CSE-INTERNET OF THINGS

(For the batches admitted from the academic year 2021-22)

Vision

- To be a recognized Centre in the field of Computer Science and Engineering by imparting quality education and also equipping the students with latest technologies, soft skills and ethical values to face the challenges in industry & society.

Mission

- To provide quality education by imparting state of the art facility in Computer Science and Engineering.
- Enrich the students with innovative and problem-solving skills by establishing continuous Industry Institute interaction.
- To prepare the learners possessing social commitment and ethical values to face the dynamic challenges of industry and society.

Institutional Objectives

- To create a conducive and competitive environment for students through curricular and extra-curricular activities.
- Promote the culture of research among the faculty.
- To promote synergetic alliances with premier Institutions, Industry, CSIR laboratories and various Government organizations for Collaborative Research Projects.
- To promote economic and social enrichment of the society through Skill Development programmes, Entrepreneurship and extension activities.
- To introduce demand-driven new UG&PG academic programmes.
- To ensure a high degree of quality in terms of providing infrastructure, research ambience, faculty and staff development.

Core Values

- *Thirst for Quality Education:* The stake holders of the institute particularly management, employees and students of the institution have a consistent thirst for quality improvement of the processes and services in the institution.
- *Lifelong Learning:* In the fast-changing technological world, acquiring a special skill at one point of time will not be enough for ever long survival. Hence to flourish in the work place and to bring in innovations in the ways of doing, employee, student as well as alumni must be continuous learners and tech savvy.

- *Diversity and Participation:* PBRVITS promotes the involvement of faculty, staff and students from all social, economic, ethnics, cultural and religious backgrounds to get the synergy of combining the diversified agents. The focus is on involving students to exhibit their talent in various curricular and co-curricular activities and strengthening alumni link to share their experiences to the students.
- *Academic Integrity and Accountability:* Management induces accountability in the employees for the career of the students and the academic leadership establishes a mentoring mechanism for realization of responsibilities of students towards their parents and in turn to the society.

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(For the batches admitted from the academic year 2021-22)

INDUCTION PROGRAM (3 weeks duration)
❖ Physical activity ❖ Creative Arts ❖ Universal Human Values ❖ Literary ❖ Proficiency Modules ❖ Lectures by Eminent People ❖ Visits to local Areas ❖ Familiarization to Dept./Branch & Innovations

Semester I (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110101	Calculus and Special Functions	3	0	0	3	30	70	100
2	BS	21A110105	Applied Chemistry	3	0	0	3	30	70	100
3	ES	21A050302	C-Programming & Data Structures	3	0	0	3	30	70	100
4	BS	21A110106	Engineering Physics	3	0	0	3	30	70	100
5	HSMC	21A110202	English for Professionals	2	0	0	2	30	70	100
6	ES	21A050301	Engineering & IT Workshop	0	0	3	1.5	30	70	100
7	BS	21A110109A	Engineering Physics Lab	0	0	3	1.5	30	70	100
8	BS	21A110108B	Applied Chemistry Lab	0	0	3	1.5	30	70	100
9	ES	21A050303	C-Programming & Data Structures Lab	0	0	3	1.5	30	70	100
Total							**20**			**900**

Semester II (First year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110102	Mathematical Methods	3	0	0	3	30	70	100
2	BS	21A110110	Probability and Statistics	3	0	0	3	30	70	100
3	ES	21A030301	Engineering Drawing	1	0	4	3	30	70	100
4	ES	21A050304	Advanced Data Structures through C++	3	0	0	3	30	70	100
5	ES	21A020303	Basic Electrical and Electronics Engineering	3	0	0	3	30	70	100
6	HSMC	21A110201	Communicative English Lab	0	0	2	1	30	70	100
7	ES	21A020304	Basic Electrical and Electronics Engineering Lab	0	0	3	1.5	30	70	100
8	ES	21A050305	Advanced Data Structures through C++ Lab	0	0	3	1.5	30	70	100
9	MC	21A000001	Environmental Science	2	0	0	0	30	--	--
Total							**19**			**800**

Semester III (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	BS	21A110111	Mathematical Foundations of Computer Science	3	0	0	3	30	70	100
2	PC	21A050401	Digital Logic Design & Computer Organization	3	0	0	3	30	70	100
3	PC	21A050402	Database Management Systems	3	0	0	3	30	70	100
4	PC	21A050403	Object Oriented Programming through Java	3	0	0	3	30	70	100
5	ES	21A350301	Fundamentals of Data Communications	3	0	0	3	30	70	100
6	PC	21A050404	Database Management Systems Lab	0	0	3	1.5	30	70	100
7	PC	21A050405	Object Oriented Programming through Java Lab	0	0	3	1.5	30	70	100
8	ES	21A350302	Communication Systems Lab	0	0	3	1.5	30	70	100
9	SC	21A050702	Graphics Design using Photoshop	1	0	2	2	30	70	100
10	MC	21A000002	Constitution of India	2	0	0	0	30	--	--
Total							**21.5**			**900**

Semester IV (Second year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050406	Internet of Things	3	0	0	3	30	70	100
2	PC	21A050407	Software Engineering & OOAD	3	0	0	3	30	70	100
3	ES	21A050306	Python Programming & Data Science	3	0	0	3	30	70	100
4	ES	21A050309	Micro Processors & Micro Controllers	2	0	2	3	30	70	100
5	HSMC	21A110203	Managerial Economics and Financial Analysis	3	0	0	3	30	70	100
6	PC	21A050410	Internet of Things Lab	0	0	3	1.5	30	70	100
7	PC	21A050411	Software Engineering & OOAD Lab	0	0	3	1.5	30	70	100
8	ES	21A050307	Python Programming & Data Science Lab	0	0	3	1.5	30	70	100
9	SC	21A050703	Advanced Java	1	0	2	2	30	70	100
Total							**21.5**			**900**
Internship-I (Mandatory) for 3 weeks during summer vacation										

Semester V (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050409	Operating Systems	3	0	0	3	30	70	100
2	PC	21A050414	Software Testing	3	0	0	3	30	70	100
3	PC	21A050408	Computer Networks	3	0	0	3	30	70	100
4	OE-I		**Open Elective – I**	3	0	0	3	30	70	100
5	PE-I	21A350401 21A050417 21A050418	**Professional Elective – I** a) Sensors and Internet of Things b) SAP c) Mobile Computing	3	0	0	3	30	70	100
6	PC	21A050419	Software Testing Lab	0	0	3	1.5	30	70	100
7	PC	21A050412	Computer Networks & Operating Systems Lab	0	0	3	1.5	30	70	100
8	SC	21A350701	Programming in Embedded C	1	0	2	2	30	70	100
9	MC	21A000003	Universal Human Values	3	0	0	3	30	70	100
10	PROJ	21A350601	Internship – I Evaluation	-	-	-	1.5	-	-	100
Total							**24.5**			**1000**

Semester VI (Third year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PC	21A050421	Artificial Intelligence	3	0	0	3	30	70	100
2	PC	21A050422	Mobile Application Development	3	0	0	3	30	70	100
3	PC	21A050423	Cloud Computing	3	0	0	3	30	70	100
4	PE-II	21A350402 21A310413 21A350403	**Professional Elective -II** a) Wireless & Adhoc Networks b) Real Time Systems c) Embedded Systems for IOT	3	0	0	3	30	70	100
5	OE-II		**Open Elective - II**	3	0	0	3	30	70	100
6	PC	21A050427	Mobile Application Development Lab	0	0	3	1.5	30	70	100
7	PC	21A050428	Artificial Intelligence Lab	0	0	3	1.5	30	70	100
8	PC	21A050429	Cloud Computing Lab	0	0	3	1.5	30	70	100
9	SC	21A350702	Arduino Programming	1	0	2	2	30	70	100
10	MC	21A000004	Research Methodology	2	0	0	0	30	---	30
Total							**21.5**			**900**
Internship-II (Mandatory) for 3 weeks during summer vacation										

