynamic webpage creating tool.	**PO8**
CO5	Distinguish PHP as a server-side programming language.	**PO1**

CO6	Outline the principles behind using MySQL as a backend DBMS with PHP.	**PO3**

	Course Code	ETCA267A
	Course Title	Web Based Programming Using Php Lab
Engineering Knowledge	PO1	2
Problem analysis	PO2	3
Design/development of solutions	PO3	3
Conduct investigations of complex	PO4	
Modern tool usage	PO5	2
The engineer and society	PO6	
Environment and sustainability	PO7	
Ethics	PO8	2
Individual or team work	PO9	
Communication	PO10	
Project management and finance	PO11	
Life-long Learning	PO12	
Application of Concepts	PSO1	
Project Management	PSO2	
Ethical and Professional Issues	PSO3	

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

ETEC 371A	**Quantitative Aptitude Reasoning-I**	L	T	P	C
ETEC 371A	**Quantitative Aptitude Reasoning-I**	L	T	P	C
Version 1.0		**-**	**-**	**2**	**1**
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

The subject expects students to achieve the following objectives:

1. To develop critical thinking skills
2. To develop the ability to analyze ideas, question assumptions and assess arguments
3. To clarify and interpret concepts and propositions.

Course Outcomes:

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

CO1. Understand and analyze the costs and benefits associated with various Information Systems projects.

CO2 Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.

CO3 Understand the various reasoning concepts to apply in practical life.

Catalog Description

Quantitative Aptitude Reasoning-I is designed for students who have basic knowledge of simple mathematical calculations and Collegiate Learning skills.

Course Content

Unit I: **10 hours**

Numbers, H.C.F. & L.C.M. of Numbers, Decimal Fractions Simplification, Square Roots & Cube Roots, Whole numbers problems, Permutations and Combination, Decimals problems, Problems on Trains, Fractions problems, Numbers and Ages, Percentage problems.

Unit II: **8 hours**

Boats and Streams, Ratio & Proportion, Pipes and Cistern, Square roots, Surds and Indices, Averages, Interest, Heights and Distances, Profit and Loss, Discount, Partnership.

Unit III: **8 hours**

Business, Permutations and Combination, Mixture and Alligation, Time and distance Series, Time & Work, The Data Interpretation part covers Tabulation, Volume & Surface Areas, Races & Games of Skill, Calendar, Clocks.

Unit IV: **10 hours**

Stocks & Shares, Permutations & Combinations, Probability, True Discount, Banker's Discount, Heights & Distances, Odd Man Out & Series, Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graph.

Textbooks:

1. Quantitative Aptitude for Competitive Examination by R S Agrawal, S. Chand publications.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill 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	Understand and analyze the costs and benefits associated with various Information Systems projects.	PO2
CO2	Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.	PO3
CO3	Understand the various reasoning concepts to apply in practical life.	PO4

Ethics and Communication Skills	PSO3	
Innovation and Industry Friendly	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or teamwork	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	2
Problem analysis	PO2	3
Engineering Knowledge	PO1	
	Course Title	Quantitative Aptitude Reasoning-I
	Course Code	ETEC 371A

1 weakly mapped
2= moderately mapped
3=strongly mapped

ETCS364A	Big Data Analysis Lab	L	T	P	C
Version 1.0	--	0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Big Data and Data Analytics
2. Hortonworks Data Platform (HDP)
3. Apache Ambari
4. Hadoop and the Hadoop Distributed File System
5. MapReduce and Yarn
6. Apache Spark

Course Outcomes

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

CO1. Learn Storing and Querying data
CO2. Learn about ZooKeeper, Slider, and Knox
CO3. Loaddata with Sqooq
CO4. Learn Dataplane Service
CO5. Understand Stream Computing
CO6. Understand Data Science essentials
CO7. Understand Drew Conway's Venn Diagram - and that of others
CO8. Understand the Scientific Process applied to Data Science

Catalog Description

This course will expose the students to the data analytics practices executed in the business world. We will explore such key areas as the analytical process, how data is created, stored, accessed, and how the organization works with data and creates the environment in which analytics can flourish.

This course will give the students a strong foundation in all the areas that support analytics and will help them to better position themselves for success within the organization. Students will develop skills and a perspective that will make them more productive.

List of Experiments (Indicative)

1	Implement the following file management tasks in Hadoop: Adding files and directories · Retrieving files · Deleting file	**2 lab hours**
2	Install and Run Hive then use Hive to create,load, alter, and drop databases, tables, joins	**2 lab hours**
3	Implement Hive Partitioning and bucketing with data set.	**2 lab hours**
4	Install and Run Pig then write Pig Latin scripts to sort, group, join and filter your data.	**2 lab hours**
5	Implement sqoop commands.	**2 lab hours**
6	Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm with data set.	**4 lab hours**
7	Working with Jupyter Notebooks. ● Creating notebooks ● Coding and running notebooks ● Sharing and publishing notebooks ● Creating a notebook ● Using notebooks	**4 lab hours**
8	Create Big SQL table and load dataset into table.	**4 lab hours**
9	Implement Hbase commands with data set.	**4 lab hours**
10	Managing the Big SQL Server ● Update the database resource percentage for the Big SQL database instance ● Inspect the Big SQL scheduler configuration file ● View the registries for compiler and runtime performance Improvement	**4 lab hours**
11	Analyzing data with Watson Studio • Run through a sample notebook in Watson Studio • Use PixieDust for data visualization	**4 Lab Hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Learn Storing and Quering data	PO2
CO2	Learn about ZooKeeper, Slider, and Knox	PO3
CO3	Load data with Sqooq	PO5
CO4	Learn Dataplane Service	PO4
CO5	Understand Stream Computing	PO1
CO6	Understand Data Science essentials	PO4
CO7	Understand Drew Conway's Venn Diagram - and that of others	PO4
CO8	Understand the Scientific Process applied to Data Science	PO6

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS364 A	Analysis Lab	2	3	3	3	2								3		3

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

ETCA367A	Practical Training	L	T	P	C
Version 1.0		0	0	2	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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
ETCA367A	Practical Training			3		3		2			3					

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

ETCS461A	Data Visualization and Story Telling Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The basic objective is to understand the data analysis & visualize your data & method, understanding models not just a tool-oriented Analyst.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Design and create data visualizations.
CO2. Conduct exploratory data analysis using visualization.
CO3. Craft visual presentations of data for effective communication.

