K.R. MANGALAM UNIVERSITY

THE COMPLETE WORLD OF EDUCATION

SCHOOL OF ENGINEERING AND TECHNOLOGY

MASTER OF COMPUTER APPLICATIONS (MCA)

Programme Code: 56

2022-24

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

Academic Council
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K.R. Mangalam University

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

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PREFACE

K.R. Mangalam University is in the process of transforming to National Educational Policy 2021. In consultation with Deans, Faculty Members, Industry Experts, and University Alumni, the Academic council constituted department-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 M.C.A is on designing information systems for various organizations such as banks, insurance companies, hotels, hospitals etc. Development of application software in diverse areas where computers are used will be the main function of MCA graduates. The major thrust is on giving the students a sound background in computing, business functioning and mathematics relevant to information technology.

The M.C.A course is spread over two years in four semesters. The total number of credits in M.C.A is 75. The first year of courses focuses on strengthening the fundamental of the students. Subjects like Programming solving in Python, Data Structures and Algorithms, Database Management Systems, Computer Organization and Assembly Language, Probability and Combinatorics, and System & Network Administration caters to build strong foundation in computing. The third semester is dedicated to the emerging technologies like Artificial Intelligence, Big Data Analytics, Block chains, Internet of Things, and Quantum Computing. Every MCA student in fourth semester is required to spend either one semester in an industry developing a software system or completing a project under university faculty to solve real-world problems. 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.

1. Introduction

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

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

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

K. R. Mangalam University is unique because of its

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

Objectives

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

2. About School

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

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

School Vision

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

School Mission

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

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

3. Programmes offered by the School

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

3.1 Department of Computer Science & Engineering

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

Programme Outcome

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

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

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

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

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

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

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

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

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

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

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

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

3.1.1 MCA

This Programme is aimed at developing a sound knowledge and understanding of concepts in key areas of Computer Science, Industrial Computing, Analysis and Synthesis involved in Computer Systems, Information Systems and Computer Applications, etc. It also aims to provide exposure to the principles and practices of design and development of computing system. An initiative to make the teaching-learning framework better and enhance the student learning outcomes, Department of Computer Science and engineering has taken a thoughtful step by introducing the concept of Learning Outcome Based Curriculum Framework (LOCF)and Choice Based Credits System (CBCS) system.

Eligibility Criteria: - The student should have passed the BCA/B. Sc. (Computer Science/ Cyber security/ Data Science) examination conducted by the Central or state University with an overall minimum aggregate of 50% or more.

Course Outline:- Python Programming/ Computer Organization/ System and Network Administration/ Advance Data Mining/ Machine Learning / Data Science /Soft Computing

Career Options :- Opportunities are there in the field of IT Consulting, Solution Development, Design Engineering, Network Administrator, IT Manager, Hardware and Software Domains, PSUs, Defense &Civil Services, Research.

Programme Specific Outcome: MCA

PSO1. Application of Concepts: Design, develop and implement interdisciplinary application software projects to meet the demands of industry requirements using modern tools and technologies.

PSO2. Ethical and Professional Responsibilities: Develop a sense of professional, ethical, legal, security and social issues and responsibilities.

PSO3.Innovation: Demonstrate skills in ideation, innovation and commercialization of IT products and services

4. Program Duration:

The maximum completion period of the MCA Programme offered by the University shall be two years.

5. Class Timings

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

6. Syllabi

The syllabi of MCA program for all semester are 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.
Two Year MCA program at a glance

	Semester I	Semester II	Semester III	Semester IV	Total
Course	11	13	10	2	36
Credit	25	29	18	5	87

6.1 Scheme of studies as per Learning outcome Based Curriculum Framework (LOCF) and Choice based credits System (CBCS)

SEMESTER I

SNo		Course Code	Course Title	L	T	P	C
1	CC	ETCA 801A	Problem Solving and Python Programming	3	1	-	4
2	CC	ETCA802A	Data Structures and Algorithms	3	1	-	4
3	OE	-	Open Elective	4	-	-	4
4	CC	ETCS 601A	Mathematical Foundations of Computer Science	3	1	-	4
	CC	ETCA 807A	Introduction to Database Management System	3	1	-	4
5	SE	ETCA 851A	Introduction to Database Management System Lab	0	-	2	1
6	SE	ETCA 853A	Problem Solving and Python Programming Lab	0	-	2	1
7	SE	ETCA 852A	Data Structures and Algorithms Lab	0	-	2	1
8	SE	-	Audit Course - I	-	-	-	-
9	SE	-	Value Added Courses	-	-	-	-
		Non Departmental Open Electives					
i	SE	ETMC 709A	Economic Analysis for Business	3	-	-	3
ii	SE	ETMC725A	Accounting for Management	3	-	-	3

iii	SE	ETMC 731A	People's Behavior in an Organization	3	-	-	3
iv	SE	ETMC803A	Ethical Dilemma and Profitability	3	-	-	3
	TOTAL			**24**	**4**	**6**	**31**

SEMESTER II

SNo		Course Code	Course Title	L	T	P	C
1	CC	ETCA 803A	Computer Organization and Assembly Language Programming	3	1	-	4
2	CC	ETCA 804A	Information Systems Analysis Design & Implementations	3	1	-	4
3	CC	ETCA 806A	Advanced Data Mining	3	1	-	4
4	CC	ETCA812A	Web Programming	3	-	-	3
5	CC	ETCA 810A	System and Network Administration	3	1	-	4
6	SE	ETCA 858A	Computer Organization and Assembly Language Programming Lab	-	-	2	1
7	SE	ETCA 854A	Advanced Data Mining Lab	-	-	2	1
8	SE	ETCA 856A	System and Network Administration Lab	-	-	2	1
9	SE	ETCA860A	Web Programming Lab	-	-	2	1
10	SE		Audit Course - II	-	-	-	-
11	SE		Value Added Courses	-	-	-	-
		TOTAL		**15**	**4**	**6**	**23**

SEMESTER III

SNo		Course Code	Course Title	L	T	P	C
1	CC	ETEL 403A	Oral and Technical Communication	3	1	-	4
2	CC	ETCA 827A	Devops	3	1	-	4
3	CC	ETCA 817A	AI and Applications	3	1	-	4
4	CC	ETCA 819A	Big Data Analytics and Applications	3	1	-	4
5	SE	ETCA 869A	Devops Lab	0	-	2	1
6	SE	ETCA 859A	AI and Applications Lab	0	-	2	1
7	SE	ETCA 861A	Seminar	0	-	2	1
8		**Departmental Electives - I***					
i	CC	ETCA 821A	Blockchains	3	1	-	4
	SE	ETCA 863A	Blockchains Lab	0	-	2	1
ii	CC	ETCA 823A	Internet of Things and Applications	3	1	-	4
	SE	ETCA 865A	Internet of Things Applications Lab	0	-	2	1
iii	CC	ETCA 825A	Quantum Computing	3	1	-	4
	SE	ETCA 867A	Quantum Computing Lab	0	-	2	1
		TOTAL		**15**	**5**	**8**	**24**

SEMESTER IV

SNo	Course Code		Course Title	L	T	P	C
1	SE	ETCA 872A	Project*	-	-	10	5
2	SE	ETCA 874A	Industrial Training*	-	-	-	5
	***One option to be selected between project and six month industrial training**						
	TOTAL			**0**	**0**	**10**	**5**
	Total Hours: Lect [L]+Prac [P]+Tut [T]			**90**			
	Total Credits [C]			**74**			

AUDIT COURSES

SEMESTER I

SNo		Course Code	Course Title	L	T	P	C
1	SE	ETCA 809A	Java Technologies	-	-	-	-
2	SE	ETCA 811A	Data Mining Concepts and Techniques	-	-	-	-
3	SE	ETCS 813A	Software Engineering Applications	-	-	-	-

SEMESTER II

SNo		Course Code	Course Title	L	T	P	C
1	SE	ETCA 812A	Linux System Fundamentals	-	-	-	-
2	SE	ETCA 814A	Numerical and Statistical Methods	-	-	-	-
3	SE	ETCA 816A	Soft Computing : Characteristics and Techniques	-	-	-	-

ETCA801A	Problem Solving and Python Programming	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To formulate simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs (in python language).
3. To test and execute the programs and correct syntax and logical errors.
4. To implement conditional branching, iteration and recursion.
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
6. To learn how to design and program Python applications.
7. To learn how to use lists, tuples, and dictionaries in Python programs.
8. To learn how to design object-oriented programs with Python classes.
9. To learn how to use class inheritance in Python for reusability.
10. To learn how to use exception handling in Python applications for error handling.

Course Outcomes

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

CO1. Develop algorithmic solutions to simple computational problems.
CO2. Demonstrate programs using simple Python statements and expressions.
CO3. Explain control flow and functions concept in Python for solving problems.
CO4. Use Python data structures – lists, tuples & dictionaries for representing compound data.
CO5. Explain files, exception, modules and packages in Python for solving problems.

Catalog Description

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: **12 lecture hours**

Introduction to Python: The basic elements of python, Branching Programs, Control Structures, Strings and Input, Iteration.

Unit II: **10 lecture hours**

Functions, Scoping and Abstraction: Functions and scoping, Specifications, Recursion, Global variables, Modules, Files.

Unit III: **10 lecture hours**

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

Unit IV: **8 lecture hours**

Simple Algorithms and Data structures: Search Algorithms, Sorting, Algorithms, Hash Tables.

Text Books

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

Reference Books/Materials

1. 1. R. NageswaraRao, "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 algorithmic solutions to simple computational problems	**PO1**
CO2	Demonstrate programs using simple Python statements and expressions	**PO1**
CO3	Explain control flow and functions concept in Python for solving problems	**PO2**
CO4	Use Python data structures – lists, tuples & dictionaries for representing compound data	**PO3**
CO5	Explain files, exception, modules and packages in Python for solving problems	**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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA801A	Problem Solving and Python Programming	3	3	2	3	-	-	-	-	-	-	-	-	3	- -	-

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

ETCA802A	Data Structures and Algorithms	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. To understand the abstract data types stack, queue, dequeue, and list.
2. To be able to implement the ADTs stack, queue, and deque.
3. To understand the performance of the implementations of basic linear data structures.
4. To be able to recognize problem properties where stacks, queues, and deques are appropriate data structures.
5. To expose the student to the algorithm analysis techniques, to the theory of reductions, and to the classification of problems into complexity classes like NP.

Course Outcomes

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

CO1. Formulate and apply object-oriented programming as a modern tool to solve engineering problems.
C02. Demonstrate an understanding of basic data structures and algorithms.
CO3. Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.
CO4. Demonstrate an understanding of analysis of algorithms.

Catalog Description

The aim of the course is to introduce basic data structures and algorithms. This course covers the design, analysis, and implementation of data structures and algorithms to solve engineering problems using an object-oriented programming language. Topics include elementary data structures, (including arrays, stacks, queues, and lists), advanced data structures (including trees and graphs), the algorithms used to manipulate these structures, and their application to solving practical engineering problems.

Course Content

Unit I: 12 lecture hours

Python: types, expressions, strings, lists, tuples; Python memory model: names, mutable and immutable values; List operations: slices etc - Binary search; Inductive function definitions: numerical and structural induction; Elementary inductive sorting: selection and insertion sort; In-place sorting.

Basic algorithmic analysis input size, asymptotic complexity, O() notation ; Arrays vs lists; ; Merge sort ; Quick sort ; Stable sorting.

Unit II: 8 lecture hours

Dictionaries; More on Python functions: optional arguments, default values; Passing functions as arguments; Higher order functions on lists: map, lter, list comprehension.
Exception handling; Basic input/output; Handling Files; String processing.

Unit III: 10 lecture hours

Backtracking: N Queens, recording all solutions; Scope in Python: local, global, nonlocal names; Nested functions; Data structures: stack, queue; Heaps.
Abstract data types; Classes and objects in Python; "Linked" lists: find, insert, delete; Binary search trees: find, insert, delete; Height-balanced binary search trees.

Unit IV: 10 lecture hours

Efficient evaluation of recursive definitions: memorization | Dynamic programming: examples | Other programming languages: C and manual memory management | Other programming paradigms: functional programming.

Text Books

1. Narasimha Karumanchi, Data Structures and Algorithms, Carrer Monk Publications
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, “Introduction to Algorithms”, 2nd Ed., PHI

Reference Books/Materials

1. Ellis Horowitz and SartazSahani, "Computer Algorithms", Galgotia 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	Formulate and apply object-oriented programming as a modern tool to solve engineering problems.	**PO1**
CO2	Demonstrate an understanding of basic data structures and algorithms	**PO3**
CO3	Demonstrate the ability to analyze, design, apply and use data structures and algorithms to solve engineering problems and evaluate their solutions.	**PO2**
CO4	Demonstrate an understanding of analysis of algorithms.	**PO3**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA802A	Data Structures and Algorithms	3	3	3	-	-	-	-	-	-	-	-	-	3	-	-

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

ETCS 601A	Mathematical Foundations of Computer Science	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Probability and Set Theory				
Co-requisites	--				

Course Objectives

1. To understand the mathematical fundamentals that is prerequisites for a variety of courses like Data Mining, Network protocols, Analysis of Web Traffic, Computer Security, Software Engineering, Computer Architecture, Operating Systems, Distributed Systems, Bioinformatics, and Machine Learning.
2. To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. To study various sampling and classification problems.