Semester VII (Fourth year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PE-III	21A050430 21A050431 21A050432	**Professional Elective -III** a) Machine Learning b) Big-Data Analytics using Hadoop c) Deep Learning	3	0	0	3	30	70	100
2	PE-IV	21A350404 21A050435 21A350405	**Professional Elective-IV** a) Computer Vision with OpenCV b) Design Patterns c) Natural Language Processing	3	0	0	3	30	70	100
3	PE-V	21A050433 21A350406 21A350407	**Professional Elective -V** a) Cyber Security b) Digital Forensics c) IOT & Multimedia Systems	3	0	0	3	30	70	100
4	OE-III		**Open Elective - III**	3	0	0	3	30	70	100
5	OE-IV		**Open Elective - IV**	3	0	0	3	30	70	100
6	HSMC	21A110204	Management Science	3	0	0	3	30	70	100
7	SC	21A050706	Hacking Tools	1	0	2	2	30	70	100
8	PROJ	21A350602	Internship-II Evaluation	-	-	-	3	--	--	100
Total							**23**			**800**
Internship-III (Mandatory) for 3 weeks during summer vacation										

Semester VIII (Fourth Year)

S. No	Category	Course Code	Course Title	Hours per week			Credits	CIE	SEE	Total
				L	T	P	C			
1	PROJ	21A350603	Internship – III	-	-	-	2	-	-	50
2	PROJ	21A350604	Major Project	0	0	12	8	60	140	200
3	PROJ	21A350605	Seminars	-	-	4	2	50	-	50
Total							**12**			**300**

Open Elective – I

S. No	Course Code	Course Title
1	21A010501	Air Pollution and Control
2	21A020501	Electric Vehicles
3	21A020502	Electrical Distribution Systems
4	21A030501	Robotics
5	21A030502	Basics of Mechanical Engineering
6	21A040501	Introduction to Control Systems
7	21A040502	Introduction to Signal Processing

Open Elective – II

S. No	Course Code	Course Title
1	21A010502	Environmental Pollution and Control
2	21A020503	Smart Grid
3	21A020504	Energy Storage Systems
4	21A030503	Automation in Industries
5	21A030504	Rapid Prototyping
6	21A040503	Principles of Communication Systems
7	21A040504	Electronic Instrumentation

Open Elective – III

S. No	Course Code	Course Title
1	21A010503	Disaster Management and Mitigation
2	21A020505	Renewable Energy Systems
3	21A020506	Concepts of Electrical Drives and Applications
4	21A030505	Optimization Techniques
5	21A030506	Global Warming and Climate Changes
6	21A040505	Electronic Sensors
7	21A040506	Introduction to Image Processing

Open Elective – IV

S. No	Course Code	Course Title
1	21A010504	Cost Effective Housing Techniques
2	21A020507	Energy Conservation and Management
3	21A020508	Basics of Power Electronics
4	21A030507	Basics of Automotive Engineering
5	21A030508	Basics of Total Quality Management
6	21A040507	Principles of Cellular and Mobile Communications
7	21A040508	Embedded Systems

Course Code	CALCULUS AND SPECIAL FUNCTIONS		L	T	P	C
21A110101	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- This course will illuminate the students in the concepts of calculus and Mean value theorems.
- To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real-world problems and their applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Utilize mean value theorems to real life problems.

CO2: Familiarize with functions of several variables which is useful in optimization.

CO3: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems.

CO4: Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 3- dimensional coordinate systems.

CO5: Utilize special functions in evaluating definite integrals.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (10 Hrs)

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof) related problems.

Learning Outcomes: At the end of this unit, students should be able to

- Translate the given function as series of Taylor's and Maclaurin's with remainders (L3)
- Analyze the behaviour of functions by using mean value theorems (L3)

UNIT – II (12 Hrs)

Multi variable calculus: Partial derivatives, total derivatives, chain rule, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Learning Outcomes: At the end of this unit, students should be able to

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

UNIT – III (10 Hrs)

Double Integrals: Evaluation of Double integrals, change of order of integration, change of variables. Areas using Double Integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)

UNIT – IV (10 Hrs)

Triple Integrals: Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates, volumes using triple integrals.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate triple integrals in Cartesian, cylindrical and spherical polar coordinates. (L5)
- Apply triple integration techniques in evaluating volumes. (L4)

UNIT – V (12 Hrs)

Beta and Gamma functions: Beta and Gamma functions and their properties, relation between beta and gamma functions, evaluation of definite integrals using beta and gamma functions.

Learning Outcomes: At the end of this unit, students should be able to

- Understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

TEXTBOOKS:

1. "Higher Engineering Mathematics", S. Grewal, Khanna Publishers, 44/e, 2017.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley & Sons,10/e, 2011.

REFERENCE BOOKS:

1. "Advanced Engineering Mathematics", R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 3/e, 2002.

2. "Calculus", George B. Thomas, Maurice D. Weir and Joel Hass, Thomas, Pearson Publishers, 13/e, 2013.
3. "Advanced Modern Engineering Mathematics", Glyn James, Pearson publishers, 4/e, 2011.
4. "Advanced Engineering Mathematics", Michael Greenberg, Pearson Education, 9th Edition.
5. "Advanced Engineering Mathematics with MATLAB", Dean G. Duffy, CRC Press
6. "Advanced Engineering Mathematics", Peter O'Neil, Cengage Learning.
7. "Engineering Mathematics Volumes-I &II", R.L. Garg Nishu Gupta, Pearson Education
8. "Higher Engineering Mathematics", B. V. Ramana, McGraw Hill Education
9. "Higher Engineering Mathematics", H. K. Das, Er. Rajnish Verma, S. Chand & Co. Ltd.
10. "Advanced Engineering Mathematics", N. Bali, M. Goyal, C. Watkins, Infinity Science Press.
11. "Engineering Mathematics", T.K.V Iyengar, B. Krishna Gandhi, S. Ranganatham, M.V.S.S.N Prasad, S. Chand Publications.

Course Code	APPLIED CHEMISTRY (Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110105			3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To familiarize Applied chemistry and applications.
- To train the students on the principles and applications of electrochemistry and polymers.
- To introduce instrumental methods and applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the salient features of different theories along with their applications.

CO2: Discuss about the model engineering materials.

CO3: Apply the knowledge of various electrodes for the development of new batteries.

CO4: Identify the different polymers and their uses in various fields of engineering.

CO5: Analyze the knowledge of different analytical techniques used in engineering and also development of new techniques.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	2	-	-	-	-	-	-	-	-	-

UNIT-I (14 Hrs)

Structure and Bonding Models: Planck's quantum theory, dual nature of matter, Schrodinger equation, significance of Ψ and Ψ^2, Molecular orbital theory –bonding in homo and hetero nuclear diatomic molecules – energy level diagrams of O_2 and CO, π-molecular orbital's of butadiene and benzene, calculation of bond order. Crystal field theory–salient features–splitting in octahedral and tetrahedral geometry.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate the molecular orbital energy level diagram of different molecular species (L2)
- Discuss the basic concept of molecular orbital theory (L3)
- Explain the calculation of bond order of O_2 and CO molecules (L2)
- Discuss the salient features of Crystal field theory (L3)

UNIT-II (10 Hrs)

Modern Engineering Materials: Band theory of solids- band diagrams for conductors, Insulators, Semiconductors, Effect of doping on band structures. Super conductors and Super capacitors: Introduction, Definition, Classification, Applications.