Catalog Description

This course complements ETCS314A. Designed to help you become a successful Data Analyst, this Subject is for those just starting their career in Analytics. It will teach you how to understand data fundamental, analyse the data methodology, techniques, powerful dashboards, Power BI & Visualization power of data along with a strong focus on case studies to ensure hands on learning. Once armed with analytics, you will also learn the powerful data visualization tool like Advanced version of Excel, Power Map, Power BI,Business Intelligence software, Tableau desktop version & other open source tools etc to present your analysis.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS314A.

Text Books

1.Stephen Few, Information Dashboard Design: Displaying Data for At-a-glance Monitoring, Analytics Press.

Reference Books/Materials

1. Julie Steele, Noah Iliinsky, Beautiful Visualization, Looking at Data Through the Eyes of Experts, O′Reilly.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Design and create data visualizations.	**PO3**
CO2	Conduct exploratory data analysis using visualization.	**PO4**
CO3	Craft visual presentations of data for effective communication.	**PO10**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS461A	Visualization and Story			3	3						3			3		

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

ETCS359A	Foundation of Neural Network and Deep Learning Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

The objective of this course is to teach students the basic concepts of neural networks, neurons, and deep learning.

Course Outcomes

On completion of this course, the students will be able to learn:-
CO1. Neural Network, Feed Forward and Backpropogation.
CO2. Tensorflow and Keras.
CO3. RNN, CNN, Autoencoders.

Catalog Description

This course complements ETCS315A. It enables them to write algorithms/programs for implementing neural networks, feed-forward neural network, and backpropogation. The student gets an opportunity to implement the programming languages (TensorFlow) to design the deep learning models. The student learns the concepts behind CNN, RNN, LSTM, Autoencoders, and GANs. The hands on learning will help build strong knowledge base for designing advanced deep learning models.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCS315A.

Text Books

1.Francois Chollet, Deep Learning with Python, Manning Publications.

Reference Books/Materials

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, Francis Bach, Deep Learning, MIT Press.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Neural Network, Feed Forward and Backpropogation.	PO1
CO2	Tensorflow and Keras.	PO3
CO3	RNN, CNN, Autoencoders.	PO2

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional
ETCS359A	Network and Deep Learning Lab	3	3	3										3		

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

Semester VI

ETCS314A	MOBILE COMPUTING	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced of Computer communication				
Co-requisites	--				

Course Objectives

1. Define mobile technologies in terms of hardware, software, and communications.
2. Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
3. Evaluate the effectiveness of different mobile computing frameworks.
4. Describe how mobile technology functions to enable other computing technologies.

Course Outcomes

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

CO1. Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.
CO2. Evaluate the effectiveness of different mobile computing frameworks.

CO3. Describe how mobile technology functions to enable other computing technologies.

Catalog Description

This course will cover the nomenclature and implementation of mobile computing and mobile communication. Coverage mobile systems will include 2G, 2.5G, 3G, 3G+, and 4G communication systems, mobile satellite communication networks, mobile IP, mobile TCP, digital audio-video broadcasting, and mobile TV. This course will also provide a systematic explanation of mobile computing as a discrete discipline and will provide an in-depth coverage of mobile systems and devices, mobile operating systems used for application development, mobile databases, client-server computing agents, application servers, security protocols, and mobile Internet, and ad-hoc and sensor networks.

Course Content

UNIT I **12 LECTURE HOURS**

Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signaling.

Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes.

UNIT II **8 LECTURE HOURS**

Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.

Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless markup Languages (WML).

UNIT III **12 LECTURE HOURS**

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G.

Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

UNIT IV **12 LECTURE HOURS**

Global Mobile Satellite Systems: case studies of the IRIDIUM and GLOBALSTAR systems.

Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.

TEXT BOOKS:

1. Yi-Bing Lin &ImrichChlamtac, “Wireless and Mobile Networks Architectures”, John Wiley & Sons.

REFERENCE BOOKS:

1. Mark Ciampa, “Guide to Designing and Implementing wireless LANs”, Thomson learning, Vikas Publishing House.

2. Ray Rischpater, “Wireless Web Development”, Springer Publishing.

3. P.Stavronlakis, “Third Generation Mobile Telecommunication systems”, Springer Publishers.

4. Hansmann, “Principles of Mobile Computing”, 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	Utilize mobile computing nomenclature to describe and analyze existing mobile computing frameworks and architectures.	PO1, PO2
CO2	Evaluate the effectiveness of different mobile computing frameworks.	PO3, PO4
CO3	Describe how mobile technology functions to enable other computing technologies.	PO10, PSO1, PSO2

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Course Code	Course Title	Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Innovation and Industry Friendly	Ethics and Communication Skills
ETCS314	COMPUT	2	2	2	2						2			3	3	

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

ETCS422A	Cloud Computing	L	T	P	C
Version 1.0		4	0	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To provide students with the fundamentals and essentials of Cloud Computing.
2. To provide students a sound foundation of the Cloud Computing so that they are able to start using and adopting Cloud Computing services and tools in their real-life scenarios.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

Course Outcomes

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

CO1. Implement a public cloud instance using a public cloud service provider.

CO2. Explain the core concepts of the cloud computing paradigm: how and why this paradigm shift came about, the characteristics, advantages and challenges brought about by the various models and services in cloud computing.

CO3. Apply the fundamental concepts in data centres to understand the trade-offs in power, efficiency and cost.

CO4. Apply trust-based security model to different layers.

CO5. Develop a risk-management strategy for moving to the Cloud.

CO6. Describe big data and use cases from selected business domains.

CO7.Identify resource management fundamentals, i.e. resource abstraction, sharing and sandboxing and outline their role in managing infrastructure in cloud computing.

CO8. Analyze various cloud programming models and apply them to solve problems on the cloud.