Course Outcomes

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

CO1. To understand the basic notions of discrete and continuous probability.
CO2. To understand the methods of statistical inference, and the role that sampling Distribution play in those methods.
CO3. To be able to perform correct and meaningful statistical analyses of simple to Moderate Complexity.
CO4. To be able to apply basic principles of graph theory to solve real-time problems.

Catalog Description

This course imparts the basic concepts of probability theory and statistics to gain insight into real, everyday statistical problems and solutions. The main objective is to develop an intuitive understanding of statistical procedures and strategies most often used by practicing engineers and scientist.

Course Content

Unit I: 10 lecture hours

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains, Random samples, sampling distributions of estimators.

Unit II: 8 lecture hours

Methods of Moments and Maximum Likelihood. Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** the problem of over-fitting model assessment.

Unit III: 10 lecture hours

Graph Theory: Isomorphism, Planar graphs, graph colouring, Hamilton circuits and Euler cycles.Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

Unit IV: 12 lecture hours

Computer science and engineering applications, Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning. Recent Trends in various distribution functions in mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Text Books

1. John Vince, “Foundation Mathematics for Computer Science”, Springer.
2. K. Trivedi, “Probability and Statistics with Reliability, Queuing, and Computer Science Applications”, Wiley
3. Alan Tucker. “Applied Combinatorics”, Wiley

Reference Books/Materials

1. Sheldon M. Ross, "Probability and Statistics for Engineers and Scientist", Elsevier Academic 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	To understand the basic notions of discrete and continuous probability.	**PO1**
CO2	To understand the methods of statistical inference, and the role that sampling distribution play in those methods.	**PO2**
CO3	To be able to perform correct and meaningful statistical analyses of simple to moderate complexities.	**PO4**
CO4	To be able to apply basic principles of graph theory to solve real-time problems.	**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 problems	Modern tool usage	The engineer and	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCS601A	Mathematical Foundations For Computer Science	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-

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

ETCA 807A	Introduction To Database Management System	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	-				
Co-requisites	-				

Course Objectives

1. Understand the different issues involved in the design and implementation of a database system.
2. Study the physical and logical database designs, database modeling, relational, hierarchical, and network models.
3. Understand and use data manipulation language to query, update, and manage a database.
4. 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. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

Course Outcomes

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

CO1. For a given query write relational algebra expressions for that query and optimize the developed expressions
CO2. For a given specification of the requirement design the databases using E-R method and normalization.
CO3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
CO4. For a given query optimize its execution using Query optimization algorithms
CO5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
CO6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Catalog Description

The course reviews topics such as conceptual data modelling, relational data model, relational query languages, relational database design and transaction processing and current technologies. It exposes the student to the fundamental concepts and techniques in database use and development as well provides a foundation for research in databases.

Course Content

Unit I: 12 lecture hours

Basic concepts: Database & Database Users, Characteristics of the Database, Database Systems.: Concepts & Architecture, Date Models. Schemas & Instances, DBMS Architecture & Data Independence, Data Base languages & Interfaces, Data Modeling using the Entity-Relationship Approach

Relational Model Languages & Systems, Relational Data Model & Relational Algebra, Relational Model Concepts, Relational Model Constraints, Relational Algebra

Unit II: 10 lecture hours

Conventional Data Models & Systems, Network, Data Model & IDMS Systems, Membership types & options in a set, DML for the network model, Navigation within a network database

Hierarchical Data Model & IMS System, Hierarchical Database structure: HSAM, HISAM, HDAM & HIDAM organization, DML for hierarchical model, Overview of IMS

Unit III: 8 lecture hours

Relational Data Base Design, Function Dependencies & Normalization for Relational Databases

Functional Dependencies, Normal forms based on primary keys (INF, 2NF, 3NF & BCNF), Lossless join & Dependency preserving decomposition.

Unit IV: 10 lecture hours

Concurrency Control & Recovery Techniques: Concurrency Control Techniques, Locking Techniques, Time stamp ordering, Granularity of Data items

Recovery Techniques: Recovery concepts, Database backup and recovery from catastrophic failures

Text Books:

Date, C.J., "An Introduction to Database Systems", Narosa Publishing House. New Delhi.

Reference Books/Materials

1. Desai, B'., "An Introduction to Database Concepts", Galgotia Publications. New Delhi.

2. Elmsari and Navathe, "Fundamentals of Database Systems", Addison Wesley, New York.3

3. Ullman, J.D., "Principles of Database Systems", Galgotia Publications. 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	For a given query write relational algebra expressions for that query and optimize the developed expressions	PO2
CO2	For a given specification of the requirement design the databases using E-R method and normalization.	PO3
CO3	For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.	PO5
CO4	For a given query optimize its execution using Query optimization algorithms	PO2
CO5	For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.	PO4
CO6	Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.	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 complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA 807A	Introduction to Database Management System	-	2	3	3	3	-	-	-	-	-	-	-	3	-	-

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

ETCA 851A	Introduction To Database Management System Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. have a good understanding of how several fundamental algorithms work, particularly those concerned with creation and updating of tables.

2.have a good understanding of the fundamental DBMS used in computer science.

3. be able to understand various queries and their execution.

4. be able to design new database and modify existing ones for new applications and

reason about the efficiency of the result

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

Database management has evolved from a specialized computer application to a central component of a modern computing environment and as a result knowledge about database system has become an essential part of computer science. The course serves as a visual guide to the material presented during our lectures. The aim of this course is to introduce Database management system, with an emphasis on foundational material. The fundamental concepts and algorithms covered are based on those used in existing commercial or experimental database systems. Our aim is to present these concepts and algorithms in general setting.

List of Experiments (Indicative)

1	SQL - A Relational Database Language	6 lab hours
2	Date Definition in SQL	6 lab hours
3	View & Queries in SQL	6 lab hours
4	Specifying Constraints & Indexes in SQL	6 lab hours
5	Specifying Constraints & Indexes in SQL	6 lab hours

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

Examination Scheme:

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

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

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

Course Code	ETCA 851A	
Course Title	Introduction to Database Management System Lab	
PO1	-	Engineering Knowledge
PO2	2	Problem analysis
PO3	3	Design/development of solutions
PO4	3	Conduct investigations of complex problems
PO5	3	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	-	Ethical and Professional Responsibilities
PSO3	-	Innovation

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

ETCA853A	Problem Solving and Python Programming 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 OO 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.
CO2. 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

Problem-solving and Python programming 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 lab hours
2	Develop programs to implement list	2 lab hours
3	Develop programs to implement Dictionary	2 lab hours
4	Develop programs to implement tuples	2 lab hours
5	Develop programs to implement function with stress on scoping	2 lab hours
6	Develop programs to implement classes and objects	2 lab hours
7	Develop programs to implement exception handling	2 lab hours
8	Develop programs to implement linear search and binary search	2 lab hours
9	Develop programs to implement insertion sort	2 lab hours
10	Develop programs to implement bubble sort	2 lab hours
11	Develop programs to implement quick sort	2 lab hours
12	Develop programs to implement heap sort	2 lab hours

Text Books

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

Reference Books/Materials

1. R. NageswaraRao, "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**

ETCA852A	Data Structures and Algorithms Lab	L	T	P	C

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	Ethical and Professional Responsibilities	Innovation
ETCA853A	Problem Solving and Python Programming Lab	-	3	2	3	-	-	-	-	-	-	-	-	-	-	-

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

Version 1.0		-	-	2	1
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. To understand and remember algorithms and its analysis procedure.
2. Introduce the concept of data structures through ADT including List, Stack, Queues .
3. To design and implement various data structure algorithms.
4. To introduce various techniques for representation of the data in the real world.
5. To develop application using data structure algorithms.
6. To compute the complexity of various algorithms.

Course Outcomes

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

CO1. Design and analyze the time and space efficiency of the data structure.
CO2. Identity the appropriate data structure for given problem.
CO3. Analyze algorithms and algorithm correctness.
CO4. Have practical knowledge on the applications of data structures.

Catalog Description

The course is designed to develop skills to design and analyze simple linear and non-linear data structures. It strengthen the ability of the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structure.

Course Content

LIST OF EXPERIMENTS

Topic 1: Sorting – Searching

- Write a program to implement Bubble Sort.
- Write a program to implement Selection sort.
- Write a program to implement Quick Sort.
- Write a program to implement Insertion Sort.
- Write a program to implement Merge Sort.

- Write a program to implement Binary Search.

Topic 2: Arrays –Stacks-Recursion

- Write a program that finds the transposes a given square matrix.
- Write a recursive program that prints all the permutations of the first n characters of a string.
- Write a program to implement a stack of strings (illustrate the operations push (), pop(), size(), empty() and top()).
- Write a program to show the linked implementation of the Stack class.
- Write a program to covert infix to postfix.
- Write a program to implement Towers of Hanoi using Stack and Queues-Linked-Lists.
- Write a program to implement a linear list and perform the operation such as insert(), search() and delete().
- Write a program to implement a queue by adding the functions such as (i) Determine the size (ii) input queue (iii) output a queue (iv) split a queue into two queues

Topic 3: Binary Trees - Binary Tree Traversal

- Write a program to implement Binary Search Tree.
- Write a program to implement Binary Search Trees using Priority queue.
- Write a program to create a binary tree and find the height of a binary tree.
- Write a program to perform the binary tree traversals.
- Write a program to perform a deletion from a Binary Tree (using a delete () function).

Topic 4: Graphs

- Write a program to implement DFS traversal of a graph.
- Write a program to implement BFS traversal of a graph

Text Books

1. NarasimhaKarumanchi, Data Structures and Algorithms, CarrerMonk Publications
2. T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, “Introduction to Algorithms”, 2nd Ed., PHI

Reference Books/Materials

1. Ellis Horowitz and SartazSahani, "Computer Algorithms", Galgotia 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	Design and analyze the time and space efficiency of the data structure.	PO3
CO2	Identity the appropriate data structure for given problem.	PO4
CO3	Analyze algorithms and algorithm correctness.	PO2
CO4	Have practical knowledge on the applications of data structures	PO1

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	Ethical and Professional Responsibilities	Innovation
ETCA852A	Data Structures and Algorithms Lab	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-

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

OPEN ELECTIVE

ETMC709A	ECONOMIC ANALYSIS FOR BUSINESS	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

1. To get an overview of economic tools, theories and principles, the exciting concepts of Marginal Decisions and Incremental Decisions.
2. To understand the factors influence Customers choice and how their decisions affect the goods markets by affecting the price, the supply and demand?
3. To understand the various types of elasticity as consumer shift from one market to another as this adds an insight about the fluctuations in commodity market
4. To understand profit maximization and cost minimization as the fundamental goals of any firm through the dynamics of Cost Analysis & Price Output Decisions
5. It helps to understand the concept of market and its various forms which are influenced by the demand and price forces.

Course Outcomes

CO1. Microeconomics as a discipline develops skills in the students to understand functioning of entire economy on the basis of individual.

CO2. Students would be exposed to economic dilemmas as per the course boundaries which will be updated with new thinking and gears while delivering the course.

CO3. Microeconomics enables studying the causes, effects and solutions of general redundancy.

CO4. Structural market framework gives immense understanding about the market at a large level.

Catalog Description

The fundamental and unique course of Micro Economics would encourage the action - leaning and value adding potential business learners who are enthusiastic and passionate with the thought

of working in International behemoths and soon-to-be-Indian behemoths of today. Also, then they need to apprehend about Business Economics jargons which are basically related to various disciplines like Management, Accounting, Economics, Basic Finance, Engineering and the like. As Micro economics gives practical inside to solve business dilemmas by using its tools for other disciplines.

Course Content

UNIT – I **8 lecture Hours**

Introduction: Nature, Scope and Significance of Managerial Economics, its Relationship with other Disciplines, Role of Managerial Economics in Decision Making, Decision Making under Risk and Uncertainty.

UNIT II **8 Lecture Hours**

Consumer Behavior and Demand Analysis: Cardinal and Ordinal Approaches to Consumer Behavior; Demand Functions; Determinants of Demand; Elasticity of Demand; Derivation of Market Demand; Demand Estimation and Forecasting.

UNIT III **6 Lecture Hours**

Theory of Production and Cost: Managerial uses of Production Function, Short Run and Long Run Production Analysis, Isoquants, Optimal Combination of Inputs, Empirical Estimation of Production Functions; Traditional and Modern Theory of Cost in Short and Long Run, Economies of Scale and Economies of Scope, Empirical Estimation of Cost Function.

UNIT IV **8 Lecture Hours**

Theory and Behavior of Firm: Profit Maximization; Alternative Objectives of Business Firms; Price Output Decisions; under Perfect Competition, Monopoly, Monopolistic Competition and Oligopoly; Pricing Policies and Methods, Strategic Behavior of Firms; **Game Theory:**Nash Equilibrium, Prisoner's Dilemma Price & Non-Price Competition.