Nano chemistry: Introduction, classification of nano materials, properties and applications of Fullerenes, carbon nanotubes and Graphene nanoparticles.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the band theory of solids for conductors, semiconductors and insulators (L2)
- Demonstrate the application of Fullerenes, carbon nanotubes and Graphenes nanoparticles (L2).

UNIT-III (13 Hrs)

Electro Chemistry and Applications: Electrodes and their concepts, Types of Reference electrodes-their applications. Electrochemical cell, Nernst equation, Numerical problems on emf.

Primary cells – Zinc-air battery, Secondary cells – Lead-acid and Lithium-ion batteries-working of the batteries including cell reactions; Fuel cells- hydrogen-oxygen, methanol- oxygen fuel cells – working of the cells.

Potentiometry- principle, potentiometric titrations (redox titrations), Conductometry-conductometric titrations (acid-base titrations).

Electrochemical sensors– potentiometric sensors principle with examples, ampere metric sensors principle with examples and their applications.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Nernst equation for calculating electrode and cell potentials (L3)
- Differentiate between potentiometric and conductometric titrations (L2)
- Explain the theory of construction of battery and fuel cells (L2)

UNIT-IV (13 Hrs)

Polymer Chemistry: Introduction to polymers, functionality of monomers and their significance, Tacticity of polymers, Types of polymerization- chain growth, step growth and copolymerization with specific examples and mechanisms of polymer formation.

Plastomers-Thermoplastics and Thermo setting plastics, Preparation, properties and applications of– PVC, Teflon, Bakelite, Nylons.

Elastomers – Buna-S, Buna-N– preparation, properties and applications of Buna-S, Buna-N.

Conducting polymers, examples, classification, polyacetylene, polyaniline - mechanism of conduction and applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the different types of polymers and their applications (L2)
- Explain the preparation, properties and applications of Bakelite, Nylons (L2)
- Describe the mechanism of conduction in conducting polymers (L2)

- Discuss Buna-S and Buna-N and their applications (L2)

UNIT-V (10 Hrs)

Instrumental Methods and Applications: Introduction, Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law- Principle, instrumentation and applications of UV-Visible**,** IR-Spectroscopy's and pH-metry, Solid-Liquid Chromatography–TLC, retention factor.

Learning Outcomes*:* At the end of this unit, students should be able to

- Explain the different types of spectral series in electromagnetic spectrum (L2)
- Understand the principles and applications of different analytical instruments (L2)

TEXTBOOKS:

1. "Engineering Chemistry", Jain and Jain, Dhanpat Rai publications, 17/e, 2018
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014
3. "Principles of Instrumental Analysis", Skoog, FJ Holler and SR Crouch, 7/e, 2018
4. "Applied Chemistry", Guesser, Springer's Publications, 2001
5. "Atkins' Physical Chemistry", Peter Atkins, Julio de Paula and James Keeler, Oxford University Press, 10/e, 2010

REFERENCE BOOKS:

1. "Concise Inorganic Chemistry", J. D. Lee, Oxford University Press, 5/e, 2008
2. "Engineering Chemistry", G. V. Subba Reddy, K. N. Jayaveera and Ramachandraiah, McGraw Hill, 2020.

Course Code	C-PROGRAMMING & DATA STRUCTURES		L	T	P	C
21A050302	(Common to all branches)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- Demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C using Arrays and Strings.
CO3: Modularize the problem and also solution.
CO4: Design applications in C using Functions, Pointers, and Structures.
CO5: Explore various operations on Stacks, Queues and Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Computer Fundamentals, Algorithm, Flowchart.

Introduction to C Language: Characteristics, Identifiers, Constants, Data types, Keywords, Basic input/output statements, Structure of a C program.

Operators and Expressions: Operators classification, Assignment Operator, Arithmetic Operators, Relational and Logical Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators with examples – Operator precedence and Associativity, Type casting.

Statements: Simple and Compound statements, Control Statements - Conditional/Decision statements, Loop Control Statements, Branch Control statements.

Learning Outcomes: At the end of this unit, students should be able to

- Solve complex problems using language independent notations (L3)
- Use C basic concepts to write simple C programs (L3)

- Test and execute the programs and correct syntax and logical errors (L4)
- Select the control structure for solving the problem (L4)
- Implement conditional branching, iterations (L2)

UNIT-II (12 Hrs)

Arrays: Declarations, Initialization and accessing elements, Single, Two and Multi-dimensional arrays.

Array Techniques: Array order reversal, finding the maximum and minimum number in a set, sorting the given array elements.

Strings: String I/O functions, String handling functions, Data conversion functions.

Learning Outcomes: At the end of this unit, students should be able to

- Use arrays to process multiple homogeneous data (L3)
- Solve mathematical problems using C Programming languages (L3)
- Apply string handling functions (L3)

UNIT-III (12 Hrs)

Functions: Types of functions, Library functions, User-defined functions, Function Categories, Nested functions, Recursion, Symbolic constants, Pre-processor Commands, Storage classes – auto, register, static, extern, Type qualifiers.

Input and output: Standard input and output, Non-formatted Input and Output statements, Formatted Input and Output statements.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of modular programming (L2)
- Apply modular approach for solving the problem (L3)
- Writing C programs using various storage classes to control variable access (L5)
- Apply input and output statements to process the data in various formats (L3)

UNIT-IV (12 Hrs)

Pointers: Pointers and addresses, Passing parameters to functions, Address Arithmetic operations, Void and Null pointers, Pointer and Arrays, Pointer and Strings, Array of Pointers, Pointer and Functions, Pointer-to-Pointer, Dynamic Memory Allocation. Uses of Pointers, Command line Arguments.

Structure and Union: Declaration and Initialization of a structure, Copy and comparisons, Array of structures, Structure with pointer, Nested structures, Type Definition, Enumeration, Union.

Learning Outcomes: At the end of this unit, students should be able to

- Structure the individual data elements to simplify the solutions (L6)
- Facilitate efficient memory utilization (L6)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT-V (14 Hrs)

Data Structures: Overview of data structures, **Stack:** Representation of a stack, Operations and Applications of a Stack – Evaluation of Arithmetic Expressions, Implementation of Recursion – **Queue:** Representation of a queue, Operations and Applications of a Queue – CPU Scheduling in Multi-programming Environment.

Linked List: Representations of linked lists, singly linked list, doubly linked list, Circular linked list and its operations.

Learning Outcomes: At the end of this unit, students should be able to

- Describe the operations of a stack (L2)
- Develop various operations on Queues (L6)
- Analyze various operations on singly linked list (L4)
- Interpret operations of doubly linked lists (L2)
- Apply various operations on Circular linked lists (L6)

TEXTBOOKS:

1. "The Complete Reference C", Herbert Schildt, McGraw Hill Education, Fourth Edition
2. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
3. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition
2. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

Course Code	ENGINEERING PHYSICS		L	T	P	C
21A110106	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		3	0	0	3
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To present the basic concepts needed to understand the crystal structure of materials, X- ray diffraction and the importance of nano materials.
- To understand the mechanisms of lasers and propagation of light through optical fibres along with engineering applications.
- To explain the significant concepts of dielectric and magnetic materials that leads to potential applications in the emerging micro devices.
- To explain the significance of acoustics and ultrasound in different engineering fields.
- Evolution of band theory to distinguish materials and explain the properties of semiconductors.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Explain the important properties of crystals & structure determination using X-ray Diffraction along with the nano materials.