Catalog Description

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. Its focus is on parallel programming techniques for cloud computing and large-scale distributed systems which form the cloud infrastructure. The topics include overview of cloud computing, cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems. Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, Yahoo, VMWare, etc. Students will also apply what they learn in one programming assignment and one project executed over Amazon Web Services.

Course Content

Unit I: **10 lecture hours**

Introduction: Cloud computing fundamentals, the role of networks in Cloud computing, Essential characteristics of Cloud computing, Cloud deployment model, Cloud service models, Multi-tenancy, Cloud cube model, Cloud economics and benefits, Cloud types and service scalability over the cloud, challenges in cloud NIST guidelines, Cloud economics and benefits, Cloud computing platforms - IaaS: Amazon EC2, PaaS: Google App Engine, Microsoft Azure, SaaS. Open Source platforms: Open Stack.

Unit II: **6 lecture hours**

Virtualization, Server, Storage and Networking: Virtualization concepts, types, Server virtualization, Storage virtualization, Storage services, Network virtualization, service virtualization, Virtualization management, Virtualization technologies and architectures, Internals of virtual machine, Measurement and profiling of virtualized applications. Hypervisors: KVM, Xen, Hyper V, VMware hypervisors and their features.

Unit III: **10 lecture hours**

Data in Cloud Computing: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map Reduce and extensions: Parallel computing, the map-Reduce model, Parallel efficiency of Map Reduce, Relational operations using Map-Reduce, Enterprise batch processing using Map Reduce.

Cloud Security: Cloud security fundamentals, Vulnerability assessment tool for cloud, Privacy and Security in cloud. Cloud computing security architecture: General Issues, Trusted Cloud computing, Secure Execution Environments and Communications, Micro - architectures; Identity Management and Access control, Autonomic security, Security challenges: Virtualization security management - virtual threats, VM Security Recommendations, VM - Specific Security techniques, Secure Execution Environments and Communications in cloud.

Unit IV: **8 lecture hours**

Issues in Cloud Computing: Implementing real time application over cloud platform, Issues in Inter -cloud environments, QOS Issues in Cloud, Dependability, data migration, streaming in Cloud. Quality of Service (QoS) monitoring in a Cloud computing environment. Cloud Middleware. Mobile Cloud Computing. Inter Cloud issues. A grid of clouds, Sky computing, load balancing, resource optimization, resource dynamic reconfiguration, Monitoring in Cloud

Text Books

1. Cloud Computing, Dr. Kumar Saurabh, Wiley Publication

Reference Books/Materials

1. Cloud computing – Automated virtualized data center, VenkataJosyula, CISCO Press

2. Cloud and virtual data storage networking, Greg Schulr CRC Press

3. Handbook of Cloud Computing, BorkoFurht, 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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCS422A	Cloud Computing	2	3	3	2	3				3				3		

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

ETCS 202A	Software Engineering	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	None				
Co-requisites	--				

Course Objectives

1. The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
2. Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

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

CO1. To learn and understand the Concepts of Software Engineering
CO2. To Learn and understand Software Development Life Cycle
CO3. To apply the project management and analysis principles to software project development.
CO4. To apply the design & testing principles to software project development.
CO5. Ability to execute tests, design test cases, use test tools, etc.
CO6. To Study about Software maintenance tools

Catalog Description

This course covers the fundamentals of software engineering, including understanding system requirements, finding appropriate engineering compromises, effective methods of design, coding, and testing, team software development, and the application of engineering tools.

Course Content

Unit I: **8 lecture hours**

Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques, requirements analysis using DFD, Data dictionaries & ER Diagrams, Requirement documentation, Nature of SRS, Characteristics & organization of SRS.

Unit II: **12 lecture hours**

Software Metrics: Software measurements: What & Why, Token Count, Size Estimation like lines of Code & Function Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics, Cost Estimation Models: COCOMO,COCOMO-II.

System Design: Design Concepts, design models for architecture, component, data and user interfaces; Problem Partitioning, Abstraction, Cohesiveness, Coupling, Top Down and Bottom-Up design approaches; Functional Versus Object Oriented Approach, Design Specification.

Coding: TOP-DOWN and BOTTOM-UP structure programming, Information Hiding, Programming Style, and Internal Documentation, Verification.

Unit III: **8 lecture hours**

Unified Approach and Unified Modeling Language: The Unified Approach: Layered Approach to OO Software Development, UML: UML Diagrams for Structure Modeling, UML Diagrams for Behavior Modeling, UML Diagram for Implementation and deployment modeling.

Software Reliability: Importance, Hardware Reliability & Software Reliability, Failure and Faults, Reliability Models, Basic Model, Logarithmic Poisson Model, Software Quality Models, CMM & ISO 9001.

Unit IV: **12 lecture hours**

Software Testing: Testing process, Design of test cases, functional testing: Boundary value analysis, Equivalence class testing, Decision table testing, Cause effect graphing, Structural testing, Path Testing, Data flow and mutation testing, Unit Testing, Integration and System Testing, Debugging, Alpha & Beta Testing, Testing Tools & Standards.

Software Maintenance: Management of Maintenance, Maintenance Process, Maintenance Models, Regression Testing, Reverse Engineering, Software Re-engineering, Configuration Management, Documentation.

Text Books

1. K. K. Aggarwal & Yogesh Singh, “Software Engineering”, New Age International.
2. R. S. Pressman, “Software Engineering – A practitioner’s approach”, McGraw Hill Int. Ed.
3. W.S. Jawadekar, “Software Engineering – Principles and Practices”, McGraw Hill

Reference Books/Materials

1. Stephen R. Schach, "Classical &Object Oriented Software Engineering", IRWIN, TMH.
2. James Peter, W. Pedrycz, "Software Engineering: An Engineering Approach", John Wiley & Sons.
3. I. Sommerville, "Software Engineering", Addison Wesley.
4. K. Chandrasehakhar, "Software Engineering & Quality Assurance", BPB.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	To learn and understand the Concepts of Software Engineering	**PO1**
CO2	To Learn and understand Software Development Life Cycle	**PO1**
CO3	To apply the project management and analysis principles to software project development.	**PO3, PO11**
CO4	To apply the design & testing principles to software project development.	**PO3**
CO5	Ability to execute tests, design test cases, use test tools, etc.	**PO4**
CO6	To Study about Software maintenance tools	**PO2, PO5**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional
ETCS 202A	Software Engineering	3	3	3	3	3						2		3	3	2