Text book [TB]:

1. Salvatore, D. Managerial economics in a global economy. Irwin, McGraw-Hill.

Reference book(s) [RB]:

1. Geetika, Ghosh, P., &Choudhury, P.R. (2nded). Managerial economics. New Delhi: McGraw Hill Education.
2. Dwivedi, D. N. Managerial economics. New Delhi, ND: Vikas Publication House.
3. Christopher, R. Thomas, & S. Charles, Maurice. Managerial economics. New Delhi: Tata McGraw Hill.
4. Dholakia, R.H., &Oza, A.N. Micro economics for management students. New Delhi: Oxford University Press.
5. Keating, Berry, & Wilson, J. H. An economic foundation for business decision. New Delhi: BiztantraPublication.
6. Gupta, G.S. Managerial economics: Micro economic. McGraw Hill.
7. Truett&Truett. Managerial economics. John Wiley & Sons Inc.
8. Petersen, H. Craig, &Cris, L W. Managerial economics. New Delhi: Pearson Education (Singapore) 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	Microeconomics as a discipline develops skills in the students to understand functioning of entire economy on the basis of individual.	**PO1**
CO2	Students would be exposed to economic dilemmas as per the course boundaries which will be updated with new thinking and gears while delivering the course	**PO2, PO7**
CO3	Microeconomics enables studying the causes, effects and solutions of general redundancy.	**PO4, PO6**
CO4	Structural economic framework gives immense understanding about the market at a large level.	**PO3, PO12**

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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	Ethical and Professional Responsibilities	Innovation
ETMC709A	**ECONOMIC ANALYSIS FOR BUSINESS**	2	3	2	3	-	2	3	-	-	-	-	-	- 3	2	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETMC725A	Accounting For Management	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of accounts				
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. The first part is designed to make students understand the basics of accounting and importance of financial statements with reference to different users of accounting information

CO2. To understand the various types of costs and preparation of cost sheet and its importance in decision making

CO3. Learn the importance and various types of budgets and its role in performance evaluation

CO4. Decision making through life cycle, target, and activity based costing and learn how CVP analysis helps in decision making

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

Nature of Accounting Information: Scope of Accounting, Accounting concepts, Principles &Standards, Journal, Ledger, Trial Balance, Depreciation Accounting (straight line and diminishing balance methods), Preparation of Final Accounts Trading Account, Profit and Loss Account; Balance Sheet (with adjustments)

Unit II: 12 lecture hours

Cost Accounting: Meaning, Objectives Importance, Methods, Classification of Cost, Preparation of Cost Sheet, Material Cost Accounting, Perpetual Inventory Control, Inventory Valuation, EOQ, ABC Analysis, Setting of Reorder Level, Maximum Level, Minimum Level.

Unit III: 12 lecture hours

Performance Evaluation Techniques: Introduction to Budgeting and Budgetary Control; Installation of Budgetary Control system; Classification of Budget; Fixed and Flexible Budgeting; Standard Costing and Variance Analysis (Labour and Materials); Balanced Scorecard; Responsibility Accounting.

Unit IV: 8 lecture hours

Decision Making Techniques: Marginal Costing; Absorption Costing; Contribution; Key factor; Cost-Volume-Profit Analysis; Decision making under decision involving alternative choice; Introduction to Activity Base Costing, Targeting Costing, Life Cycle Costing; Uniform Costing

Text Books

1. Maheshwari, S.N. Accounting for Management. Vikas Publishing House. New Delhi:

Reference Books/Materials

1. Shashi K Gupta, Sharma R.K. Management Accounting, Kalyani publications
2. Arora, M. N. (2015). Cost Accounting (12th ed). New Delhi: Vikas Publishing House.

3. Khan, M.Y., & Jain, P.K. (2015). Financial Management, Text, Problems & Cases (7th ed). New Delhi: Tata McGraw Hill Company.

4. Maheshwari, S.N. Financial and Cost Accounting. New Delhi: Sultan Chand & Sons.

5. Maheshwari, S.N. (2015). Advanced Accountancy -Vol. I & II (10th ed). New Delhi: Vikas Publishing House.

6. ICAI, Accounting Standards.

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

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**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 first part is designed to make students understand the basics of accounting and importance of financial statements with reference to different users of accounting information	**PO1, PO2**
CO2	To understand the various types of costs and preparation of cost sheet and its importance in decision making	**PO3**
CO3	Learn the importance and various types of budgets and its role in performance evaluation	**PO5**
CO4	Decision making through life cycle, target and activity based costing and learn how CVP analysis helps in decision making.	**PO7, PO12**

Course Code	Course Title		
ETMC725A	Accounting For Management		
		PO1	Engineering Knowledge
		PO2	Problem analysis

Code	Outcome	ETMC725A – Accounting For Management
PO1	Engineering Knowledge	2
PO2	Problem analysis	3
PO3	Design/development of solutions	2
PO4	Conduct investigations of complex problems	3
PO5	Modern tool usage	-
PO6	The engineer and society	3
PO7	Environment and sustainability	2
PO8	Ethics	-
PO9	Individual or team work	-
PO10	Communication	-
PO11	Project management and finance	2
PO12	Life-long Learning	-
PSO1	Application of Concepts	- 3
PSO2	Ethical and Professional Responsibilities	2
PSO3	Innovation	-

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

ETMC 731A	People's Behaviour in an organisation	L	T	P	C
Version 1.0		3	0	0	3
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives:

1. To help the students to develop cognizance of the importance of human behaviour.

2. To enable students to describe how people behave under different conditions and understand why people behave as they do.

3. To provide the students to analyse specific strategic human resources demands for future action.

4. To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behaviour and improve results.

Course Outcomes:

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

CO1: Demonstrate the applicability of the concept of organizational behavior to understand the behavior of people in the organization.
CO2: Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.
CO3: Analyze the complexities associated with management of the group behavior in the organization.
CO4: Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.

Catalog Description:

The main objective of Organizational Behavior course is to help the students to acquire and develop skill to take rational decisions in the process of O.B. People have always been regarded as important in managing organizations. Human aspects are critical in each functional aspects of management and equally so for the effective utilization of resources. In view of this,

organizational behavior has assumed great importance. This course is designed primarily for students who are being exposed to Organizational Behavior for the first time.

This course covers the explanations about the human behavior in the organizational context. It details the impact of individual, group and organizational factors on human behavior. The course also focuses on understanding the behavior of the employees working in the organization. It highlights the significance of Challenges and Opportunities of OB, perception, attribution, learning, organizational change, organizational culture, motivation, leadership and conflict management. Classroom activities involving lectures, discussions and case studies (topped up with role play) will be designed to encourage students to get involved and absorb & assimilate inputs. These activities will also be supplemented by group discussions, cooperative group solving problems, analysis of video cases and debates.

Course Content:

UNIT I

Foundation and background of OB: concept, nature & scope of OB, Foundations of OB, challenges & opportunities, ethical issues in OB.

UNIT II

Individual behavior and processes: individual differences–values and attitudes; Perception concept, process and applications; Personality-concept, determinants and theories applications; Learning and Reinforcement, Stress–symptoms, causes, consequences and management.

UNIT III

Interpersonal and team processes: group behavior, group development, group dynamics, social loafing; developing teams–self-directed work teams, virtual teams; team building; Empowerment-concept, significance, Conflict–Concept, sources, types, management of conflict, Power–concept, sources, approaches; organizational politics

UNIT IV

Organizational processes and structure: organizational structure and design, Work and job design; organizational learning; organizational culture; organizational change and development.

TEXT BOOKS:

1. Robbins, S.P. (2008) Organizational Behaviour, (7th Edition), New Delhi ND: Prentice Hall of India.

REFERENCE BOOKS

1. Pareek, Udai. (2012). Understanding OrganisationalBehaviour (3rd Edition). New Delhi ND: Oxford University Press.
2. Prasad, L.M. (2014).Organizational Behaviour (5th Revised Edition) Sultan Chand & Sons.
3. Aswathappa, K. (2007). Organizational Behavior, (7th Edition) New Delhi ND: Himalaya Publishing House.
4. VSP Rao, (2009) Organizational Behavior, (9th Edition) Excel Books.

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

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 the applicability of the concept of organizational behavior to understand the behavior of people in the organization.	**PO2**
CO2	Demonstrate the applicability of analyzing the complexities associated with management of individual behavior in the organization.	**PO3, PO4**
CO3	Analyze the complexities associated with management of the group behavior in the organization.	**PO9**
CO4	Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.	**PO8**

ETMC 731A	Course Code	
People' s Behaviour in an Organisation	Course Title	
-	PO1	Engineering Knowledge
3	PO2	Problem analysis
2	PO3	Design/development of solutions
3	PO4	Conduct investigations of complex
-	PO5	Modern tool usage
-	PO6	The engineer and society
-	PO7	Environment and sustainability
3	PO8	Ethics
2	PO9	Individual or team work
-	PO10	Communication
-	PO11	Project management and finance
-	PO12	Life-long Learning
3	PSO1	Application of Concepts
- 2	PSO2	Ethical and Professional Responsibilities
-	PSO3	Innovation

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

ETMC803A	ETHICAL DILEMMA AND PROFITABILITY	L	T	P	C
Version 1.0		**3**	**0**	**0**	**3**
Pre-requisites/Exposure	**Basics of Management Studies**				
Co-requisites					

Course Objectives

1. To understand the Business Ethics and to provide best practices of business ethics.
2. Learn scope of business ethics in finance, Human resources, marketing, and IT and other fields of management.
3. To learn the various ethical perceptions and implement in their careers to become a good managers.
4. To imbibe the ethical issues in corporate governance and to adhere to the ethical codes.
5. To develop various corporate social Responsibilities and practise in their professional life

Course Outcomes

At the end of the course, students will be able to:-

CO1. Understand the concept of core business ethics issues and ethical concepts relevant to resolving moral issues in business and Re-examine the knowledge of business and economic concepts from an ethical perspective

CO2: Understand various ethical issues that face organizations in the fields of finance, human resource management, sales and marketing, and information Technology. Use ethical theories and frameworks to analyze ethical dilemmas in business and resolve practical problems

CO3. Demonstration of the various aspects of business ethics in context to global economy which can critically evaluate the different ways in which people may respond to ethical issues at work and what may influence such responses.

CO4. Demonstrate detailed knowledge of the development of Corporate Social Responsibility and the responsibilities of business corporations beyond profit maximization. Understand the theory of corporate governance and apply this theory in analyzing corporate structures, board composition and how boards of directors conduct their affairs.

Catalog Description

The course seeks to bridge the gap between the ethical behavior of the individual and the challenges posed by organized business activity in the global marketplace. It further seeks to educate participants about legal, social and ethical matters in business, and make them sensitive

to the consequences of their decisions. The course does not provide solutions to ethical dilemmas, but encourages critical ethical thinking and decision making. The students will also be exposed to ethical problems and issues in various situations.

Course Content

UNIT I **07 lecture hours**

Ethics and Business: Meaning, Evolution, Ethical Issues, Classification of Ethics, Ethical Decision Making, Concept, Evolution, Characteristics and Principles of Business Ethics, Advantages of Business Ethics, Approaches of Business Ethics, Relationship between Ethics and Business Ethics.

UNIT II **08 lecture hours**

Ethical Issues: Ethics in Human Resources, Ethics in Marketing, Ethics in Information Technology, Ethics in Finance, and Theories of Ethics: Teleological (Utilitarianism), Deontology (Kantianism), Virtue Ethics.

UNIT III **07 lecture hours**

Business Ethics in Global Economy: Ethical Perception and International Business, Global Values, Various Ethical Issues around the Globe, Cross Cultural Issues, Cross Religion and cross Racial Issues

UNIT IV **08 lecture hours**

Corporate Governance: Definition of Corporate Governance, Need for Corporate Governance, Principles and Importance of Corporate Governance, Important Issues in Corporate Governance, Corporate Governance in India Past, Present and Future, Current Scenario of Corporate Governance in India, Clause 49, Corporate Social Responsibility for Business.

TEXT BOOKS:

1. Ghosh, B.N. (2015). “Business Ethics and Corporate Governance” New Delhi; McGraw Hill.
2. Murthy. (2015). “Business Ethics and Corporate Governance” Mumbai; Himalaya Publishing House.

REFERENCE BOOKS:

1. Manuel G. Velasquez. (2012). “Business Ethics” New Delhi; Pearson Education Inc.
2. S.S. Khanka. (2014). “Business Ethics and Corporate Governance” New Delhi; S. Chand Publication.

3. Nirmala, Reddy, Rani. (2015). “Business Ethics and Corporate Governance” Mumbai; Himalaya Publishing House.
4. BadiRavindernath V. (2014). “Business Ethics” New Delhi; Vrinda Publication.
5. Hartman, Lauro (2014). “Perspective in Business Ethics” New Delhi; McGraw Hill.
6. Fernando A. C. (2015). “Business Ethics: An Indian Perspective” Noida; Pearson Edu. Inc.