CO2: Identify the importance of lasers and fiber optics in different engineering fields

CO3: Understands the response of dielectric & magnetic materials to the applied electric & magnetic fields

CO4: Explain the basic concepts of acoustics and ultrasonics.

CO5: Elaborate the physical properties of semiconductors.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Crystallography & Nano materials

Crystallography: Introduction – Space lattice – Unit cell – Lattice parameters – Bravias lattice – Crystal systems – Packing fractions of SC, BCC and FCC - Directions and planes in crystals – Miller indices – Interplanar spacing in cubic crystals – X-ray diffraction - Bragg's law – Laue Method - Powder method.

Nano materials – Introduction – Surface area and quantum confinement – Physical properties: electrical and magnetic properties – Synthesis of nanomaterials: Top-down: Ball Milling – Bottom-up: Chemical Vapour Deposition – Applications of nanomaterials.

Learning Outcomes: At the end of this unit, students should be able to

- Classify various crystal systems (L2)
- Identify different planes in the crystal structure (L3)
- Analyze the crystalline structure by Bragg's law to measure the crystallinity of a solid by powder method (L4)
- Identify the nano size dependent properties of nano materials (L2)
- Illustrate the methods for the synthesis and characterization of nano materials (L2)

UNIT - II (12 Hrs)

Lasers and Fiber optics

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein's coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Transmission of signals in step index and graded index fibers – Propagation Losses (qualitative) – Applications of fiber in medical field .

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of LASER light Sources (L2)
- Apply the concepts to learn the types of lasers (L3)
- Identifies the Engineering applications of lasers (L2)
- Explain the working principle of optical fibers (L2)
- Classify optical fibers based on refractive index profile and mode of propagation (L2)
- Identify the applications of optical fibers in various fields (L2)

UNIT – III (12 Hrs)

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Electronic, Ionic and Orientation polarizations (Qualitative) – Lorentz internal field – Clausius-Mossotti equation.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and Permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, para & Ferro-Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of dielectric constant and polarization in dielectric materials (L2)
- Summarize various types of polarization of dielectrics (L2)
- Interpret Lorentz field and Clausius - Mosotti relation in dielectrics (L2)
- Classify the magnetic materials based on susceptibility and their temperature dependence

(L2)

- Explain the applications of dielectric and magnetic materials (L2)

UNIT - IV (13 Hrs)

Acoustics and Ultrasonics

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine's formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

Ultrasonics- Introduction – Properties – Production by magneto striction and piezoelectric methods – Detection – Acoustic grating – Non Destructive Testing – Applications.

Learning Outcomes: At the end of this unit, students should be able to

- Explain how sound is propagated in buildings (L2)
- Analyze acoustic properties of typically used materials in buildings (L4)
- Recognize sound level disruptors and their use in architectural acoustics (L2)
- Identify the use of ultrasonics in different fields (L3)

UNIT - V (13 Hrs)

Semiconductors- Origin of energy bands - Classification of solids into conductors, semiconductors and insulators -Intrinsic and extrinsic semiconductors (Qualitative treatment)– Density of carriers and Fermi levels in intrinsic & extrinsic semiconductors Drift & diffusion currents and Einstein's equation – Hall effect - Direct and indirect band gap semiconductors.

Learning Outcomes: At the end of this unit, students should be able to

- Classify the energy bands of semiconductors (L2)
- Interpret the direct and indirect band gap semiconductors (L2)
- Identify the type of semiconductor using Hall effect (L2)
- Identify applications of semiconductors in electronic devices (L2)

TEXTBOOKS:

1. "Engineering Physics", Dr. M. N. Avadhanulu & Dr. P. G. Kshirsagar, S. Chand and Company
2. "Engineering Physics", B.K. Pandey and S. Chaturvedi, Cengage Learning.
3. "Engineering Physics", K. Thyagarajan, McGraw Hill Publishers

REFERENCE BOOKS:

1. "Engineering Physics", Shatendra Sharma, Jyotsna Sharma, Pearson Education, 2018
2. "Engineering Physics", Sanjay D. Jain, D. Sahasrabudhe and Girish, University Press
3. "Semiconductor physics and devices - Basic principles", Donald A, Neamen, McGraw

Hill
4. “Engineering physics”, P.K. Palanisamy, SCITECH Publications
5. “Applied Physics”, S. Mani Naidu, Pearson Publications
6. “Lasers and Non-Linear Optics”, B.B Laud, New Age International Publishers.

Course Code	ENGLISH FOR PROFESSIONALS		L	T	P	C
21A110202	(Common to all branches)		2	0	0	2
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To improve Reading and Writing proficiency of students in English with an emphasis on Vocabulary development.
- To provide knowledge of grammatical structures and encourage their appropriate use in writing.
- To improve students' comprehension skills required for academic and professional needs.
- To equip students with writing skills required for professional correspondence in different contexts.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate word knowledge and its usage in appropriate contexts.
CO2: Recognize and incorporate basic grammar mechanics and sentence variety in writing.
CO3: Improve comprehension skills through intensive and extensive reading practice.
CO4: Learn and apply various writing formats for effective communication.
CO5: Improve writing skills needed for professional correspondence in various contexts.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

UNIT-I (10 Hrs)

Vocabulary Building: Introduction to affixes and base words, Prefixes and suffixes, Basic comparing and contrasting, Idioms and Phrases, One word substitutes, Words often confused, Synonyms and Antonyms used in the everyday contexts, Using prior knowledge to determine the correct word for the context, Discovering the correct word in the sentence by looking at the surrounding words, Vocabulary in social interactions.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize word parts: affixes, prefixes, suffixes and base words. (L2)
- Use words appropriately in a context. (L3)
- Guess the meanings of the words by using the contextual clues. (L2)
- Use synonyms, antonyms, phrases and idioms in writing. (L2)

UNIT-II (10 Hrs)

Essentials of Sentence Formation: Basic Sentence Structure, word order, Subject-Verb Concord, Using Tenses, Punctuation Marks, Correction of Common Errors

Learning Outcomes: At the end of this unit, students should be able to

- Frame a sentence without any grammatical errors. (L3)
- Use appropriate punctuation marks. (L3)
- Identify common errors in a sentence. (L2)

UNIT-III (10 Hrs)

Reading Comprehension: Understanding short real-world notices, messages, factual material - Scanning, skimming - Inferring meaning - Critical reading - Reading and information transfer

Learning Outcomes: At the end of this unit, students should be able to

- Use skimming and scanning strategies while reading. (L3)
- Infer meaning from the given text. (L3)
- Distinguish between the main idea and supporting ideas. (L3)
- Critically analyse the given text. (L4)

UNIT-IV (10 Hrs)

Writing Skills: Rules for good writing and composition; Paragraph Writing: Structure of a paragraph, Types of paragraphs, Usage of Cohesive Devices; Essay writing: Structure of an Essay, Types of Essays; Letter Writing (Formal and informal): Format and Structure; and Email writing

Learning Outcomes: At the end of this unit, students should be able to

- Learn to organize thoughts into meaningful paragraphs. (L2)
- Use cohesive devices in making the piece of writing more coherent. (L3)
- Compose essays on different topics in a more organised structure. (L3)
- Draft letter and emails in a definite format. (L3)

UNIT-V (10 Hrs)

Professional Correspondence: Internal Correspondences – Memorandum, Note Taking, Minutes of Meetings; External Correspondences - Business Letters - Cover Letters - Sale Letters - Inquiry Letters - Complaint Letters - Emails & Netiquette

Learning Outcomes: At the end of this unit, students should be able to

- Draft official e-mails and letters for different professional purposes. (L3)
- Write proficiently memos and minutes of meeting. (L3)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://digital.library.upenn.edu/women/sultana/dream/dream.html
2. https://owl.purdue.edu/
3. https://www.thesaurus.com/
4. https://www.readwritethink.org/classroom-resources/student-interactives
5. https://www.fluentu.com/blog/english/english-writing-websites/

Course Code	ENGINEERING & IT WORKSHOP LAB		L	T	P	C
21A050301	(Common to all branches)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

PART-A (ENGINEERING WORKSHOP)

COURSE OBJECTIVES:

- To familiarize the students with wood working, sheet metal operations, fitting and electrical house, Wiring and foundry skills.
- To provide technical training to the students on Word, Excel and Presentation.
- To make the students know about the internal parts of a computer.
- To learn how to use Internet facility for Browsing and Searching.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply wood working skills and build different parts with metal sheets in real world applications.