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

ETCS401A	Artificial Intelligence	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

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

CO1. Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques.
CO2. Apply these techniques in applications which involve perception, reasoning and learning.
CO3. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CO4. Acquire the knowledge of real world Knowledge representation.
CO5. Analyze and design a real world problem for implementation and understand the dynamic behavior of a system.
CO6. Use different machine learning techniques to design AI machine and enveloping applications for real world problems.
CO7.Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Catalog Description

The course introduces the theoretical building blocks necessary to create intelligent machines. While we may struggle to define intelligence in an absolute sense, we can agree upon multiple approaches toward creating AI; from an initial attempt at acting humanly to a broader context of acting rationally. Solving problems which are seemingly simple for humans can seem like insurmountable hurdles for machines.

Course Content

Unit I: **8 lecture hours**

Scope of AI: Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, AI techniques-search knowledge, abstraction. Problem Solving (Blind): State space search; production systems, search space control; depthfirst, breadth-first search. Heuristic Based Search: Heuristic search, Hill climbing, best-first search, A* Algorithm, Problem Reduction, Constraint Satisfaction

Unit II: **12 lecture hours**

Knowledge Representation: Predicate Logic: Unification, Modus Ponens, Modus Tokens, Resolution in Predicate Logic, Conflict Resolution Forward Chaining, Backward Chaining, Declarative and Procedural Representation, Rule based Systems. Structured Knowledge Representation: Semantic Nets: Slots, exceptions and default frames, conceptual dependency

Unit III: **12 lecture hours**

Handling Uncertainty: Non-Monotonic Reasoning, Probabilistic reasoning: Bayesian Inference, use of uncertainty factors. Natural Language Processing: Introduction, Syntactic Processing, Semantic Processing, Pragmatic Processing.

Unit IV: **8 lecture hours**

Learning: Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets. Expert Systems: Need and justification for expert systems, knowledge acquisition, Case Studies: MYCIN, RI.

Text Books

1. Artificial Intelligence, E. Rich and K. Knight, TMH.

Reference Books/Materials

1. Artificial Intelligence, P. H. Winston,Pearson Education.
2. Introduction to AI and Expert Systems, D. W. Patterson, PHI.
3. Principles of AI, N. J. Nilsson, Narosa Publishing House

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

Examination Scheme:

Components	Quiz	Quiz	Mid Term	Presentation/	End Term

			Exam	**Assignment/ etc.**	**Exam**
Weightage (%)	**10**	**10**	**20**	**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**

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	2
Problem analysis	PO2	3
Engineering Knowledge	PO1	2
	Course Title	ARTIFICAL INTELLIGENCE
	Course Code	ETCS401A

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**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCA362A	Cloud Computing Lab	2	3	3	2	3				3				3		

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCS451A	Artificial Intelligence Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Prolog/ Python				
Co-requisites	--				

Course Objectives

1. To have clear understanding of the problem-solving processes.
2. To explore Search strategies ranging from blind or uninformed search to heuristic or informed search are discussed.
3. To understand real world always entails uncertainty and the concept of uncertainty is introduced.
4. To know about Probabilistic reasoning, representing knowledge under uncertainty, Bayesian Networks, Exact and approximate inference in Bayesian Networks
5. To gain idea of supervised, unsupervised and reinforcement learning is covered.
6. To introduce the students to the challenges involved in designing intelligent

Course Outcomes

On completion of this course, the students will be able to
CO1. Demonstrate working knowledge in Prolog in order to write simple Prolog programs
CO2. Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)
CO3. Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving
CO4. Know how to build simple knowledge-based systems
CO5.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information

Catalog Description

While AI applications can be developed in any number of different languages, certain language features make programming AI applications straightforward. Prolog is structured in such a way that AI program development is supported by Prolog language features. Other languages, such as Java, support AI programming through code libraries. This course will provide students with an introduction to AI via programming features that support basic AI applications. The main of this course is make students familiar with AI programming and be able to use it in future models to implement various AI applications.

List of Experiments (Indicative)

1	Write a program to solve 8-queens problem in Prolog.	**2 lab hours**

2	Solve any problem using depth first search in Prolog.	**2 lab hours**
3	Solve any problem using best first search in Prolog.	**2 lab hours**
4	Solve 8-puzzle problem using best first search in Prolog.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis.	**2 lab hours**
6	Solve traveling salesman problem in Prolog.	**2 lab hours**
7	Write a Program to Implement Tic-Tac-Toe game in Prolog/python.	**2 lab hours**
8	Write a Program to Implement Water-Jug problem.	**3 lab hours**
9	Write a Program to Implement Monkey Banana Problem using Python.	**2 lab hours**
10	Write a Program to Implement N-Queens Problem.	**4 lab hours**
11	Write a Program to Implement Missionaries-Cannibals Problems.	**4 lab hours**
14	Make a minor project using AI.	**3 lab hours**
15	Study about various applications of AI.	**4 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Demonstrate working knowledge in Prolog in order to write simple Prolog programs	**PO1**

CO2	Understand different types of AI agents know various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction, genetic algorithms)	**PO4**
CO3	Understand the fundamentals of knowledge representation (logic-based, frame-based, semantic nets), inference and theorem proving	**PO5**
CO4	Know how to build simple knowledge-based systems	**PO2**
CO5	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PSO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCS 451A	ARTIFICIAL INTELLIGENCE LAB	2	3		3	3										3

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

ETEC 372A	Quantitative Aptitude Reasoning-II	L	T	P	C
Version 1.0		**-**	**-**	**2**	**1**
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

The subject expects students to achieve the following objectives:

1. To develop critical thinking skills
2. To develop the ability to analyze ideas, question assumptions and assess arguments
3. To clarify and interpret concepts and propositions.

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

CO1. Understand and analyze the costs and benefits associated with various Information Systems projects.
CO2 Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.
CO3 Understand the various reasoning concepts to apply in practical life.