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	**10**	**10**	**20**	**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 concept of core business ethics issues and ethical concepts relevant to resolving moral issues in business and Re-examine the knowledge of business and economic concepts from an ethical perspective	**PO1**
CO2	Understand various ethical issues that face organizations in the fields of finance, human resource management, sales and marketing, and information Technology. Use ethical theories and frameworks to analyze ethical dilemmas in business and resolve practical problems	**PO2, PO4**
CO3	Demonstration of the various aspects of business ethics in context to global economy which can critically evaluate the different ways in which people may respond to ethical issues at work and what may influence such responses.	**PO6, PO7**
CO4	Demonstrate detailed knowledge of the development of Corporate Social Responsibility and the responsibilities of business corporations beyond profit maximization. Understand the theory of corporate governance and apply this theory in analyzing corporate structures, board composition and how boards of directors conduct their affairs.	**PO8, PO12**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETMC803A	Ethical Dilemma And Profitability	2	3	-	3	-	2	3	3	-	-	-	-	- 3	3	-

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

ETCA 803A	Computer Organization and Assembly Language Programming	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

This course covers the basics of computer organization with emphasis on the lower level abstraction of a computer system including digital logic, instruction set and assembly language programming. Topics includes data representation, logic gates, simplification of logical expressions, design and analysis of simple combinational circuit such as decoders and multiplexers, flip-flops and registers, design and analysis of simple synchronous sequential circuit, random-access and read-only memories, instruction set architecture and programming in assembly language. The Intel 80386 instruction set is used as a case study with programming experience in the Linux environment.

Course Content

Unit I: 12 lecture hours

Von Neumann Architecture, Instruction execution, concept of Interrupts, Fixed point and floating-point arithmetic, error detection and other codes, concepts of Gates and Logic Circuits

The Combinational and Sequential circuits, Design of Combinational circuits, examples of combinational circuits, flip flops, sequential circuit design, examples of sequential circuits

Unit II: 10 lecture hours

The memory hierarchy, Cache, RAM, ROM, DRAM, Flash Memory, secondary storage technologies and Characteristics, RAID and its levels, Cache Organization, The Memory System of Micro-Computer, Input output interfaces, the concepts of device controllers, Input output techniques, DMA, Device drivers, Input output processors, Interrupt Processing

Hard Drives: Partitioning and Formatting: FAT, Inodes, Drive Speed, Access Time, Rotation Speeds, Hard Drive Interfaces, Removable Storage Options, Video Cards, Liquid Crystal Display (LCD), Modems, Print Resolution, Scanners, Keyboards, Mouse, Power supply

Unit III: 8 lecture hours

The Instruction format, The Instruction set architecture, The types of Instructions, The types of operands, Addressing modes and their importance, Description of Various types of Registers, Need and importance of registers, The Micro-operation concepts, The Instruction execution and micro-operations

The organization of Arithmetic logic unit, The characteristics of ALU, Design of simple units of ALU, Pipelining, The hardwired control, Wilkes control, The Micro-programmed control, the microinstructions, the execution of micro-program, RISC principles, Large Register file in RISC, RISC pipelining

Unit IV: 10 lecture hours

8086 microprocessors, The Instruction format, The addressing modes, The types of Instructions, The need and use of assembly language, Input output in assembly Language Program, Sample Assembly Programs including Arrays, Counters, Dealing with various simple statements, Use of various addressing modes

Modular Programming, Interfacing assembly with HLL, Device drivers in assembly, Interrupts in assembly

Text Books

M. Morris Mano, Computer System Architecture, Pearson 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.

3. "Microprocessor and Interfacing: Programming and Hardware Experiments", D.V. Hall, Mc-Graw Hill Education.

4. B.Ram Computer Fundamentals Architecture and Organization,New Age Intl.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO 1	Understand the concepts of microprocessors, their principles and practices.	PO2
CO 2	Write efficient programs in assembly language of the 8086 family of microprocessors.	PO3
CO 3	Organize a modern computer system and be able to relate it to real	PO4

	examples.	
CO 4	Develop the programs in assembly language for 80286, 80386 and MIPS processors in real and protected modes.	**PO9**
CO 5	Implement embedded applications using Emulator.	**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 complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA 803A	Computer Organization and Assembly Language Programming	-	2	3	3	2	-	-	-	3	-	-	-	-	-	-

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

ETCA804A	Information Systems Analysis Design & Implementations	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Advanced Computer Programming				
Co-requisites	--				

Course Objectives

1. The primary goal of this course is to help students develop a comprehensive understanding of how information systems are developed through the activities of systems planning, analysis, design and implementation; an understanding suited to the needs of a business analyst, information systems selector or managerial consultant.
2. The key modeling concepts applicable to both structured and object-oriented approaches to systems development are examined.

Course Outcomes

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

CO1. Identify and understand key aspects of the systems development process, from planning through analysis and design to implementation and maintenance.

CO2. Recognize success factors associated with systems development, including individual and organizational factors.

CO3. Recognize and apply various strategies, tools and modeling techniques related to different approaches to systems development (including structured and object-oriented approaches) to theanalysis and design of a business information system.

CO4. Understand and apply key principles of good user interface design.

CO5. Understand and carry out key activities associated with systems development including activities related to project initiation and project planning, analysis of a business problem, determining information needs, and the selecting and recommending an IS-based solution

Catalog Description

The primary goal of this course is to help students develop a comprehensive understanding of how information systems are developed through the activities of systems planning, analysis, design and implementation; an understanding suited to the needs of a business analyst, information systems selector or managerial consultant. The key modeling concepts applicable to both structured and object-oriented approaches to systems development are examined.

Course Content

Unit I: 8 lecture hours

Overview of Systems Analysis and Design: Systems Development Life Cycle. Concept and Models: requirements determination. logical design. physical design, test planning implementation planning and performance evaluation; communication, interviewing, presentation skills; group dynamics; risk and feasibility analysis; group-based approaches. JAD, structures walkthroughs, and design and code reviews; prototyping; database design; software quality metrics; application categories software package evaluation and acquisition.

Unit II: 12 lecture hours

Information requirement Analysis: Process modelling with physical and logical data flow diagrams, data modelling with logical entity relationship diagrams;

Developing a Proposal: Feasibility study and cost estimation.

System Design: Design of input and control, design of output and control, file design/database design, Process design, user interface design; prototyping; software constructions; documentation.

Unit III: 12 lecture hours

Application Development Methodologies and CASE tools: Information engineering, structured systems analysis and design and object oriented methodologies for application

development data modeling, process modeling, user interface design and prototyping; use of computer aided software engineering (CASE) tools in the analysis, design and implementation of information systems.

Design and Implementation of 00 platforms: Object oriented analysis and design through object modeling technique, object modeling, dynamic modeling and functional modeling, object-oriented design and object oriented programming systems for implementation, object oriented data bases.

Unit IV: 8 lecture hours

Managerial Issues in Software Projects: Introduction to software markets; planning of software projects, size and cost estimations; project scheduling; measurement of software quality and productivity; ISO and capability maturity models for organizational growth.

Text Books

1. Haryszkiewycz, LT., "Introduction of Systems Analysis and Design". Prentice Hall of India.

2. Rajaraman, V, "Analysis and Design of Information Systems". Prentice Hall of India.

3. Senn, LA., "Analysis and Design of Information Systems". Tata McGraw Hill Book Company.

4. Whiten, 1.K., Bentley, L.D., Beslow, V.M., "Systems Analysis and Design Methods". Galgotia Publications Pvt. Ltd.

Reference Books/Materials

2. Schaum's outline series, "Data Structure", McGraw Hills.

3. 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	Identify and understand key aspects of the systems development process, from planning through analysis and design to implementation and maintenance.	**PO1**
CO2	Recognize success factors associated with systems development, including individual and organizational factors.	**PO4**
CO3	Recognize and apply various strategies, tools and modelling techniques related to different approaches to systems development (including structured and object-oriented approaches) to theanalysis and design of a business information system.	**PO5**
CO4	Understand and apply key principles of good user interface design.	**PO2**
CO5	Understand and carry out key activities associated with systems development including activities related to project initiation and project planning, analysis of a business problem, determining information needs, and the selecting and recommending an IS-based solution	**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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA804A	Information systems analysis & design implementations	2	2		3	3	-	-	-	-	-	-	-	3	-	-

1=weakly mapped

2= moderately mapped

3=strongly mapped

ETCA 806A	Advanced Data Mining	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Database, Query tools, Data Warehouse and data mining concepts				
Co-requisites	--				

Course Objectives

1. Understand basic data mining tasks, principles, techniques and metrics.
2. Learning about data mining techniques.
3. Understand and apply the concept of classification and clustering.
4 To learn how to extract data from the Web, Text mining.
5. Describing and demonstrating the knowledge of spatial and temporal mining.

Course Outcomes

On completion of this course, the students will be able to
CO1. Develop an understanding of the data mining process and Issues.
CO2. Understanding the Classification and Prediction, Cluster Analysis and association rules.
CO3. Understand various techniques for data mining and apply the techniques in solving data mining problems using data mining tools and systems.
CO4. To understand how text mining is different from data mining and how to mine it.
CO5. Explore recent trends in data mining spatial-temporal mining temporal mining.

Catalog Description

This course introduces concepts, algorithms, and techniques of data mining on different types of datasets, which covers basic data mining algorithms, as well as advanced topics on text mining, recommender systems, and graph/network mining.

Course Content

Unit I: 10 lecture hours

Data mining tasks – mining frequent patterns, associations and correlations, classification and regression for predictive analysis, cluster analysis, outlier analysis; advanced pattern mining in multilevel, multidimensional space –mining multilevel associations, mining multidimensional associations, mining quantitative association rules, mining rare patterns and negativepatterns.

Unit II: 10 lecture hours

Classification by back propagation, support vector machines, classification using frequent patterns, other classification methods –genetic algorithms, roughest approach, fuzz set approach.

Density based methods –DBSCAN, OPTICS, DENCLUE; Grid Based methods –STING, CLIQUE; Exception – maximization algorithm; clustering High-Dimensional Data; Clustering Graph and Network Data.

Unit III: 10 lecture hours

Introduction, web mining, web content mining, web structure mining, web usage mining, Text mining – unstructured text, episode rule discovery for texts, hierarchy of categories, text clustering.

Unit IV: 10 lecture hours

Introduction; Temporal Data Mining –Temporal Association Rules, Sequence Mining, GSP algorithm, SPADE, SPIRIT Episode Discovery, Time Series Analysis, Spatial Mining Spatial Mining Tasks, Spatial Clustering. Data Mining Applications.

Text Books

1.DataMining Concepts and Techniques, Jiawei Hang MichelineKamber, Jianpei, Morgan Kaufmannn.
2. Data Mining Techniques – Arun K pujari, Universities Press.

Reference Books/Materials

1.Introduction to Data Mining – Pang-Ning Tan, Vipinkumar, Michael Steinbach, Pearson.
2.Data Mining Principles & Applications –T.VSveresh Kumar, B.Esware Reddy, Jagadish S Kalimani, Elsevier.

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

Examination Scheme:

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 an understanding of the data mining process and Issues.	**PO1, PO2**
CO2	Understanding the Classification and Prediction, Cluster Analysis and association rules	**PO4**
CO3	Understand various techniques for data mining and apply the techniques in solving data mining problems using data mining tools and systems	**PO3, PO5**
CO4	To understand how text mining is different from data mining and how to mine it	**PO4**
CO5	Explore recent trends in data mining spatial-temporal mining temporal mining.	**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 problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA 806A	ADVANCE DATA MINING	2	2	3	3	3	-	-	-	-	-	-	-	-	-	-

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

ETCA812A	Web Programming	L	T	P	C
Version 1.0		3	-	-	3
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.
2. Master the fundamentals of Django framework.
3. Discover how to work with Git and GitHub.
4. Position students so that they can create, share, test and deploy web application projects.

Course Outcomes:

At the end of the course, the students should be able to:

CO1. To design simple webpages using HTML and CSS

CO2. To use GIT and GIT HUB for project management

CO3. To apply Django web framework to create websites

CO4. To create interactive and responsive website using Javascript

CO5. To test and deploy application web applications

Catalog Description

This course concerns with the design and implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Topics include database design, scalability, security, and user experience. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.

Course Content

UNIT I:

Introduction, Web Programming, HTML (Hypertext Markup Language), Document Object Model (DOM), More HTML Elements, Forms, CSS (Cascading Style Sheets), Responsive

Design, Bootstrap, SASS (Syntactically Awesome Style Sheets), Introduction to Git, GitHub, Commits, Merge Conflicts, Branching, More GitHub Features

UNIT II:

Decorators and Lambda Function in Python, Introduction to Web Applications, HTTP, Django, Routes, Templates: Conditionals and Styling, Tasks, Forms: Django Forms, Sessions

Introduction to SQL: Databases, Column Types; Tables ; SELECT: Working with SQL in the Terminal, Functions, UPDATE, DELETE, Other Clauses, Joining Tables: JOIN Query, Indexing, SQL Vulnerabilities;

Django Models, Migrations, Shell: Starting our application, Django Admin, Many-to-Many Relationships, Users

UNIT III:

Introduction to JavaScript, Events, Variables, querySelector, DOM Manipulation:JavaScript Console, Arrow Functions, TODO List; Intervals, Local Storage, APIs: JavaScript Objects, Currency Exchange.