CO2: Apply fitting operations in various applications and Preparation of moulds and castings.

CO3: Apply different types of basic electric circuit connections.

CO4: Prepare documentation, spread sheets for calculations and slides for Presentation.

CO5: Identify Computer peripherals and its functions, Internet browsing to obtain the required information

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	-	-	-	-	-	2	1	-
CO2	3	2	2	-	-	2	-	-	-	-	-	2	1	-
CO3	3	2	-	-	-	2	-	-	-	-	-	2	1	2
CO4	3	-	-	-	-	2	-	-	-	-	-	2	-	2
CO5	3	2	-	-	-	2	2	-	-	-	-	2	-	2

LIST OF TOPICS:

Wood Working: Familiarity with different types of woods and tools used in wood working and make following joints

a) Half – Lap joint b) Dovetail joint or Bridle joint

Sheet Metal Working: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets

a) Tapered tray b) Conical funnel

Fitting: Familiarity with different types of tools used in fitting and do the following fitting exercises

a) V-fit b) Square fit.

Electrical Wiring: Familiarities with different types of basic electrical circuits and make the following connections

a) Parallel and series b) Two-way switch c) Godown lighting

Foundry:

a) Preparation of mould cavity using single piece pattern.
b) Preparation of mould cavity using split piece pattern

PART-B (IT WORKSHOP)

LIST OF TOPICS:

Task 1:

MS-Word: Students should be able to create documents using the word processor tool. Alignment of the lines, Inserting header and Footer, changing the font, changing the color, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit report.

Task 2:

Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet.

Task 3:

Presentations: creating, opening, saving the presentations, selecting the style for slides, formatting the slides with different fonts, colors, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, running the slide show.

Task 4: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 5:

Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email.

REFERENCE BOOKS:

1. "Workshop Practice Manual", K. Venkata Reddy, BS Publications.
2. "Engineering work shop practice for JNTU", V. Ramesh babu, VRB Publishers Pvt. Ltd., 2009.
3. "Work shop manual", P. Kannaiah, K. L. Narayana, SCITECH Publishers.
4. "Engineering practices lab manual", Jeyapoovan, Saravanapandian, Vikas Publishing House, 4/E
5. "Dictionary of mechanical engineering", GHF Nayler, Jaico Publishing House.
6. "Introduction to Computers", Peter Norton, McGraw Hill
7. "MOS study guide for word, Excel, Power point & Outlook Exams", Joan Lambert, Joyce Cox.
8. "Introduction to Information Technology", ITL Education Solutions limited, Pearson Education.
9. "Networking your computers and devices", Rusen, Prentice Hall of India
10. "Bigelow's Trouble shooting, Maintaining & Repairing PCs", Bigelow, Tata McGraw Hill Edition

Course Code	ENGINEERING PHYSICS LAB		L	T	P	C
21A110109A	(Common to CE, ME, CSE-IOT, CSE-AI, AIML)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- Understand the role of Optical fiber parameters in engineering applications.
- Recognize the significance of laser by studying its characteristics and its application in finding the wavelength.
- Understands the concepts of interference, diffraction and their applications.
- Verify the Laws of Stretched Strings by sonometer.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Operate various optical instruments

CO2: Estimate wavelength of laser using laser

CO3: Evaluate the acceptance angle of an optical fiber and numerical aperture

CO4: Plot the intensity of the magnetic field of circular coil carrying current with distance

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-

LIST OF EXPERIMENTS

1. Determine the thickness of the wire using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelength by plane diffraction grating method
4. Determination of wavelength of LASER light using diffraction grating.
5. Determination of numerical aperture and acceptance angle of a given optical fiber
6. Magnetic field along the axis of a circular coil carrying current –Stewart Gee's method.
7. Sonometer: Verification of the three laws of stretched strings
8. Determination of particle size using LASER.
9. Study the variation of B versus H by magnetizing the magnetic material. (B-H curve)
10. Determination of rigidity modulus of material of a wire -dynamic method. (Torsional Pendulum)

REFERENCE BOOKS:

1. "A Textbook of Practical Physics", S. Balasubramanian, M.N. Srinivasan, S Chand Publishers, 2017.
2. http://vlab.amrita.edu/index.php -Virtual Labs, Amrita University

Course Code	APPLIED CHEMISTRY LAB		L	T	P	C
21A110108B	(Common to EEE, ECE, CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of Chemistry
- To verify the fundamental concepts with experiments.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Distinguish different types of titrations in the volumetric analysis

CO2: Determine the cell constant and conductance of solutions

CO3: Measure the strength of an acid present in secondary batteries

CO4: Analyze the effect of absorbance of given sample solution on concentration by using colorimetry.

CO5: Prepare advanced polymer Bakelite materials.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-		-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Preparation of Standard Oxalic acid solution
2. Determination of Strength of an acid in Lead- Acid battery
3. Estimation of Ferrous Iron by Dichrometry
4. Potentiometry - Determination of redox potentials and emfs
5. Conductometry - Determination of cell constant and conductance of solutions.
6. Conductometric titration of a) strong acid vs strong base b) weak acid vs strong base.
7. P^H-metric titration of a) strong acid vs strong base b) weak acid vs strong base.
8. Verification of the Beer-Lambert's Law and determination of strength of the given unknown solution.
9. Determination of the Retention factor of the sample by Thin Layer Chromatography (TLC).
10. Measurement of 10Dq by spectrophotometric method.
11. Preparation of Bakelite and measurement of its mechanical properties (strength)
12. Preparation of nanomaterials.

TEXTBOOKS:

1. "A Text Book on Experiments and Calculations in Engineering Chemistry", S. Chand Publications, 9/e, 2003.
2. "Engineering Chemistry", Shashi Chawla, Dhanpat Rai publications, 2/e, 2014.
3. "Experiments in Applied Chemistry", Dr. Sunita Rattan, S. K. Kataria & Sons Publishers of Engineering, 2/e, 2004.

REFERENCE BOOKS:

1. "Vogel's Text Book of Quantitative Chemical Analysis", Mendham J et.al, Pearson Education, 6/e, 2012.

Course Code	C-PROGRAMMING & DATA STRUCTURES LAB (Common to all branches)		L	T	P	C
21A050303			0	0	3	1.5
Pre-requisite	NIL	Semester	I			

COURSE OBJECTIVES:

- To get familiar with the basic concepts of C Programming
- To make the student solve problems, implement algorithms using C language
- To design programs using arrays, strings, pointers and structures
- To design Stack and Queue operations
- To apply different operations on linked lists

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of C programming language.
CO2: Select the right control structure for solving the problem.
CO3: Develop C programs using functions, arrays, structures and pointers.
CO4: Illustrate the concepts Stacks and Queues.
CO5: Design operations on Linked lists.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

Week 1

a) Write a C program to swap the given two integer values without using temporary variable.
b) Write a C program to print the first 'N' Fibonacci sequence numbers.