Catalog Description

Quantitative Aptitude Reasoning-II is designed for students who have completed Foundations of Mathematical Reasoning and the co-requisite Frameworks for Mathematics and Collegiate Learning

Course Content

Unit I: 10 hours

Verbal Reasoning: General Mental Ability, Series Completion, Analogy, Classification, Coding-Decoding, Blood Relations, Puzzle Test, Sequential Output Tracing, Direction Sense Test, Logical Venn Diagrams, Alphabet Test, Alpha - Numeric Sequence Puzzle, Number.

Unit II: 10 hours

Ranking & Time Sequence Test, Mathematical Operations, Logical Sequence of Words, Arithmetical Reasoning, Inserting the Missing Character, Data Sufficiency, Eligibility Test, Assertion and Reasoning, Situation Reaction Test, Verification of Truth of the Statement.

Unit III: 8 hours

Logical Deduction, Logic, Statement – Arguments, Statement-Assumptions, Statement - Courses of Action, Statement – Conclusions, Deriving Conclusions from Passages, Theme Detection, Cause and Effect Reasoning.

Unit IV: **12 hours**

Non-Verbal Reasoning: Series Analogy, Classification, Analytical Reasoning, Mirror-Images, Water-Images, Spotting Out the Embedded Figures, Completion of Incomplete Pattern, Figure Matrix, Paper Folding, Paper Cutting, Rule Detection, Grouping of Identical Figures, Cubes and Dice, Dot Situation, Construction of Squares and Triangles, Figure Formation & Analysis.

Textbooks:

1. Quantitative Aptitude for Competitive Examination by R S Agrawal, S. Chand publications.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw hill 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	Understand and analyze the costs and benefits associated with various Information Systems projects.	PO2
CO2	Conduct reasoning to solve organizational problem, make recommendations, and draw logical conclusions.	PO3
CO3	Understand the various reasoning concepts to apply in practical life.	PO4

Ethics and Communication Skills	PSO3	
Innovation and Industry Friendly	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or teamwork	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	2
Problem analysis	PO2	3
Engineering Knowledge	PO1	
	Course Title	Quantitative Aptitude Reasoning-II
	Course Code	ETEC 372A

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

ETCS464A	Major Project	L	T	P	C
Version 1.0		-	-	-	6
Pre-requisites/Exposure	--				
Co-requisites	--				

The course is designed to provide an opportunity to students to demonstrate the ability to devise, select and use a range of methodologies and tools to the Chosen/Given project, applying the theoretical knowledge to a real life situation. Experiential Learning outside classroom through self-exploration, practical experience, Industry, field experience, live experience, research, design projects etc.

The learning process in the Project seeks out and focuses attention on many latent attributes, which do not surface in the normal class room situations. These experiential learning attributes through project includes Intellectual ability, Professional judgment and decision making ability, Inter-disciplinary approach, Skills for data handling, Ability in written and oral presentation, Sense of responsibility Developing professional Skills Application of theory, concepts in given industry /practical / field scenario.

Course Outcomes

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

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.
C02. Use the relevant tools necessary for engineering practice.
CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

Students are expected make a project based on the latest advancements related to the parent branch of Engineering. Students may opt for an in-disciplinary project (if feasible).
The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department. This is expected to provide a good training for the student(s) in technical aspects

Student will be continuously evaluated during the semester in form of Project Progress Seminars. At the end of the semester, assessment of the research/project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.

Course Content

The assignment to normally include:

1. Review and finalization of the Approach to the Problem relating to the assigned topic.
2. Preparing an Action Plan for conducting the investigation, including team work.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Preparing a report in the standard format for being evaluated by the Department.
6. Final project presentation before a Departmental Committee.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.	PO3
CO2	Use the relevant tools necessary for engineering practice.	PO5
CO3	Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.	PO3
CO4	Communicate effectively and learn to be a team player.	PO10

Ethical and Professional	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management	PO11	
Communication	PO10	3
Individual or team work	PO9	
Ethics	PO8	
Environment and	PO7	
The engineer and	PO6	
Modern tool usage	PO5	2
Conduct investigations	PO4	
Design/development of	PO3	3
Problem analysis	PO2	
Engineering Knowledge	PO1	
	Course Title	Major Project
	Course Code	ETCS462A

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

ETCA328A	MULTIMEDIA TECHNOLOGIES	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Multimedia				
Co-requisites	--				

Course Objectives

The students will be able to get an idea on:

1. identify the essential features of graphics/image data types, file formats, and colour models in images and video.
2. explain the technical details of multimedia data representations.
3. perform a comparative analysis of the major methods and algorithms for multimedia data compression.
4. explain the technical details of popular multimedia compression standards.
5. write code and develop a multimedia application using JAI and JMF.
6. explain the principles and technical details of several wired and wireless networking protocols.
7. configure and manage multimedia content delivery platforms.

Course Outcomes

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

CO1. Discuss the technical details of common multimedia data formats, protocols, and compression techniques of digital images, video and audio content.

CO2. Describe and understand the technical details of JPEG and MPEG families of standards.

CO3. Describe the principles and technical details of several wired and wireless networking protocols.

CO4. Develop simple but demonstrative multimedia applications using JAI and JMF.

CO5. Understand and describe technical aspects of popular multimedia web applications including VoD and VoIP

CO6. identify the essential issues of quality of service in multimedia networking.

Catalog Description

Multimedia Technologies is an indispensable part of modern computing environments. This course will explain the technologies underlying digital images, videos and audio contents,

including various compression techniques and standards, and the issues to deliver multimedia content over the Internet. This course is designed for Professional developers who want a technical foundation for developing applications with distributed multimedia components.

Course Content

Unit I: **8 lecture hours**

Introductory Concepts: Multimedia - Definitions, Basic properties and medium types. (Temporal and non-temporal). Multimedia applications, Uses of Multimedia, Introduction to making multimedia - The Stages of project, the requirements to make good multimedia, Multimedia skills and training . Multimedia-Hardware and Software: Multimedia Hardware - Macintosh and Windows production Platforms, Hardware peripherals - Connections, Memory and storage devices, Media software - Basic tools, making instant multimedia, Multimedia software and Authoring tools, Production Standards.