Introduction to User Interfaces,Single Page Applications, Scroll:Infinite Scroll; Animation, React: Addition

UNIT IV

Introduction to Testing, Assert: Test-Driven Development, Unit Testing, Django Testing: Client Testing, Selenium, CI/CD, GitHub Actions, Docker

Scalability, Scaling, Load Balancing, Autoscaling: Server Failure, Scaling Databases: Database Replication, Caching, Security: Git and GitHub, HTML, HTTPS: Secret-Key Cryptography,Public-Key Cryptography, Databases : APIs, Environment Variables;
JavaScript: Cross-Site Request Forgery

Textbooks:

1. Internet and World Wide Web, Deitel H.M., P.J.Deitel , Pearson
2. Django for APIs: Build web APIs with Python and Django, Willam S. Vincent,

Reference Books:

1. Web Technologies, Uttam K. Roy, Oxford University Press
2. HTML Black Book, Stephen Holzner, Wiley Dreamtech.
3. SQL, PL/SQL: Programming Language of Oracle, Ivan Bayross, BPB Publications

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	To design simple webpages using HTML and CSS	PO5
CO2	To use GIT and GIT HUB for project management	PO11
CO3	To apply Django web framework to create websites	PO4
CO4	To create interactive and responsive website using Javascript	PO3
CO5	To test and deploy application web applications	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 complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA812A	Web Programming	-	-	3	3	3	-	-	-	-	-	2	-	-	-	-

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

ETCA 810A	System And Network Administration	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Computer Networks				
Co-requisites	Operating System				

Course Objectives

1. Install or upgrade a network operating system and gain practical experience in installing the Windows Server 200x operating System and Linux Operating System
2. Analyse and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system.
3. Manage and implement disaster recovery.
4. Implement Web servers, terminal services
5. Implement, administer and monitor a Windows-based LAN and Linux-based LAN including configuring hardware devices
6. Evaluate troubleshooting alternatives

Course Outcomes

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

CO1. Define the role of system and network administrator and understand the various components of operating systems.
CO2. Understand the installation process and manage the users and related process in various operation system environment.
CO3. Implement Web servers, terminal services, administer and monitor a Windows-based LAN and Linux based LAN including configuring hardware devices.
CO4. Analyze and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system.

Catalog Description

The module provides students with the knowledge and the skills necessary to install, configure and administer a network on server machines that are part of a domain. The module approaches network administration on both operating system and hardware levels. The general concepts covered in this course apply to the administration of all kinds of systems. However, in order to ground the ideas presented, we will focus primarily on one -- Linux, a popular UNIX-like OS for which we can provide facilities and is easily available to anyone with a PC.

Course Content

Unit I: 10 lecture hours

Introduction to Systems and Network Administration: The Scope of Systems and Network Administration, The Goals of Systems and Network Administration, System Components and their Management: Operating Systems: Windows and Unix Variants, File Systems and Standards (UFS, NFS, NTFS), Processes and Job Control, Privileged, User and Group Accounts, Logs and Audits, Systems Performance Tuning

Unit II: 12 lecture hours

Host Management: Booting and Shutting down of an Operating System, Formatting, Partitioning and Building a File System, File System Layout, Concept of swap space, Cloning Systems, OS Installation, Installation and configuration of devices and drivers, Software Installation and Structuring Software, Open Source Software: The GNU Project, Superuser/Administrator Privileges, User Management, Adding/Removing users, Controlling User Resources, Disk Space Allocation and quotas, Process Management and Monitoring, Scheduling Processes, Killing/Stopping processes, Restarting a Process, Monitoring Process Activity, Maintaining Log Files, File System Repair, Backup and Restoration, , Handling Man Pages/Help System, Kernel Customization, Integrating Multiple Operating Systems, System Sharing, User IDs, Passwords and Authentication.

Unit III: 10 lecture hours

Network Administration: Introduction to Network Administration Approaches, Addressing and Sub netting : Fixed Vs Variable Masks, VLAN Principles and Configuration, Routing Concepts, Static and Dynamic Routing, Routing Protocols: RIP, OSPF, BGP, Network Address Translation (NAT), Configuring a Linux/Windows Box as a Router, Dial-up configuration and Authentication: PPP, Radius, RAS, Configuring a DNS Server, Configuring Send mail Service, Configuring a Web Server, Configuring a Proxy Server, TCP/IP Troubleshooting: ping, traceroute, ifconfig, netstat, ipconfig, Network Management.

Unit IV: 8 lecture hours

Host and Network Security :Security Planning, Categories of Security: C1, C2, C3, C4, Password Security, Access Control and Monitoring: Wrappers, Firewalls: Filtering Rules, Detection and Prevention of Denial of Service (DOS) Attacks, Automatic Identification of Configuration Loop Holes, Security Information Resources: CERT, Installing and Upgrading System Software, Use of Scripting tools: Shell Scripting, Perl/Python Scripting, Use of Make Option

Text Books

1. "Principles of Network and System Administration", Mark Burgess, John Wiley and Sons Ltd,
2. "TCP/IP Network Administration" (3rdEdition), Craig Hunt, O'Reilly and Associates Inc.
3. "Linux Network Administrator's Guide", Olaf Kirch and Terry Dawson, (2ndEdition), O'Reilly and Associates Inc.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	Define the role of system and network administrator and understand the variouscomponents of operating systems.	PO2
CO2	Understand the installation process and manage the users and related process in various operation system environment.	PO3
CO3	Implement Web servers, terminal services, administer and monitor a Windows-based LAN and Linux based LAN including configuring hardware devices.	PO4, PO9
CO4	Analyze and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system. .	PO5, 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	Ethical and Professional Responsibilities	Innovation
ETCA810A	System and Network Administration	-	3	2	3	2	-	-	-	2	-	-	-	3	3	-

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

ETCA 858A	Computer Organization and Assembly Language Programming Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Microprocessor Systems				
Co-requisites	--				

Course Objectives

1. Develop and assemble assembly programs.
2. Identify and use proper assembler directives.
3. Design simple assembly programs.
4. Write programs that interface with a programming language.
5. Appreciate the System Software development environment.

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

This course is an attempt to familiarize students with some of the important Assemblers available in the Windows environment. Students may use any of these tools available. Students may also find that assembler directives used by these programs may differ. Assembly and C Programming helps students greatly in System Software implementation and giving understanding of the machine.

List of Experiments (Indicative)

1	Write a program to add two numbers present in two consecutive memory locations and store the result in next memory location.	2 lab hours
2	Write a program to exchange two memory variables using MOV and XCHG instruction. Can you do it with just XCHG?	2 lab hours
3	Write a program to find the sum of two BCD numbers stored in memory.	2 lab hours
4	Write a program, which will read two decimal numbers, then multiply them together, and finally print out the result (in decimal).	2 lab hours
5	Write a program to find the factorial of decimal number given by user.	2 lab hours
6	Write a program to find nCr for a given n and r.	2 lab hours
7	Write a program to arrange given N numbers in descending order.	2 lab hours
8	Write a program, which will read in decimal inputs repeatedly until a zero value is read; at this point, it should print out the sum of the numbers read in so far.	2 lab hours
9	Write a program for finding the largest number in an array of 10 elements.	2 lab hours
10	Develop and execute a program to sort a given set of 8-bit unsigned integers into ascending order.	1 lab hours
11	Develop and execute an assembly language program to sort a given set of 16- bit unsigned integers into descending order.	2 lab hours
12	Write a Program which adds the sales tax in the Price list of items and replace the Price list with calculated values.	2 lab hours
13	Write a program to Convert ASCII number into decimal digit.	2 lab hours
14	Write a Program for performing the following operation. Z=((A-B)/10*C) ** 2	2 lab hours
15	Write a Program for adding an array of Binary Digits.	2 lab hours

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

Examination Scheme:

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

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

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

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA 858A	Computer Organization and Assembly Language Programming Lab		2	3	3	2	-	-	-	3	-	-	-	3	-	-

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

ETCA 854A	Advance Data MiningLab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Database, Query tools, Data Warehouse and data mining concepts				
Co-requisites	--				

Course Objectives

1. Understand basic data mining tasks, principles, techniques and metrics.
2. Learning about data mining techniques.
3. Understand and apply the concept of classification and clustering.
4 To learn how to extract data from the Web, Text mining.
5. Describing and demonstrating the knowledge of spatial and temporal mining.

Course Outcomes

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

CO1. Develop an understanding of the data mining process.
CO2. Understanding the Classification and Prediction, Cluster Analysis and association rules.
CO3. Understand various techniques for data mining and apply the techniques in solving data mining problems using data mining tools and systems.
CO4. To understand how text mining is different from data mining and how to mine it.
CO5. Explore recent trends in data mining spatial-temporal mining temporal mining.

Catalog Description

This course supplements ETCA806A. The aim is to have hands-on session on various algorithms, and techniques of data mining forvarious datasets. The students will be working on basic data mining algorithms, as well as advanced topics on text mining, recommender systems, and graph/network mining.

List of Experiments (Indicative)

1	Data Analysis- Parametric - Means, T-Test, Correlation	**4 lab hours**

2	Data Analysis- Prediction for numerical outcomes - Linear regression	**4 lab hours**
3	Data Analysis- Correlation analysis	**4 lab hours**
4	Data Analysis- Preparing data for analysis	**2 lab hours**
5	Data Analysis- Pre-processing techniques	**2 lab hours**
6	Data Mining - Implement clustering algorithm	**2 lab hours**
7	Data Mining - Implement classification using	**2 lab hours**
8	Data Mining - Decision tree	**4 lab hours**
9	Data Mining - Back propagation	**4 lab hours**
10	Data Mining - Visualization methods	**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	Develop an understanding of the data mining process and Issues.	**PO1, PO2**
CO2	Understanding the Classification and Prediction, Cluster Analysis and association rules	**PO4**

CO3	Understand various techniques for data mining and apply the techniques in solving data mining problems using data mining tools and systems	**PO3, PO5**
CO4	To understand how text mining is different from data mining and how to mine it	**PO4**
CO5	Explore recent trends in data mining spatial-temporal mining temporal mining.	**PO4**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Ethical and Professional Responsibilities	PSO3 Innovation
ETCA 854A	ADVANCE DATA MININGLAB	2	2	3	3	3	-	-	-	-	-	-	-	-	-	-

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

ETCA856A	System And Network Administration Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Computer Networks				
Co-requisites	Operating System				

Course Objectives

1. Install or upgrade a network operating system and gain practical experience in installing the Windows Server 200x operating System and Linux Operating System
2. Analyses and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system.
3. Manage and implement disaster recovery.
4. Implement Web servers, terminal services
5. Implement, administer and monitor a Windows-based LAN and Linux-based LAN including configuring hardware devices
6. Evaluate troubleshooting alternatives

Course Outcomes

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

CO1. Define the role of system and network administrator and understand the various components of operating systems.

CO2. Understand the installation process and manage the users and related process in various operation system environment.

CO3. Implement Web servers, terminal services, administer and monitor a Windows-based LAN and Linux based LAN including configuring hardware devices.

CO4. Analyze and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system.

Catalog Description

This module complements the course ETCA810A. The course will provide on-hands training to administer the computer systems and networks..

List of Experiments (Indicative)

1	Management of the users & the domain.	**2 lab hours**
2	Configuring DHCP	**2 lab hours**

3	Setting up of a DNS.	**2 lab hours**
4	Setting up the local security policy.	**2 lab hours**
5	Start and stop services from user window and command prompt.	**2 lab hours**
6	Use of event viewer.	
7	Use of the performance monitor.	**2 lab hours**
8	Management of the IIS and FTP server.	
9	Setting up of local area network.	**2 lab hours**
10	Use of utilities (a) Ping (b) Tracert (c) netstat (d) net (e) IP configuration (f) Path ping	**2 lab hours**
11	Use of network monitor.	
12	Setting up and use "Terminal Client Services".	**2 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Define the role of system and network administrator and understand the variouscomponents of operating systems.	**PO2**
CO2	Understand the installation process and manage the users and related process in various operation system	**PO3**

	environment.	
CO3	Implement Web servers, terminal services, administer and monitor a Windows-based LAN and Linux based LAN including configuring hardware devices.	**PO4, PO9**
CO4	Analyze and implement a security policy through: accounts, general network policy, file attributes, disk quotas and the distributed file system. .	**PO5, PO9**

Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethics and Professional Responsibilities	Innovation
ETCA856A	System and Network Administration Lab	-	3	2	3	2	-	-	-	2	-	-	-	3	3	-

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

ETCA860A	Web Programming Lab	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	Basics of programming				
Co-requisites	--				

Course Objectives

1. Provide an understanding of the role computation can play in solving problems.
2. Master the fundamentals of Django framework.
3. Discover how to work with Git and GitHub.
4. Position students so that they can create, share, test and deploy web application projects.

Course Outcomes:

At the end of the course, the students should be able to:

CO1. To design simple webpages using HTML and CSS

CO2. To use GIT and GIT HUB for project management

CO3. To apply Django web framework to create websites

CO4. To create interactive and responsive website using Javascript

CO5. To test and deploy application web applications

Catalog Description

This course complements ETCA812A. This course concerns the implementation of web apps with Python, JavaScript, and SQL using frameworks like Django, React, and Bootstrap. Through hands-on projects, students learn to write and use APIs, create interactive UIs, and leverage cloud services like GitHub and Heroku. By semester's end, students emerge with knowledge and experience in principles, languages, and tools that empower them to design and deploy applications on the Internet.

Course Content

The industry expert will give 10 or more exercises based upon syllabus ETCA812A.