Week 2

a) Write a C program to print reverse of a given integer value.
b) Write a C program to find the roots of a quadratic equation.

Week 3

Write a C program that use recursive functions.

i) GCD of given two values.
ii) Factorial of a given value.

Week 4

a) Write a C program to find both the largest and smallest number in a list of integers.

b) Write a C program to perform the following:

i) Addition of Two matrices ii) Multiplication of Two matrices

Week 5

a) Write a C program that displays the position or index in the string S where the string T begins or -1 if S doesn't contain T.

b) Write a C program to read a set of strings and sort them in alphabetical order.

Week 6

a) Write a C program to count number of alphabets, digits and special symbols of a given line.

b) Write a C program to check whether a given string is palindrome or not.

Week 7

Write a C program to demonstrate the difference between call-by-value and call-by-address mechanisms.

Week 8

Write a program to perform the operations addition, subtraction, multiplication of complex numbers.

Week 9

Write a C program that implement stack operations using arrays.

Week 10

a) Write a C program that implement linear queue operations using arrays.

b) Write a C program that implement circular queue operations using arrays.

Week 11

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on doubly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following operations on circular linked list.
i) Creation ii) Insertion iii) Deletion iv) Traversal

TEXTBOOKS:

1. "Programming in C and Data Structures", J.R. Hanly, Ashok N Kamthane and A. Ananda Rao, Pearson Education.
2. "Computer Science: A Structured Programming Approach Using C", B.A. Forouzon and R.F. Gilberg, CENGAGE Learning, Third Edition, 2016.
3. "C and Data Structures", E Balaguruswamy, Tata McGraw Hill, Fourth Edition.
4. "Schaum's Outline of Data Structures", Seymour Lipschutz, McGraw Hill, Revised First Edition.

REFERENCE BOOKS:

1. "The C Programming Language", Brain W Kernighan and Dennis M Ritchie, Prentice Hall Publication, Second Edition,
2. "Fundamentals of Data Structures in C", Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Computer Science Press, Second Edition.
3. "Programming in C", Pradip Dey and Manas Ghosh, Oxford University Press, 2018.

Course Code	MATHEMATICAL METHODS (Common to all branches)		L	T	P	C
21A110102			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- This course aims at providing use of matrix algebra techniques for practical applications.
- This course aims at providing the student with the knowledge on Various numerical Methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Develop the use of matrix algebra techniques that is needed by engineers for practical applications.

CO2: Understand and solve the roots of equation using Bisection method, Iterative method, Regula-Falsi method, Newton Raphson method and solve the system of algebraic equations.

CO3: Apply concept of interpolation and derive interpolating polynomial using Newton's forward and backward formulae, Lagrange's formulae, Gauss forward and backward formulae.

CO4: Solving initial value problems to ordinary differential equations.

CO5: Determine the process of finding integral equations using Simson's 1/3, Simson's 3/8 Rule and Trapezoidal rule and fitting a best curve using least squares method.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	2	-	-	-	-	-	-	-	2	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	2	1	-

UNIT- I (10 Hrs)

Matrices: Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigen values and Eigenvectors and their Properties, Cayley- Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, Diagonalization of a matrix.

Learning Outcomes: At the end of this unit, students should be able to

- Solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigen values and eigenvectors (L3).
- Identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics (L3)

UNIT - II (10 Hrs)

Solution of Algebraic & Transcendental Equations: Introduction-Bisection method-Iterative method-Regula-Falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan Method-Gauss Seidal method.

Learning outcomes: At the end of this unit, students should be able to

- Calculate the roots of equation using Bisection method and Iterative method. (L3)
- Calculate the roots of equation using Regula-Falsi method and Newton Raphson method. (L3)
- Solve the system of algebraic equations using Gauss Jordan method and Gauss Seidal method. (L3)

UNIT - III (10 Hrs)

Interpolation: Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of interpolation. (L2)
- Derive interpolating polynomial using Newton's forward and backward formulae. (L3)
- Derive interpolating polynomial using Lagrange's formulae. (L3)
- Derive interpolating polynomial using Gauss forward and backward formulae. (L3)

UNIT - IV (12 Hrs)

Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series-Picard's Method of successive Approximations- Euler's Method - Modified Euler's Method-Runge-Kutta Methods.

Learning Outcomes: At the end of this unit, students should be able to

- Solve initial value problems to ordinary differential equations using Taylor's method. (L3)
- Solve initial value problems to ordinary differential equations using Euler's method and Runge Kutta methods. (L3)

UNIT - V (12 Hrs)

Numerical Integration & Curve Fitting:

Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

Fitting of straight line – second degree curve –Exponential curve –Power curve by the method of least squares.

Learning Outcomes: At the end of this unit, students should be able to

- Fit a best curve using method of least squares. (L3)
- Solve integral equations using Simson's 1/3 and Simson's 3/8 rule. (L3)
- Solve integral equations using Trapezoidal rule. (L3)

TEXTBOOKS:

1. "Higher Engineering Mathematics", B. S. Grewal, Khanna publishers.
2. "Advanced Engineering Mathematics", Erwin Kreyszig, Wiley India
3. "Introductory Methods of Numerical Analysis", S. S. Sastry, PHI publishers.

REFERENCE BOOKS:

1. "Higher Engineering Mathematics", B. V. Ramana, Mc Graw Hill publishers.
2. "Advanced Engineering Mathematics", Alan Jeffrey, Elsevier Publishers
3. "A Text Book of Engineering Mathematics Vol – I", T.K.V. Iyengar, B. Krishna Gandhi, S. Chand & Company.

Course Code	PROBABILITY AND STATISTICS (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110110			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To familiarize the students with the foundations of probability and statistical methods.
- To impart probability concepts and statistical methods in various applications Engineering.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve the central tendency, correlation and correlation coefficient and regression

CO2: Understand the terminologies of basic probability, two types of random variables and their probability functions.

CO3: Interpret the behavior of various discrete and continuous probability distributions.

CO4: Apply the concept of hypothesis testing for large samples.

CO5: Apply the statistics for testing the significance of the given small sample data by using t- test, F- test and Chi-square test.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	3	-	-	-	-	-	1	-	-	-	-
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-

UNIT-1 (12 Hrs)

Statistics Introduction, Measures of Variability (dispersion) Skewness Kurtosis, correlation, correlation coefficient, rank correlation, regression lines, regression coefficients and their properties

Learning Outcomes: At the end of this unit, students should be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- adopt correlation methods and regression analysis (L5)

UNIT-II (11 Hrs)

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Bayes theorem, random variables (discrete and continuous), probability density functions, properties.

Learning Outcomes: At the end of this unit, students should be able to

- Define the terms trial, events, sample space, probability, and laws of probability (L1)

- Make use of probabilities of events in finite sample spaces from experiments (L3)
- Apply Bayes theorem to real time problems (L3)
- Explain the notion of random variable, distribution functions and expected value (L2)

UNIT-III (12 Hrs)

Probability distributions: Discrete distribution - Binomial, Poisson approximation to the binomial distribution and their properties. Continuous distribution: normal distribution and their properties.