Unit II: **12 lecture hours**

Multimedia building blocks Creating & Editing Media elements: Text, image, Sound, animation Analog/ digital video Data Compression: Introduction, Need, Difference of lossless / lossy compression techniques. Brief overview to different compression algorithms concern to text, audio, video and images etc.

Unit III: **12 lecture hours**

Multimedia and the Internet: History, Internet working, Connections, Internet Services, The World Wide Web, Tools for the WWW - Web Servers, Web Browsers, Web page makers and editors, Plug-Ins and Delivery Vehicles, HTML, Designing for the WWW – Working on the Web, Multimedia Applications - Media Communication, Media Consumption, Media Entertainment, Media games

Unit IV: **8 lecture hours**

Multimedia-looking towards Future: Digital Communication and New Media, Interactive Television, Digital Broadcasting, Digital Radio, Multimedia Conferencing, Virtual Reality, Digital Camera. Assembling and delivering a Multimedia project-planning and costing Designing and Producing, content and talent, Delivering, CD-ROM: The CD family, production process, CD-i – Overview – Media Types Technology

Text Books

1. Tay Vaughan, “Multimedia: Making it work”, TMH.

Reference Books/Materials

1. Ralf Steinmetz and KlaraNaharstedt, “Multimedia: Computing, Communications Applications”, Pearson

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Discuss the technical details of common multimedia data formats, protocols, and compression techniques of digital images, video and audio content.	**PO1**
CO2	Describe and understand the technical details of JPEG and MPEG families of standards.	**PO3**
CO3	Describe the principles and technical details of several wired and wireless networking protocols.	**PO5**
CO4	Develop simple but demonstrative multimedia applications using JAI and JMF.	**PO2, PSO3**
CO5	Understand and describe technical aspects of popular multimedia web applications including VoD and VoIP	**PO4**
CO6	identify the essential issues of quality of service in multimedia networking.	**PO6**

Ethical and Professional Issues	PSO3	3
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	2
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	2
Problem analysis	PO2	
Engineering Knowledge	PO1	2
	Course Title	MULTIMEDIA TECHNOLOGIES
	Course Code	**ETCA328A**

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

ETCA370A	MULTIMEDIA TECHNOLOGIES LAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning of Multimedia				
Co-requisites	--				

Course Objectives

The students will be able to get an idea on:

1. identify the essential features of graphics/image data types, file formats, and colour models in images and video.
2. explain the technical details of multimedia data representations.
3. perform a comparative analysis of the major methods and algorithms for multimedia data compression.
4. explain the technical details of popular multimedia compression standards.
5. write code and develop a multimedia application using JAI and JMF.
6. explain the principles and technical details of several wired and wireless networking protocols.
7. configure and manage multimedia content delivery platforms.

Course Outcomes

Upon completion of the course the students will be able to:
CO1.formulate a working definition of interactive multimedia
CO2.demonstrate competence in using the authoring program HyperStudio;
CO3. demonstrate the use of animation, digitized sound, video control, and scanned images;
CO4.use basic instructional design principles in the development of stacks;
CO5.will develop conceptual maps of content and process for interactive multimedia instructional programs

Catalog Description

Multimedia is the combined use of text, graphics, sound, animation, and video. A primary objective of this workshop is to teach participants how to develop multimedia programs. Another objective is to demonstrate how still images, sound, and video can be digitized on the computer. Participants in this workshop will create their own multimedia courses using HyperStudio on the Macintosh platform. Hyper Studio is an authoring tool that allows you to develop an electronic stack of cards that contain buttons, graphics, and text. Issues concerning multimedia design and its use in education will be the focus of reading and class discussions throughout the course of the workshop.

Course Content

1	Compare different Image Compression Techniques with regards to quality and compression ratios.	**2 lab hours**
2	Study how to create simple animations.	**2 lab hours**
3	Test different audio compression formats using an audio compression tool. Classify your results on the basis of fidelity, size and error tolerance.	**2 lab hours**
4	Learning video compression: Tools, codecs, quality vs. compression and the video quality requirements suitable for different medium.	**2 lab hours**
5	Create a website for a software company which contains all the details of that company and include links to other related web pages.	**2 lab hours**
6	Deploy the webpage to a hosting space. Identify the categories of web hosting services and their characteristics.	**4 lab hours**
7	Understanding principles in designing a simple game.	**4 lab hours**
8	Any other experiments using Flash or other suitable tools.	**4 lab hours**
9	To study about animation Tool.	**4 lab hours**
10	To study about tools for website designing.	**4 lab hours**
11	To explore about Adobe Photoshop.	

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**

CO1	formulate a working definition of interactive multimedia	**PO2**
CO2	demonstrate competence in using the authoring program Hyper Studio;	**PO3**
CO3	demonstrate the use of animation, digitized sound, video control, and scanned images;	**PO5, PSO3, PO9**
CO4	use basic instructional design principles in the development of stacks;	**PO4**
CO5	will develop conceptual maps of content and process for interactive multimedia instructional programs	**PO5**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCA370A	MULTIMEDIA TECHNOLOGIES LAB		2	3	3	3				3						3

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

ETCA330	Network Security & Cryptography	L	T	P	C
Version 1.0					
Pre-requisites/Exposure	Basics of Programming Skills				
Co-requisites	Basics of Mathematics				

Course Objectives

CO1. Build a solid mathematical basis to understand foundations of cryptography and Network Security.
CO2. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
CO3. Formally understand the notions related to security authentication and privacy.
CO4. Provide a rigorous treatment of the emerging and key subject subarea of CSE - security.
CO5. To understand various protocols for network security to protect against the threats in the networks.

Course Outcomes

On completion of this course, the students will be able to understand cryptosystem to protect data security on the internet and generate ideas to solve real life problems.

Catalog Description

This course ETCA330A will teach students to provide security of the data over the network along with research in the emerging areas of cryptography and network security. During this course, student will learn to implement various networking protocols. The course outline will include understanding to protect any network from the threats in the world.

Course Content

Unit I: **8 lecture hours**

Introduction: Plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography.