Textbooks:

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

2. Django for APIs: Build web APIs with Python and Django, Willam S. Vincent,

Reference Books:

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

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

3. SQL, PL/SQL: Programming Language of Oracle, Ivan Bayross, BPB Publications

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	Mapped Program Outcomes
CO1	To design simple webpages using HTML and CSS	PO5
CO2	To use GIT and GIT HUB for project management	PO11
CO3	To apply Django web framework to create websites	PO4
CO4	To create interactive and responsive website using Javascript	PO3
CO5	To test and deploy application web applications	PO5

	Course Code	ETCA860A
	Course Title	Web Programming Lab
Engineering Knowledge	PO1	
Problem analysis	PO2	
Design/development of solutions	PO3	3
Conduct investigations of complex problems	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	2
Life-long Learning	PO12	
Application of Concepts	PSO1	
Ethical and Professional Responsibilities	PSO2	
Innovation	PSO3	

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

ETCA403A	Oral and Technical Communication	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. Understand the basics of technical communication.
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 presentation skills.

Course Outcomes

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

CO1. Understand the basics of technical communication skills.

CO2. Understand the correct form of English with proficiency.

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

CO4. Improve professional and technical communication.

CO5. Enhance presentation and 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 and technical communication skills.

Course Content

UNIT II **10 Lecture Hours**

Fundamentals of Technical Communication: Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences;

Paragraph; Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

UNIT II **10 Lecture Hours**

Forms of Technical Communication: Technical Report: Definition & importance; Thesis/Project writing: structure & importance; synopsis writing: Methods; Technical research Paper writing: Methods & style; Seminar & Conference paper writing; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration, C.V./Resume writing; Technical Proposal: Types, Structure & Draft.

UNIT III **10 Lecture Hours**

Technical Presentation: Strategies & Techniques Presentation: Forms; interpersonal Communication; Class room presentation; style; method; Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear; Audience Analysis & retention of audience interest; Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

UNIT IV **10 Lecture Hour**

Technical Communication Skills: Interview skills; Group Discussion: Objective & Method; Seminar/Conferences Presentation skills: Focus; Content; Style; Argumentation skills: Devices: Analysis; Cohesion & Emphasis; Critical thinking; Nuances: Exposition narration & Description; effective business communication competence: Grammatical; Discourse competence: combination of expression & conclusion; Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non verbal means.

TEXT BOOKS:

The Chicago Manual of Style, 13th Edition, Prentice Hall of India, 1989 Gowers, Ernest, "The Complete Words".Penguin.

IEEE Transactions on "Written and Oral Communications" has many papers of relevance Ludlow, R., and Panton, F., "The Essence of Effective Communication", Prentice Hall of India Pvt.Ltd.

Menzel, D.H., Jones, H.M., Boyd, L.G., "Writing a Technical Paper".McGraw Hill. Strunk, W., White.E.B., "The Elements of Style", 3rd Edition, McMillan. Munter, M., "Business Communication: Strategy and Style" Prentice Hall, New Jersey. Tubian, K.L., "A Manual for Writen of 1erm Papers, Thesis and Dissertation", Univ. of Chicago Press.

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand the basics of technical communication	**PO10,PSO1**
CO2	Understand the correct form of English with proficiency.	**PO12,PSO1**
CO3	Improve student's personality and enhance their self-confidence.	**PO10,PSO2**
CO4	Improve professional communication.	**PO10, PSO2**
CO5	Enhance technical presentation and academic writing skills.	**PO9,PO10,PSO 2**

ETEL 403A	Course Code	
ORAL AND TECHNICAL COMMUNICATION	Course Title	
-	PO1	Engineering Knowledge
-	PO2	Problem analysis
-	PO3	Design/development of solutions
-	PO4	Conduct investigations of complex problems
-	PO5	Modern tool usage
-	PO6	The engineer and society
-	PO7	Environment and sustainability
-	PO8	Ethics
2	PO9	Individual or teamwork.
3	PO10	Communication
-	PO11	Project management and finance
-	PO12	Life-long Learning
2	PSO1	Application of Concepts
2	PSO2	Ethical and Professional Responsibilities
-	PSO3	Innovation

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

ETCA 827A	Devops	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure					
Co-requisites	--				

Course Objectives

DevOps is basically creating a niche or environment that emphasize bringing both development and operational team together.The key objective is to concentrate on the requirements of the project or the entire business requirement.

- **Analysis:** Analysis of the entire business requirement and then gathering the necessary information or data.
- **Design:** Putting all the gathered data into a proper format and then proceed with the development activity.
- **The development teams should develop code: Optimized and ready to move codes**.
- **Compilation:** Simultaneous compilation of codes to keep a check on the beauty of the code.
- **Test:** Without this phase, any software product is not ready for deployment; therefore, it is very much needed to go through testing in each phase.

Course Outcomes

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

1. Identify the difference between Agile and Devops.

2. Practice of GitHub

3. Illustrate various Building tools

4. Analyse various Testing tools

5 Illustrate various Configuration management tools

Catalog Description

Modern software systems are becoming increasingly complex, to meet quality, availability, and security demands. And these systems are changing rapidly to keep up with the needs of end-users.In this course,we look at how the DevOps philosophy can provide a holistic way to look at

software development, deployment, and operations. And provide some tenets to help improve quality, and stability.

Course Content

Unit I: (10 Lecture)

Learning Objectives, DevOps Overview, Relationship between Agile and DevOps, DevOps Tool chain, Challenges with the traditional approach, Addressing challenges through DevOps, DevOps approach to the challenges, Overview of the DevOps tools, workflow of DevOps, JIRA

Suggested sources : https://www.atlassian.com/software/jira/guides/use-cases/what-is-jira-used-for

Unit II: (10 Lecture)

VERSION CONTROL SYSTEMS: Overview of version control systems – role of version control systems – Types of control systems and their supporting tools – Overview of Git – Overview of Source code and Version Control hosts – Deploy the files to GitHub.

Suggested Source : https://github.com/features

Unit III: (10 Lecture)

CONTINUOUS INTEGRATION AND BUILDING TOOL: Importance of continuous Integration, Overview and Features of Jenkins, Set up Jenkins, Overview and Features of Maven,- Setup Maven, Overview and Features of TeamCity, Setup TeamCity

Suggested Source:

1. https://www.jenkins.io/doc/

2. http://maven.apache.org/
3.https://www.tutorialspoint.com/continuous_integration/continuous_integration_creating_project_teamcity.htm

Unit IV: (10 Lecture)

SOFTWARE AND AUTOMATION TESTING FRAMEWORKS: Software Testing overview, Testing levels Approach and Automation Tools, Test driven development approaches and JUnit5, Behavior driven development approach with cucumber.

Suggested Source :

https://howtodoinjava.com/junit-5-tutorial/

https://junit.org/junit5/docs/current/user-guide/

CONFIGURATION MANAGEMENT TOOLS: Overview of configuration management tools, overview of puppet, puppet configuration, overview of Chef, Chef configuration, overview of Ansible,Ansible configuration, containerization and Docker.

Suggested Source :

1. https://www.tutorialspoint.com/puppet/index.htm

2. https://puppet.com/blog/how-get-started-puppet-beginners-guide/

3. https://www.tutorialspoint.com/chef/index.htm

4. https://docs.chef.io/chef_overview/

5. https://www.tutorialspoint.com/ansible/index.htm

6. https://docs.ansible.com/ansible/latest/user_guide/intro_getting_started.html

7. https://docker-curriculum.com/

TEXT BOOKS

1. Jez Humble and David Farley, Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation, Pearson Education, Inc.2011
2. Jennifer Davis, Katherine Daniels, Effective DevOps: Building a Culture of Collaboration, Affinity, and Tooling at Scale, O'Reilly, 2016 REFERENCE BOOKS
3. . Gene Kim, Jez Humble, Patrick Debois, and John Willis, THE DEVOPS HANDBOOK How to Create World-Class Agility, Reliability, & Security in Technology Organizations, IT Revolution Press, 2016.
4. EBOOK
    I. https://devops.com/downloads/7-best-devops-ebooks-2018-collection/
    II. http://images.itrevolution.com/documents/DevOps_Handbook_Intro_Part1_Part2.pd3
    III. https://www.microfocus.com/media/ebook/Software-DevOps-eBook.pdf MOOC 1
    IV. https://www.coursera.org/learn/uva-darden-continous-delivery-devops

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Identify the difference between Agile and Devops.	**PO1, PO2, PO5**
CO2	Practice of GitHub	**PO3, PO4, PO5**
CO3	Illustrate various Building tools	**PO3, PO4, PO5**
CO4	Analyse various Testing tools	**PO3, PO4, PO5**
CO5	Illustrate various Configuration management tools	**PO3, PO5, PO7**

ETCA827A	Course Code	
Devops	Course Title	
2	PO1	Engineering Knowledge
2	PO2	Problem analysis
3	PO3	Design/development of solutions
3	PO4	Conduct investigations of complex problems
3	PO5	Modern tool usage
-	PO6	The engineer and society
1	PO7	Environment and sustainability
-	PO8	Ethics
-	PO9	Individual or team work
-	PO10	Communication
-	PO11	Project management and finance
-	PO12	Life-long Learning
3	PSO1	Application of Concepts
1	PSO2	Ethical and Professional Responsibilities
-	PSO3	Innovation

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

ETCA817A	AI AND APPLICATIONS	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Artificial Intelligence				
Co-requisites	--				

Course Objectives

The students will be able to get an idea on:

The main learning objectives of the course are to:
1. Identify problems where artificial intelligence techniques are applicable
2.Apply selected basic AI techniques; judge applicability of more advanced techniques.
3. Participate in the design of systems that act intelligently and learn from experience.

Course Outcomes

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

CO1.Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction)
CO2. Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools
CO3.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO4. Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems
CO5.To demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO6. To demonstrate proficiency in applying scientific method to models of machine learning.

Catalog Description

The course is an introduction to AI from an applied perspective. It begins by describing what the latest generation of artificial intelligence techniques can do. After an introduction of some basic concepts and techniques, the course illustrates both the potential and current limitations of these techniques with examples from a variety of applications. In a final project, groups of students will participate in the creation of an AI-based application.

Course Content

Unit I: 8 lecture hours

Introduction: Introduction to intelligent agents
Problem solving: Solving problems by searching, state space formulation, depth first and breadth first search, iterative deepening

Unit II: 12 lecture hours

Intelligent search methods: A***** and its memory restricted variants

Production systems: Design implementation and limitations, case studies

Unit III: 12 lecture hours

Game Playing: Mini max, alpha-beta pruning

Knowledge and reasoning: Propositional and first order logic, semantic networks, building a knowledge base, inference in first order logic, logical reasoning systems

Unit IV: 8 lecture hours

Planning: STRIPS partial order planning, uncertain knowledge and reasoning, probabilistic reasoning systems, Bayesian networks

Learning from observations: Inductive learning, learning decision trees, computational learning theory, Explanation based learning

Applications: Environmental Science, Robotics, Aerospace, Medical Sciences etc.

Text Books

1. "AI" by Rich and Knight, Tata McGraw Hill.

Reference Books/Materials

1. Neural Networks in Computer Intelligence" by KM Fu, McGraw Hill
2. "AI: A modern approach" by Russell and Norvig, 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 various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction).	**PO1, PSO2**
CO2	Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools.	**PO3**
CO3	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information.	**PO5**
CO4	Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems	**PO2, PSO1**
CO5	To demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	**PO4**
CO6	To demonstrate proficiency in applying scientific method to models of machine learning.	**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 complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA817 A	AI and applications	2	2	2	3	3	2	-	-	-	-	-	-	3	3	-

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

ETCA819A	Big Data Analytics and Applications	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Cloud Computing				
Co-requisites	--				

Course Objectives

1. Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications.
2. Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
3. Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and scalability issues.
4. Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
5. Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.
6. Ability to integrate machine learning libraries and mathematical and statistical tools with modern technologies like Hadoop and Map reduce

Course Outcomes

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

CO1. Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
CO2. Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.
CO3. Interpret business models and scientific computing paradigms and apply software tools for big data analytics.
CO4. Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.
CO5. Provide an overview of an exciting growing field of big data analytics.
CO6. Introduce the tools required to manage and analyze big data like Hadoop, No Sq l Map Reduce.
CO7. Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.
CO8. Enable students to have skills that will help them to solve complex real-world problems in for decision support.

Catalog Description

With the advance of IT storage, processing, computation, and sensing technologies, Big Data has become a novel norm of life. Only until recently, computers are able to capture, and analysis all sorts of large-scale data from all kinds of fields -- people, behavior, information, devices, sensors, biological signals, finance, vehicles, astrology, neurology, etc. Almost all industries are bracing into the challenge of Big Data and want to dig out valuable information to get insight to solve their challenges. This course shall provide the fundamental knowledge to equip students being able to handle those challenges. This discipline inherently involves many fields. Because of its importance and broad impact, new software and hardware tools and algorithms are quickly emerging. A data scientist needs to keep up with this ever-changing trend to be able to create a state-of-the-art solution for real-world challenges.