Learning Outcomes: At the end of this unit, students should be able to

- Apply Binomial and Poisson distributions for real data to compute probabilities, theoretical frequencies (L3)
- Interpret the properties of normal distribution and its applications (L2)

UNIT-IV (11 Hrs)

Estimation and Testing of hypothesis, large sample tests: Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of estimation, interval estimation and confidence intervals (L2)
- Apply the concept of hypothesis testing for large samples (L4)

UNIT-V (11 Hrs)

Small sample tests: Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), $\chi 2$ - test for goodness of fit, $\chi 2$ - test for independence of attributes.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the concept of testing hypothesis for small samples to draw the inferences (L3)
- Estimate the goodness of fit (L5)

TEXTBOOKS:

1. "Miller and Freund's Probability and Statistics for Engineers", Richard A. Johnson, Pearson, 7/e, 2008.
2. "Fundamentals of Mathematical Statistics", S.C. Gupta and V.K. Kapoor, S. Chand & Sons Publications, 11/e, 2012.

REFERENCE BOOKS:

1. "A First Course in Probability", S. Ross, Pearson Education India, 2002.
2. "An Introduction to Probability Theory and its Applications", W. Feller, Wiley Publications, 1/e, 1968.
3. "Probability, Random Variables & Random Signal Principles", Peyton Z. Peebles, McGraw Hill Education, 4/e, 2001.

Course Code	ENGINEERING DRAWING		L	T	P	C
21A030301	(Common to all branches)		1	0	4	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modelling.
- Instruct graphical representation of machine components.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Construction of various conic curves, Cycloid curves

CO2: Construction of projections of Points, Lines applied in engineering

CO3: Construction of projections of Planes.

CO4: Construction of projection of solids development of surfaces regular Solids .

CO5: Representation of Ortho and Isometric views of solids.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO2	3	1	-	-	-	-	-	-	-	2	-	-	2	2
CO3	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO4	3	2	2	-	3	-	-	-	-	2	-	2	2	2
CO5	3	2	2	-	3	-	-	-	-	2	-	2	2	2

UNIT-I (12 Hrs)

Introduction to Engineering Drawing: Principles of Engineering Drawing and their Significance - Conventions in drawing-lettering - BIS conventions.

a) Conic sections including the rectangular hyperbola- general method only,

b) Cycloid, Epi-cycloid and Hypocycloid - general method only.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the significance of engineering drawing (L2)
- Know the conventions used in the engineering drawing (L1)
- Identify the curves obtained in different conic sections (L2)
- Draw different cycloidal curves. (L3)

UNIT– II (12 Hrs)

Projection of points, lines: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, true angle made by line.

Learning Outcomes: At the end of this unit, students should be able to

- Know how to draw the projections of points, lines (L1)
- Find the true length of the lines. (L2)

UNIT-III (18 Hrs)

Projection of planes: Projections of regular plane inclined to both the planes and also draw the projections of different planes in Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of planes. (L2)
- Draw the projection of plane inclined to one plane and both the planes. (L3)
- Understand the different commands used in Computerized drawing to draw different planes. (L2)

UNIT- IV (15 Hrs)

Projections of solids: Projections of regular solids inclined to one or both planes by rotational method.

Development of Solids: Development of lateral Surfaces of Right Regular Solids (without section)-Prism, Cylinder, Pyramid, Cone.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the procedure to draw projection of solids. (L2)
- Draw the projection of solid inclined to one plane. (L3)
- Draw the projection of solids inclined to both the planes. (L3)

UNIT–V (18 Hrs)

Isometric and Orthographic Projections: Principles of isometric projection- Isometric Scale- Isometric Views- Conventions- Isometric Views of lines, Planes, Simple solids (cube, cylinder and cone). Conversion of Isometric Views to Orthographic Views. Drawing the Isometric views using Computerized drawing.

Learning Outcomes: At the end of this unit, students should be able to

- Learn the basics convectional representation of different projections (L1)
- Draw the Orthographic projection of simple solids. (L3)
- Draw the Isometric projection of simple solids. (L3)

TEXTBOOKS:

1. "Engineering Drawing", K. L. Narayana & P. Kannaiah, SciTech Publishers, Chennai, 3/e.
2. "Engineering Drawing + AutoCAD", K. Venugopal, V. Prabhu Raja, New Age Publishers.
3. "Engineering Drawing", N. D. Bhatt, Charotar Publishers, 53/e, 2016

REFERENCE BOOKS:

1. "Engineering Drawing", Dhanajay A Jolhe, Tata McGraw-Hill, Copy Right, 2009.
2. "Engineering Drawing", Basant Agarwal & C. M. Agarwal, Tata McGraw-Hill
3. "Engineering Drawing", Shah and Rana, Pearson Education, 2/e, 2009

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050304			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To be familiar with basic techniques of object-oriented principles and exception handling using C++
- To be familiar with the concepts like Inheritance, Polymorphism
- Solve problems using data structures such as linear lists, stacks, queues
- Be familiar with advanced data structures such as balanced search trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Distinguish between procedures and object-oriented programming.
CO2: Apply advanced data structure strategies for exploring complex data structures.
CO3: Compare and contrast various data structures and design techniques in the area of Performance.
CO4: Implement data structure algorithms through C++.
CO5: Incorporate data structures into the applications such as binary search trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT-1 (13 Hrs)

ARRAYS: Abstract Data Types and the C++ Class, An Introduction to C++ Class- Data Abstraction and Encapsulation in C++- Declaring Class Objects and Invoking Member Functions- Special Class Operations- Miscellaneous Topics- ADTs and C++Classes, The Array as an Abstract Data Type, The Polynomial Abstract Data type- Polynomial Representation- Polynomial Addition. Spares Matrices.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about OOPS concepts (L3).
- Learn and solve about different types of Class Types and Polynomial representation (L3)

UNIT- II (10 Hrs)

STACKS AND QUEUES: Templates in C++, Template Functions- Using Templates to Represent Container Classes, The Stack Abstract Data Type, The Queue Abstract Data Type, Subtyping and Inheritance in C++, Evaluation of Expressions, Expression- Postfix Notation- Infix to Postfix.

Learning Outcomes At the end of this unit, students should be able to

- Translate the given function as Templates in C++ (L3)
- Analyze the behaviour of different types of Classes, ADT and Expressions (L3)

UNIT – III (12 Hrs)

LINKED LISTS – I: Single Linked List and Chains, Representing Chains in C++, defining a Node in C++- Designing a Chain Class in C++- Pointer manipulation in C++- Chain Manipulation Operations, The Template Class Chain, Implementing Chains with Templates- Chain Iterators- Chain Operations- Reusing a Class, Circular Lists, Available Space Lists, Linked Stacks and Queues, Polynomials,

Learning Outcomes: At the end of this unit, students should be able to

- Learn and implement different types of Linked Lists (L3)
- Acquire the Knowledge of functions of Templates in C++ (L1)
- Implement Chain Iterators and Polynomials (L3)

UNIT – IV (13 Hrs)

LINKED LISTS – II: Polynomial Representation- Adding Polynomials- Circular List Representation of Polynomials, Equivalence Classes, Sparse Matrices, Sparse Matrix Representation- Sparse Matrix Input- Deleting a Sparse Matrix, Doubly Linked Lists, Generalized Lists, Representation of Generalized Lists- Recursive Algorithms for Lists Reference Counts, Shared and Recursive Lists

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate double integrals of functions of several variables using Polynomial Representation (L5)
- Apply Matrix techniques in evaluating different types (L4)
- Evaluating Generalized Lists and Recursive algorithms (L5)

UNIT-5 (12 Hrs)

TREES: Introduction, Terminology, Representation of Trees, Binary Trees, The Abstract Data Type, Properties of Binary Tress, Binary Tree Representations, Binary Tree Traversal and Tree Iterators, Introduction, Inorder Traversal Preorder Traversal, Postorder Traversal, Thread Binary Trees, Threads, Inorder Traversal of a Threaded Binary Tree, Inserting a Node into a Threaded Binary Tree, Heaps, Priority Queues, Definition of a Max Heap, Insertion into a Max Heap, Deletion from a Max Heap, Binary Search Trees, Definition, Searching a Binary Search Tree,

Insertion into a Binary Search Tree, Deletion from a Binary Search Tree, Height of Binary Search Tree.