Unit II: **12 lecture hours**

Symmetric key algorithms: introduction, algorithms types and modes, DES, AES.

Asymmetric key algorithms: introduction, history of asymmetric key cryptography, RSA symmetric and asymmetrickey cryptography together, Digital signature.

Unit III: **8 lecture hours**

Internet security protocols: basic concepts, Secure Socket Layer (SSL), Transport Layer Security (TLS), SecureHyper Text Transfer protocol (SHTTP), Time Stamping Protocol

(TSP), Secure Electronic Transaction (SET), SSL versus SET, Electronic Money, Email Security

Unit IV: **8 lecture hours**

User Authentication and Kerberos: Introduction, Authentication basics, Passwords, authentication tokens, certificate based authentication, biometric based authentication, Kerberos, key distribution center (KDC), Security handshake pitfalls, single sign on(SSO) approach.

Text Books

1. AtulKahate, "Cryptography and Network Security", TMH

2. Mani Subramaniam , "Network Management Principles & Practices" AWL

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	Build a solid mathematical basis to understand foundations of cryptography and Network Security.	**PO1, PO2**
CO2	To learn about how to maintain the Confidentiality, Integrity and Availability of a data.	**PO4**
CO3	Formally understand the notions related to security authentication and privacy.	**PO2**

CO4	Provide a rigorous treatment of the emerging and key subject subarea of CSE - security.	**PO2, PO3**
CO5	To understand various protocols for network security to protect against the threats in the networks.	**PO2, PO4**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of	Conduct investigations	Modern tool usage	The engineer and	Environment and	Ethics	Individual or team work	Communication	Project management	Life-long Learning	Application of Concepts	Project Management	Ethical and Professional Issues
ETCA330A	Network Security & Cryptography		2	1					2					3		

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

ETCA372A	Network Security and Cryptography Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Computer Programming				
Co-requisites	Basics of Mathematics				

Course Objectives

1. Explain the concepts of Network Security and Cryptography.
2. Appraise the concept of confidentiality, Integrity and Availability.
3. Create scalable applications that can robustly handle security issues of the system

Course Outcomes

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

CO1. Apply the knowledge of symmetric cryptography to implement simple ciphers

CO2. Analyze and implement public key algorithms

CO3. Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.

CO4. Explore the different network reconnaissance tools to gather information about networks

Catalog Description

This course complements ETCA330A. It enables them to understand working principle behind encryption techniques. The list of experiments help to provide security in variety of ways using encryption algorithms to solve the given problem efficiently.

List of Experiments (Indicative)

1	Understanding types of Network Attacks: Case study of different types of passive and active attacks (2 each).	**2 lab hours**
2	To study Symmetric key encryption principles.	**2 lab hours**
3	Write a program to implement DES algorithm or use existing library programs to test it.	**2 lab hours**
4	Examine different techniques for authentication. Study examples of each type.	**2 lab hours**
5	Examine how PGP works.Use the tools available at gnupg.org, study the commands and use it.	**2 lab hours**
6	To study MD5 algorithm. Use existing implementations in your own code to generate and verify MD5 hashes for files.	**2 lab hours**

7	To study RSA algorithm.	**2 lab hours**
8	Study of Secure Socket Layer (SSL).	**2 lab hours**
9	To study security requirements for websites	**2 lab hours**
10	To study Wireless Network security.	**2 lab hours**
11	Examine how firewalls work.	**2 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply the knowledge of symmetric cryptography to implement simple ciphers	**PO2**
CO2	Analyze and implement public key algorithms	**PO3**
CO3	Use tools like sniffers, port scanners and other related tools for analyzing packets in a network.	**PO5**
CO4	Explore the different network reconnaissance tools to gather information about networks	**PO1, PO3**

Ethics and Professional Issues	PSO3	2
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	3
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	2
Conduct investigations of complex	PO4	
Design/development of solutions	PO3	3
Problem analysis	PO2	3
Engineering Knowledge	PO1	2
	Course Title	Network Security & Cryptography Lab
	Course Code	ETCA372A

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

ETCA 332A	Software Testing	L	T	P	C
Version 1.0		3	1	-	4
Pre-requisites/Exposure	-				
Co-requisites	-				

Course Objectives

1. Various test processes and continuous quality improvement
2. Types of errors and fault models
3. Methods of test generation from requirements
4. Behaviour modelling using UML: Finite state machines (FSM)
5. Test generation from FSM models
6. Input space modelling using combinatorial designs
7. Combinatorial test generation
8. Test adequacy assessment using: control flow, data flow, and program mutations
9. The use of various test tools
10. Application of software testing techniques in commercial environments

Course Outcomes

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

CO1. List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.

CO2. Distinguish characteristics of structural testing methods.

CO3. Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.

CO4. Discuss about the functional and system testing methods.

CO5. Demonstrate various issues for object-oriented testing.

Catalog Description

This course will examine fundamental software testing and program analysis techniques. In particular, the important phases of testing will be reviewed, emphasizing the significance of each phase when testing different types of software. Students will learn the state of the art in

testing technology for object-oriented, component-based, concurrent, distributed, graphical-user interface, and web software. In addition, closely related concepts such as mutation testing and program analysis (e.g., program-flow and data-flow analysis) will also be studied. Emerging concepts such as test-case prioritization and their impact on testing will be examined. Students will gain hands-on testing/analysis experience via a multi-phase course project. By the end of this course, students should be familiar with the state-of-the-art in software testing. Students should also be aware of the major open research problems in testing.

Course Content

Unit I: **12 lecture hours**

Introduction: What is software testing and why it is so hard?, Error, Fault, Failure, Incident, Test Cases, Testing Process, Limitations of Testing, No absolute proof of correctness, Overview of Graph Theory.

Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

Unit II: **10 lecture hours**

Structural Testing: Path testing, DD-Paths, Cyclomatic Complexity, Graph Metrics, Data Flow Testing, Mutation testing.

Testing Activities: Unit Testing, Levels of Testing, Integration Testing, System Testing, Debugging, Domain Testing.