Course Content

Unit I: **12 lecture hours**

Statistical Analysis of Data, Individual Differences, Descriptive Statistics, Frequency Distributions, Histograms, Histograms, Shapes of Distributions, Measures of Central Tendency Computing the Mean, Measuring Variability, Measures of Relationship, Regression, Reliability Indices, Standard Scores (Z-scores), Inferential Statistics, Populations and Samples

Unit II: **10 lecture hours**

The Null Hypothesis, Chi-Square and T-Test, Statistical Decisions, Statistical Decision Process, Testing for Mean Differences, Power of a Statistical Test, Statistical versus Practical Significance, Effect Size, Meta-Analysis.

Unit III: **10 lecture hours**

Data Visualization: Meaning and significance, Traits of Meaning full Data, Brief History of Information Visualization, Power of visual perception, Making abstract data Visible, Building Blocks of information Visualization. Analytical Techniques.

Unit IV: **8 lecture hours**

Big Data, In-Memory Processing, limitations of In Memory Processing. Big Data Privacy, Big data Visualization, Map Reduce algorithm, OLAP and its applications, Data Mining Process, Knowledge Discovery, Decision Support Systems

Text Books

1. **"**Now You See It: Simple Visualization Techniques for Quantitative Analysis**"** by Stephen Few, Publisher: Jonathan G Koomey

Reference Books/Materials

1. Big Data Analytics: Turning Big Data into Big Money by Frank J. Ohlhorst Publisher: Wiley
2. Gelman, Andrew, and Jennifer Hill. Data Analysis Using Regression and Multilevel/Hierarchical Models. 1st ed. Cambridge, UK: Cambridge University Press.
3. Gelman, Andrew, John B. Carlin, Hal S. Stern, and Donald B. Rubin. Bayesian Data Analysis. New York, NY: Chapman & 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	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.	**PO1**
CO2	Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics.	**PO1**
CO3	Interpret business models and scientific computing paradigms and apply software tools for big data analytics.	**PO5**
CO4	Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.	**PO2**
CO5	Provide an overview of an exciting growing field of big data analytics.	**PO2**
CO6	Introduce the tools required to manage and analyze big data like Hadoop, NoSqlMapReduce.	**PO5**
CO7	Teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability.	**PO1**
CO8	Enable students to have skills that will help them to solve complex real-world problems in for decision support.	**PO4**

ETCA 869A	Devops Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure					

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	Ethical and Professional Responsibilities	Innovation
ETCA819A	Big Data Analytics and Applications	3	3		3	3	-	-	-	-	-	-	-	3	-	

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

Co-requisites	--

Course Objectives

DevOps is basically creating a niche or environment that emphasize bringing both development and operational team together.The key objective is to concentrate on the requirements of the project or the entire business requirement.

- **Analysis:** Analysis of the entire business requirement and then gathering the necessary information or data.
- **Design:** Putting all the gathered data into a proper format and then proceed with the development activity.
- **The development teams should develop code: Optimized and ready to move codes**.
- **Compilation:** Simultaneous compilation of codes to keep a check on the beauty of the code.
- **Test:** Without this phase, any software product is not ready for deployment; therefore, it is very much needed to go through testing in each phase.

Course Outcomes

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

1. Manage Project using on JIRA .

2. Manage Software Version Control using GitHub

3. Illustrate various Building tools

4. Analyze various Testing tools

5 Configure Management tools

Catalog Description

This module complements the course ETCA869A.

List of Experiments (Indicative)

The list of experiments will be decided by faculty member based on course ETCS869A.

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	Manage Project using on JIRA .	**PO1, PO2, PO5**
CO2	Manage Software Version Control using GitHub	**PO3, PO4, PO5**
CO3	Illustrate various Building tools	**PO3, PO4, PO5**
CO4	Analyze various Testing tools	**PO3, PO4, PO5**
CO5	Configure management tools	**PO3, PO5, PO7**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA869 A	Devops Lab	2	2	3	3	3		1						3	1	

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

ETCA859A	AI AND ITS APPLICATIONSLAB	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning of Artificial intelligence				
Co-requisites	--				

Course Objectives

The students will be able to get an idea on:

1. To gain a historical perspective of AI and its foundations
2. To introduce the basic principles, techniques, and applications of Artificial Intelligence.
3. To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
4. To experience programming in AI language tools.
5. To explore potential areas like expert systems, neural networks, fuzzy logic, robotics, natural language processing, and computer vision.
6. To experience AI development tools such as an 'AI language', expert system shell, and/or data mining tool.
7. To experiment with a machine learning model for simulation and analysis

Course Outcomes

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

CO1.Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction)
CO2. Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools
CO3.Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO4. Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems
CO5.To demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
CO6. To demonstrate proficiency in applying scientific method to models of machine learning.

Catalog Description

The primary objective of this course is to introduce the basic principles, techniques and applications of Artificial Intelligence. Emphasis will be placed on the practical implementation of fundamentals concepts and 'hands-on 'approachfor understanding, as well as a challenging avenue for exploration and creativity.

Course Content

1	Write a program to solve 8 queens problem using PROLOG.	**2 lab hours**
2	Solve any problem using depth first search using PROLOG.	**2 lab hours**
3	Solve any problem using best first search using PROLOG.	**2 lab hours**
4	Solve 8-puzzle problem using best first search using PROLOG.	**2 lab hours**
5	Solve Robot (traversal) problem using means End Analysis using PROLOG.	**2 lab hours**
6	Solve travelling salesman problem using PROLOG	**4 lab hours**
7	Create a game project using artificial intelligence	**4 lab hours**
8	To create a relational database in PROLOG	**4 lab hours**
9	Concept of Unification, Backtracking and Recursion in artificial intelligence.	**4 lab hours**
10	Write a program to solve water jug problem using LISP.	**4 lab hours**
11	WAP in turbo prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.	**2 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction)	**PO2**
CO2	Understand the fundamentals of knowledge representation, inference and theorem proving using AI tools	**PO3**
CO3	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information	**PO5, PSO1, PO9**
CO4	Ability to apply knowledge representation, reasoning, and machine learning techniques to real-world problems	**PO4**
CO5	To demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	**PO1**
CO6	To demonstrate proficiency in applying scientific method to models of machine learning.	**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 complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
ETCA859A	AI and its application Lab	3	2	3	3	3				3				3		

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

ETCA861A	Seminar	L	T	P	C
Version 1.0		-	-	2	1
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out literature survey
2. To learn the art of technical report writing
3. To learn the art of verbal communication with the help of modern presentation techniques

Course Outcomes

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

CO1. Carry out the extensive literature survey.
CO2. Learn to write and present technical reports/articles.
CO3. Learn to analyze various methods and techniques applicable to the topic to study.
CO4. Have practical knowledge on the applications of topic of study on society.

Catalog Description

A student will select a topic in emerging areas of Engineering & Technology and will carry out the task under the supervision of a teacher assigned by the department. He/ She will give a seminar talk on the same before a committee constituted by the Dean. The committee should comprise of 2 or 3 faculty members from different specializations.

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 Seminar 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	Carry out the extensive literature survey.	PO2
CO2	Learn to write and present technical reports/articles.	PO5
CO3	Learn to analyze various methods and techniques applicable to the topic to study.	PO2
CO4	Have practical knowledge on the applications of topic of study on society.	PO6

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA861 A	Seminar		3			3	2							2		

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

ETCA821A	Blockchains	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Basics of Cryptography				
Co-requisites	Basic Mathematics				

Course Objectives

1. Help in understanding Creation of block and working of blockchain technology to innovate and improve business process.

Course Outcomes

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

CO1. Understand blockchain technology.
CO2. Develop blockchain based solutions and write smart contract using Hyperledger Fabric andEthereum frameworks.
CO3. Build and deploy block chain application for on premise and cloud-based architecture.
CO4. Integrate ideas from various domains and implement them using block chain technologyin different perspectives.

Catalog Description

Through this subject, student will be able to understand the coarse grained aspects of Blockchain Technology. Student will understand the applications of Blockchain and its working in networks. The internals of framework and working will be discussed throughout the course duration.

Course Content

Unit I: 8 lecture hours

Introduction: Overview of Block chain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Block chain, Understanding Cryptocurrency to Block chain, Permissioned Model of Block chain, Overview of Security aspects of Blockchain.

Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency.

Unit II: 12 lecture hours

Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts,

Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay.

Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – basic introduction, HashcashPoW, BitcoinPoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

Unit III: 12 lecture hours

Permissioned Blockchain: Permissioned model and use cases, Design issues for Permissioned block chains, Execute contracts, State machine replication, Overview of Consensus models for permissioned block chain- Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport- Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

Enterprise application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Block chain, Block chain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Block chain

Unit IV: 8 lecture hours

Hyperledger Fabric: Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

Text Books

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O'Reilly, 2015
2. Josh Thompsons, "Block Chain: The Block Chain for Beginners- Guide to Blockchain Technology and Leveraging Block Chain Programming"
3. Daniel Drescher, "BlockChain Basics", Apress; 1st edition, 2017
4. AnshulKaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
5. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralizationand Smart Contracts Explained", Packt Publishing
6. RiteshModi, "Solidity Programming Essentials: A Beginner's Guide to Build SmartContracts for Ethereum and Block Chain", Packt Publishing

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	Understand blockchain technology.	PO1
CO2	Develop blockchain based solutions and write smart contract using Hyper ledger Fabric and Ethereum frameworks	PO2, PO3
CO3	Build and deploy blockchain application for on premise and cloud-based architecture	PO5
CO4	Integrate ideas from various domains and implement them using block chain technology in different perspectives.	PO5, PO6, PO12

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA821 A	Blockchains	3	3	3		2	2									

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

ETCA863A	Blockchains Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Basics of Cryptography				
Co-requisites	Basics of Mathematics				

Course Objectives

The Lab taps into the transformative potential of block chain and related technologies to achieve the goals set out for Sustainable Development.

Course Outcomes

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

CO1.To understand the practical implementation of Blockchain technology.
CO2. To be able to explain the different components involved within Blockchain implementation.
CO3. To know when and why you may want to use Blockchain within your environment.
CO4. To be able to implement IoT asset tracking app using Block chain.
CO5. To be able to Secure art using block chain digital certificates.

Catalog Description

This course complements ETCS304A. It enables students to utilize potential of blockchain into aoptimal solution(s). The list of experiments helps to understand details of component, implementation and application domain of blockchain.

List of Experiments (Indicative)

1	Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on Cloud torun. https://github.com/hyperledger/ https://docs.docker.com/get-started/ https://console.ng.bluemix.net/docs/services/blockchain/index.html https://console.bluemix.net/docs/containers/container_index.html#container_index	**2 lab hours**
2	Create and deploy a block chain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chaincode, and perform invoke and query on your block chain network	**2 lab hours**

	(https://developer.ibm.com/patterns/create-and-deploy-block chain-network-using-fabric-sdk-java/)	
3	Interact with a block chain network. Execute transactions and requests against a block chain network by creating an app to test the network and its rules (https://developer.ibm.com/patterns/interacting-with-a-block chain-network/)	**2 lab hours**
4	Deploy an asset-transfer app using block chain. Learn app development within aHyperledger Fabric network (https://developer.ibm.com/patterns/deploy-an-asset-transfer-app-using-block chain/)	**2 lab hours**
5	Use block chain to track fitness club rewards Build a web app that uses Hyperledger Fabric to track and trace member rewards (https://developer.ibm.com/patterns/fitness-club-rewards-points-iot-and-retail-integration/)	**2 lab hours**
6	Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBMBlock chain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing resultsand data in the starter plan (https://developer.ibm.com/patterns/car-auction-network-hyperledger-fabric-node-sdk-starter-plan/)	**2 lab hours**
7	Develop an IoT asset tracking app using Block chain. Use an IoT asset tracking device to improve a supply chain by using Block chain, IoT devices, and Node-RED (https://developer.ibm.com/patterns/develop-an-iot-asset-tracking-app-using-block chain/)	**2 lab hours**
8	Secure art using block chain digital certificates. Node.js-based auction application can help democratize the art market	**2 lab hours**
9	Mini projects such as : (i) Block chain for telecom roaming, fraud, and overage management. See howcommunication service providers use block chain to enhance their value chains. https://developer.ibm.com/patterns/blockchain-for-telecom-roaming-fraud-and-overagemanagement/ (ii) Use IoT dashboards to analyze data sent from a Block chain network. Build an IoT app and IoT dashboards with Watson IoT	**6 lab hours**

	Platform and Node-RED to analyze IoTdatasent from a Block chain network https://developer.ibm.com/patterns/iot-dashboards-analyze-data-block chain-network/) (iii) Create an Android app with Block chain integration. Build a Block chain enabled health and fitness app with Android and Kubernetes https://developer.ibm.com/patterns/create-an-android-app-with-block chain-integration/ (iv) Create a global finance block chain application with IBM Block chain Platform Extension for VS Code. Develop a Node.js smart contract and web app for a GlobalFinance with block chain use case https://developer.ibm.com/patterns/global-financing-use-case-for-block chain/ (v) Develop a voting application using Hyperledger and Ethereum. Build a decentralized App that combines Ethereum's Web3 and Solidity smart contracts with Hyperledger'shosting Fabric and Chaincode EVM https://developer.ibm.com/patterns/voting-app-hyperledger-ethereum/ (vi) Create a block chain app for loyalty points with Hyperledger Fabric Ethereum Virtual Machine. Deploy Fabric locally with EVM and create a proxy for interacting with asmart contract through a Node.js web app https://developer.ibm.com/patterns/loyalty-points-fabric-evm/	

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 practical implementation of Block chain technology.	**PO1**
CO2	To be able to explain the different components involved within Block chain implementation.	**PO3**
CO3	To know when and why you may want to use Block chain within your environment.	**PO2, PO4**
CO4	To be able to implement IoT asset tracking app using Block chain.	**PO3, PO4, PO5**
CO5	To be able to Secure art using block chain digital certificates.	**PO4**

Course Code	Course Title	PO1 Engineering Knowledge	PO2 Problem analysis	PO3 Design/development of solutions	PO4 Conduct investigations of complex problems	PO5 Modern tool usage	PO6 The engineer and society	PO7 Environment and sustainability	PO8 Ethics	PO9 Individual or team work	PO10 Communication	PO11 Project management and finance	PO12 Life-long Learning	PSO1 Application of Concepts	PSO2 Ethical and Professional Responsibilities	PSO3 Innovation
ETCA863A	Blockchain Lab	2	2	3	3	3										

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

ETCA 823A	Internet of Things and Applications	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

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

CO1. Understand IoT and its hardware and software components
CO2. Interface I/O devices, sensors and communication mobiles
CO3. Remotely monitor data and control devices
CO4. Develop real life IoT based projects

Catalog Description

The Internet of Things (IoT) is everywhere. It provides advanced data collection, connectivity, and analysis of information collected by computers everywhere—taking the concepts of Machine-to-Machine communication farther than ever before. This course gives a foundation in the Internet of Things, including the components, tools, and analysis by teaching the concepts behind the IoT and a look at real-world solutions.

Course Content

Unit I: **8 lecture hours**

Introduction to IoT: Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals-Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

Unit II: **9 lecture hours**

Elements of IoT: Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.

Software Components: Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

Unit III: **10lecture hours**

IoT Application Development: Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

Unit IV: **12lecture hours**

IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

Text Books

1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"

2. Dr. SRN Reddy, RachitThukral and Manasi Mishra, "Introduction to Internet of Things: A

Practical Approach", ETI Labs

3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies,

Platforms, and Use Cases", CRC Press

4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi

5. Adrian McEwen, "Designing the Internet of Things", Wiley

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

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

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

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

CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**
CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

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	Ethical and Professional Responsibilities	Innovation
ETCA 823A	Internet of Things and Applications	2	3	3	3											

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

ETCA 865A	Internet of Things and Applications Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Sensors, System Integration				
Co-requisites	Cloud and Network Security				

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-time IoT based projects

Course Outcomes

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

CO1. Understand IoT and its hardware and software components
CO2. Interface I/O, sensors and communication mobiles
CO3. Remotely monitor data and control devices
CO4. Develop real life IoT based projects

Catalog Description

This course complements ETCA823A. The Internet of Things (IoT) Lab focuses on learning, research and hands-on investigation with a variety of emerging devices and technologies (involving smart devices, pervasive connectivity, virtual interfaces and cloud computing), and their potential applications in consumer, retail, health care and industrial contexts. It serves as an exciting multidisciplinary learning and research environment for students and faculty, as well as a thought-leadership showcase to experience cutting-edge technologies and use-cases.

List of Experiments (Indicative)

1	Familiarization with Arduino /Raspberry Pi and perform necessary software installation.	**2 lab hours**
2	To interface LED/Buzzer with Arduino /Raspberry PiandwriteaprogramtoturnONLEDfor1 secafterevery2 seconds.	**2 lab hours**
3	TointerfacePushbutton/Digitalsensor(IR/LDR)withArduino/RaspberryPiandwriteaprogramto turn ON LED when push buttonis pressed orat sensor detection.	**2 lab hours**
4	TointerfaceDHT11sensorwithArduino/RaspberryPiandwriteaprogramtoprinttemperature and humidity readings.	**2 lab hours**
5	TointerfacemotorusingrelaywithArduino/RaspberryPiandwriteaprogramtoturnONmotor when push button is pressed.	**2 lab hours**
6	TointerfaceOLEDwithArduino/RaspberryPiandwriteaprogramtoprinttemperatureandhumidityreadings on it.	**2 lab hours**

7	TointerfaceBluetoothwithArduino/RaspberryPiandwriteaprogramtosendsensordatatosmartphoneusingBluetooth.	**2 lab hours**
8	TointerfaceBluetoothwithArduino/RaspberryPiandwriteaprogramtoturnLEDON/OFF when‘1’/’0’isreceivedfromsmartphoneusingBluetooth.	**3 lab hours**
9	WriteaprogramonArduino/RaspberryPitouploadtemperatureandhumiditydatato thingspeak cloud.	**2 lab hours**
10	WriteaprogramonArduino/RaspberryPitoretrievetemperatureandhumiditydatafrom thingspeak cloud.	**2 lab hours**
11	To install My SQL database on Raspberry Pi and perform basic SQL queries.	**2 lab hours**
12	Write a program on Arduino /Raspberry Pi to publish temperature data to MQTT broker.	**2 lab hours**
13	WriteaprogramonArduino/RaspberryPitosubscribetoMQTTbrokerfortemperaturedataanddprint it.	**2 lab hours**
14	WriteaprogramtocreateTCPserveronArduino/RaspberryPiandrespondwithhumiditydatato TCP client when requested.	**3 lab hours**
15	Write aprogramtocreateUDPserveronArduino/RaspberryPiandrespondwithhumiditydatato UDP client when requested.	**3 lab hours**

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

Examination Scheme:

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Understand IoT and its hardware and software components	**PO2**
CO2	Interface I/O devices, sensors and communication mobile.	**PO1**

CO3	Remotely monitor data and control devices	**PO4**
CO4	Develop real life IoT based projects	**PO3**

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	Ethical and Professional Responsibilities	Innovation
ETCS865A	Internet of Things Applications Lab	2	3	3	3											

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

ETCS825A	Quantum computing	L	T	P	C
Version 1.0		3	1	0	4
Pre-requisites/Exposure	Data Structures and Algorithms; Programming in Python				
Co-requisites	--				

Course Objectives

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

1. Explain the working of a Quantum Computing program, its architecture and program model
2.Develop quantum logic gate circuits
3. Develop quantum algorithm
4. Program quantum algorithm on major toolkits

Course Outcomes

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

CO1 To learn concept of quantum computing in order to develop algorithms.
CO2. To understand the logic gates of circuits.
CO3. To understand basic techniques of quantum algorithms
CO4. To learn Quantum algorithms and their usage

Catalog Description

The objective of this course is to impart necessary knowledge to the learner so that he/she can develop and implement algorithm and write programs using these algorithm.

Course Content

Unit I: **12 lecture hours**

Introduction to Quantum Computing: Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum computing, Overview of major concepts in Quantum Computing: Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

Unit II: **8 lecture hours**

Math Foundation for Quantum Computing

Math Foundation for Quantum Computing: Matrix Algebra: basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

Unit III: 8 lecture hours

Building Blocks for Quantum Program: Architecture of a Quantum Computing platform,
Details of q-bit system of information representation: Block Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perceptive e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlledgates, Ising, Deutsch, swap etc.
Programming model for a Quantum Computing Program: Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

Unit IV: 12 lecture hours

Quantum Algorithms: Basic techniques exploited by quantum algorithms: Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks
Major Algorithms: Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch -Jozsa Algorithm
OSS Toolkits for implementing Quantum program: IBM quantum experience, Microsoft Q RigettiPyQuil (QPU/QVM)

Text Books

1. John Gribbin, "Computing with Quantum cats: From colossus to Qubits", Wiley 2010

Reference Books/Materials

1. Riley Tipton, "Quantum computing from the ground up".

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

Components	Quiz	Attendance	Mid Term Exam	Presentation/ Assignment/ etc.	End Term Exam
Weightage (%)	10	10	20	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 concept of quantum computing in order to develop algorithms.	**PO1, PO2**
CO2	To understand the logic gates of circuits.	**PO3, PO4**
CO3	To understand basic techniques of quantum algorithms	**PO10, PSO1**
CO4	To learn Quantum algorithms and their usage	**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 problems	Modern tool 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 and Professional Responsibilities	Innovation
ETCS825A	Computing	2	2	2	2						2			3		3

ETCS867A	Quantum Computing Lab	L	T	P	C
Version 1.0		0	0	2	1
Pre-requisites/Exposure	Practical learning				
Co-requisites	--				

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

Course Objectives

1. Building Quantum dice

2. Building Quantum Random No. Generation

3. Composing simple quantum circuits with q-gates and measuring the output into classical

bits.

Course Outcomes

On completion of this course, the students will be able to
CO 1 Implementation of Shor's Algorithms

CO2. Implementation of Grover's Algorithm

CO3. Implementation of Deutsch's Algorithm

CO4. Implementation of Deutsch-Jozsa's Algorithm

CO5. Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm

LIST OF SUGGESTED BOOKS

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", CambridgeUniversity Press.

2. David McMahon, "Quantum Computing Explained", Wiley

3. IBM Experience: https://quantumexperience,ng,bluemix.net

4. Microsoft Quantum Development Kit https://www.microsoft.com/en-us/quantum/development-kit

5. Forest SDK PyQuil:https://pyquil.readthedocs.io/en/stable/

Course Content

List of Experiments

1	Building Quantum dice	**2 lab hours**
2	Building Quantum Random No. Generation	**4 lab hours**
3	Composing simple quantum circuits with q-gates and measuring the output into classical bits.	**4 lab hours**
4	Implementation of Shor's Algorithms.	**4 lab hours**
5	Implementation of Grover's Algorithm	**2 lab hours**
6	Implementation of Deutsch's Algorithm	**4 lab hours**
7	Implementation of Deutsch's--Jozsa's Algorithm	**4 lab hours**
8	Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm	**6 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	Implementation of Shor's Algorithms	**PO2**
CO2	Implementation of Grover's Algorithm	**PO3**
CO3	Implementation of Deutsch's Algorithm	**PO5**
CO 4	Implementation of Deutsch-Jozsa's Algorithm	**PSO1**
CO5	Mini Project such as implementing an API for efficient search using Grover's Algorithms or Integer factorization using Shor's Algorithm	**PO9**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7
ETCS867A	Quantum Computing Lab		2	3		3		

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

ETCA872A	Project	L	T	P	C
Version 1.0		-	-	10	5
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

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

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

Course Outcomes

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

CO1. Use applied scientific knowledge to identify and implement relevant principles of mathematics and computer science.
CO2. Use the relevant tools necessary for engineering practice.
CO3. Define overall needs and constraints to solve a problem and develop/ design a prescribed engineering sub-system.
CO4. Communicate effectively and learn to be a team player.

Catalog Description

This course is a scholarly research project/design project that shows evidence of critical analysis and understanding of the topic. Project is design based where a student/group of students work on various aspects of an integrated design, application oriented, work oriented in nature is done under the supervision/guidance of faculty guide and/or external guide depending upon the place of course being undertaken is conducted allowing students to pursue their area of interest to greater depth help students to relate theory to actual practice in the industry help students to be innovative, creative and through independent study/team work.

The project may be a complete hardware or a combination of hardware and software under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership.

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.
3. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed.
4. Final development of product/process, testing, results, conclusions and future directions.
5. Must submit at least two conference paper before evaluation by Department.
6. Preparing a project report in the standard format for being evaluated by the Department.
7. Final 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.	**PO2**
CO4	Communicate effectively and learn to be a team player.	**PO10**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA 872A	Project		3	3		3					3			3		2

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

ETCA874A	Industrial Training	L	T	P	C
Version 1.0		-	-	-	5
Pre-requisites/Exposure	--				
Co-requisites	--				

Course Objectives

1. To learn how to carry out extensive research/study in the area of project implementation.
2. To be associated with an area of research/research project and contribute towards domain knowledge.
3. To learn technical report/project documentation writing.
4. To learn and implement the technology that in being used is the specific industry where the training is carried out.

Course Outcomes

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

CO1. Carry out the extensive literature survey/study in the area on internship provided.
CO2. Write technical documentation for the project implement.
CO3. Analyze and develop various methods and techniques applicable to the topic to study/area of implementation.
CO4. Have practical knowledge on the applications of project of implementation on society.

Catalog Description

The student will carry out a minimum of six months in industry or appropriate workplace/ academic and research institutions in India/abroad. The internship should give exposure to the practical aspects of the discipline. In addition, the student may also work on a specified task or project which may be assigned to him/her. The outcome of the internship/industrial training should be presented in the form of a report.

Course Content

The assignment will be defined by the organization where the student will carry of his industrial training.

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

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

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

Mapping between COs and POs		
	Course Outcomes (COs)	**Mapped Program Outcomes**
CO1	Carry out the extensive literature survey/study in the area on internship provided.	**PO2**
CO2	Write technical documentation for the project implement.	**PO5**
CO3	Analyze and developvarious methods and techniques applicable to the topic to study/area of implementation.	**PO3**
CO4	Have practical knowledge on the applications of project of implementation on society.	**PO6**

		Engineering Knowledge	Problem analysis	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual or team work	Communication	Project management and finance	Life-long Learning	Application of Concepts	Ethical and Professional Responsibilities	Innovation
Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ETCA 874A	Industrial Training		3	3		3	2							3		2

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