Unit III: **8 lecture hours**

Reducing the number of test cases: Prioritization guidelines, Priority category, Scheme, Risk Analysis, Regression Testing, and Slice based testing

Object Oriented Testing: Issues in Object Oriented Testing, Class Testing, GUI Testing, Object Oriented Integration and System Testing.

Unit IV: **10 lecture hours**

Testing Tools: Static Testing Tools, Dynamic Testing Tools, and Characteristics of Modern Tools and Implementation with example, Advanced topics in software testing: web based testing, Client server testing, Automated test cases generation, Regular expression and FSM based testing.

Text Books:

1. William Perry, “Effective Methods for Software Testing”, John Wiley & Sons.

2. CemKaner, Jack Falk, Nguyen Quoc, “Testing Computer Software”, Van Nostrand Reinhold, NewYork.

Reference Books/Materials

1. Boris Beizer, “Software Testing Techniques, Second Volume”, VanNostrand Reinhold, New York,.

2. Louise Tamres, “Software Testing”, Pearson Education.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.	PO3
CO2	Distinguish characteristics of structural testing methods.	PO2
CO3	Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.	PO5
CO4	Discuss about the functional and system testing methods.	PO4
CO5	Demonstrate various issues for object-oriented testing.	PO4

Ethical and Professional Issues	PSO3	
Project Management	PSO2	
Application of Concepts	PSO1	3
Life-long Learning	PO12	
Project management and finance	PO11	
Communication	PO10	
Individual or team work	PO9	
Ethics	PO8	
Environment and sustainability	PO7	
The engineer and society	PO6	
Modern tool usage	PO5	3
Conduct investigations of complex	PO4	3
Design/development of solutions	PO3	3
Problem analysis	PO2	2
Engineering Knowledge	PO1	
	Course Title	SOFTWARE TESTING
	Course Code	ETCA 332A

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

ETCA 374A	SOFTWARE TESTING LAB	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	-				
Co-requisites	-				

Course Objectives

1. Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs.
2. Implement various test processes for quality improvement
3. Design test planning
4. Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques.

Course Outcomes

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

CO1. List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.

CO2. Distinguish characteristics of structural testing methods.

CO3. Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.

CO4. Discuss about the functional and system testing methods.

CO5. Demonstrate various issues for object-oriented testing.

Catalog Description

Software Testing is an essential component of any organisation's ability to build software quality. Software Testers are, in general, not programmers. This course presents the Foundational software testing goals as laid out by the International Software Testing Qualifications Board (ISTQB) and approaches to testing software through all phases of the Software Testing Lifecycle. The course material includes – software testing standards and metrics, types of testing (black-box and white-box), test planning, analysis, test case generation, estimating test resources, test scheduling, test execution, assessing and managing risk, test prioritisation, automation strategy, defect management, test execution.

List of Experiments (Indicative)

1	Learn the procedure for Functional Testing using QTP.	2 lab hours
2	Learn to generate and run Test Scripts repeatedly for Regression Testing (Record and Play).	4 lab hours
3	Learn to check the behavior of Test Scripts for Multiple data (Parameterization).	4 lab hours
4	Learn how to do synchronization of Test Cases (Synchronization).	2 lab hours
5	Enables to add check points to Test Cases to know the current state of the object (Checkpoints).	4 lab hours
6	Learn to test the recovery mechanism for the specified scenario (Recovery Scenario Manager).	4 lab hours
7	Know to test Web application for no. of links, no. of images, load time, web buttons etc (Testing web application).	4 lab hours
8	Learn to do Manual Testing by writing own Test Cases (Identify Business Scenario's for Employee Login Form).	4 lab hours
9	Learn to write own Test cases and do Manual Testing (Independent Test cases for Students University Result System).	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	List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.	**PO3**
CO2	Distinguish characteristics of structural testing methods.	**PO2**
CO3	Demonstrate the integration testing which aims to uncover interaction and compatibility	**PO5**

	problems as early as possible.	
CO4	Discuss about the functional and system testing methods.	**PO4**
CO5	Demonstrate various issues for object-oriented testing.	**PO4**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
ETCA 332A	SOFTWARE TESTING		2	3	3	3								3		

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

ETCA 374A	SOFTWARE TESTING LAB	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	-				
Co-requisites	-				

Course Objectives

1. Investigate the reason for bugs and analyze the principles in software testing to prevent and remove bugs.
2. Implement various test processes for quality improvement
3. Design test planning
4. Use practical knowledge of a variety of ways to test software and an understanding of some of the tradeoffs between testing techniques.

Course Outcomes

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

CO1. List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.

CO2. Distinguish characteristics of structural testing methods.

CO3. Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.

CO4. Discuss about the functional and system testing methods.

CO5. Demonstrate various issues for object-oriented testing.

Catalog Description

Software Testing is an essential component of any organisation's ability to build software quality. Software Testers are, in general, not programmers. This course presents the Foundational software testing goals as laid out by the International Software Testing Qualifications Board (ISTQB) and approaches to testing software through all phases of the Software Testing Lifecycle. The course material includes – software testing standards and metrics, types of testing (black-box and white-box), test planning, analysis, test case generation, estimating test resources, test scheduling, test execution, assessing and managing risk, test prioritisation, automation strategy, defect management, test execution.

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6	Learn to test the recovery mechanism for the specified scenario (Recovery Scenario Manager).	4 lab hours
7	Know to test Web application for no. of links, no. of images, load time, web buttons etc (Testing web application).	4 lab hours
8	Learn to do Manual Testing by writing own Test Cases (Identify Business Scenario's for Employee Login Form).	4 lab hours
9	Learn to write own Test cases and do Manual Testing (Independent Test cases for Students University Result System).	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	List a range of different software testing techniques and strategies and be able to apply specific(automated) unit testing method to the projects.	**PO3**
CO2	Distinguish characteristics of structural testing methods.	**PO2**
CO3	Demonstrate the integration testing which aims to uncover interaction and compatibility problems as early as possible.	**PO5**

CO4	Discuss about the functional and system testing methods.	**PO4**
CO5	Demonstrate various issues for object-oriented testing.	**PO4**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics	Analysis
ETCA 332A	SOFTWARE TESTING		2	3	3	3								3		

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