Learning Outcomes: At the end of this unit, students should be able to

- Understand Tree functions and its relations (L2)
- Conclude the use of different types of Trees representation (L4)

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W.Savitch, Pearson education, Fourth edition

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020303			3	0	0	3
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To teach DC and AC electrical circuit analysis
- To explain working principles of transformers and electrical machines
- To impart knowledge on Power system generation, transmission and distribution
- Familiar with the theory, construction, and operation of electronic devices
- Learn about biasing of BJTs and FETs.
- Design and construct amplifiers, understand the concept & principles of logic devices.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply concepts of KVL/KCL in solving DC circuits
CO2: Illustrate working principles of DC Motor, Transformer and Induction motors
CO3: Understand the basics of Power generation, Transmission and Distribution
CO4: Explain the theory, construction, operation and working of electronic devices.
CO5: Analyze and design small signal amplifier circuits, logic gate, combinational and sequential circuits

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

Part A: Basic Electrical Engineering

UNIT-I (10 Hrs)

DC & AC Circuits: Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms -peak and rms values - phasor representation - real power - reactive power - apparent power – power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.

Learning Outcomes: At the end of this unit, students should be able to

- Recall Kirchoff laws (L1)

- Analyze simple electric circuits with DC excitation (L4)
- Apply network theorems to simple circuits (L3)
- Analyze single phase AC circuits consisting of series RL - RC - RLC combinations (L4)

UNIT-II (10 Hrs)

DC & AC Machines: Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator –principle and operation of DC Motor – Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single-Phase Transformer - OC and SC tests on transformer -Principle and operation of 3-phase AC machines [Elementary treatment only]

Learning Outcomes: At the end of this unit, students should be able to

- Explain principle and operation of DC Generator & Motor. (L2)
- Perform speed control of DC Motor (L3)
- Explain operation of transformer and induction motor. (L2)
- Explain construction & working of induction motor - DC motor (L2)

UNIT-III (10 Hrs)

Basics of Power Systems: Layout & operation of Hydro, Thermal, Nuclear Stations - Solar & wind generating stations – Typical AC Power Supply scheme – Elements of Transmission line – Types of Distribution systems: Primary& Secondary distribution systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand working operation of various generating stations (L1)
- Explain the types of Transmission and Distribution systems (L2)

TEXTBOOKS:

1. "Basic Electrical Engineering", D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, 2010.
2. "Principles of Power System", V.K. Mehta & Rohit Mehta, S. Chand, 2018.

REFERENCE BOOKS:

1. "Fundamentals of Electrical Engineering", L. S. Bobrow, Oxford University Press, 2011.
2. "Electrical and Electronics Technology", E. Hughes, Pearson, 2010.
3. "Generation Distribution and Utilization of Electrical Energy", C.L. Wadhwa, New Age International Publications, 3rd Edition.

Part 'B'- Electronics Engineering

UNIT-I (10 Hrs)

Diodes and Applications: Semiconductor Diode, Diode as a Switch& Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Operation and Applications of Zener Diode, LED, Photo Diode.

Transistor Characteristics: Bipolar Junction Transistor (BJT) – Construction, Operation, Amplifying Action, Common Base, Common Emitter and Common Collector Configurations, Operating Point, Biasing of Transistor Configuration; Field Effect Transistor (FET) – Construction, Characteristics of Junction FET, Concepts of Small Signal Amplifiers –CE & CC Amplifiers.

Learning outcomes: At the end of this unit, students should be able to

- Remember and understand the basic characteristics of semiconductor diode. (L1)
- Understand principle of operation of Zener diode and other special semiconductor diodes (L1)
- Analyze BJT based biasing circuits. (L3)
- Design an amplifier using BJT based on the given specifications. (L4)

UNIT-II (10 Hrs)

Operational Amplifiers and Applications: Introduction to Op-Amp, Differential Amplifier Configurations, CMRR, PSRR, Slew Rate; Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground; Op-Amp Applications - Inverting, Non-Inverting, Summing and Difference Amplifiers, Voltage Follower, Comparator, Differentiator, Integrator.

Learning outcomes: At the end of this unit, students should be able to

- Describe operation of Op-Amp based linear application circuits, converters, amplifiers and non-linear circuits. (L2)
- Analyze Op-Amp based comparator, differentiator and integrator circuits. (L3)

UNIT-III (10 Hrs)

Digital Electronics: Logic Gates, Simple combinational circuits–Half and Full Adders, BCD Adder. Latches and Flip-Flops (S-R, JK and D), Shift Registers and Counters.

Learning outcomes: At the end of this unit, students should be able to

- Explain the functionality of logic gates. (L2)
- Apply basic laws and De Morgan's theorems to simplify Boolean expressions. (L3)
- Analyze standard combinational and sequential circuits. (L4)

TEXTBOOKS:

1. "Electronic Devices & Circuit Theory", R. L. Boylestad & Louis Nashlesky, Pearson Education, 2007.
2. "Op-Amps & Linear ICs", Ramakanth A. Gayakwad, Pearson, 4th Edition, 2017.
3. "Modern Digital Electronics", R. P. Jain, Tata Mcgraw Hill, 3rd Edition, 2003.
4. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2nd Edition, 2012.

REFERENCE BOOKS:

1. "Basic Electronics - Devices, Circuits and IT Fundamentals", Santiram Kal, Prentice Hall of India, 2002.
2. "A Text Book of Electronic Devices and Circuits", R. S. Sedha, S.Chand & Co, 2010.
3. "Introductory Electronic Devices & Circuits - Conventional Flow Version", R. T. Paynter, Pearson Education, 2009.

Course Code	COMMUNICATIVE ENGLISH LAB		L	T	P	C
21A110201	(Common to all branches)		0	0	2	1
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make students communicate their thoughts, opinions and ideas freely in real life situations.
- To improve the language proficiency of students in English with special emphasis on Listening and Speaking skills.
- To equip students with professional skills & soft skills, Develop communication skills in formal and informal situations
- To help students present themselves confidently during Group Discussions and Oral Presentations

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Use creativity in listening to formal and informal conversations.
CO2: Analyze the concepts of active listening and barriers to listening.
CO3: Communicate effectively in everyday life using right oral expressions.
CO4: Acquire the confidence to present themselves effectively during academic and professional presentations.
CO5: Acquire basic knowledge of non-verbal communication and its importance.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	3	-	-	-	-	-
CO4	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO5	-	-	-	-	-	-	-	2	3	-	-	-	-	-

UNIT-I (6 Hrs)

Essentials of Listening: Purpose of Listening, Listening to Conversation (Formal and Informal), Active Listening- an Effective Listening Skill, Barriers to Listening, Listening to Announcements- (railway/ bus stations/ airport /sports announcement/commentaries etc.)

Learning Outcomes: At the end of this unit, students should be able to

- Know the difference between hearing and listening. (L2)
- Understand the purpose of active listening. (L2)
- Follow the announcements through focused listening. (L2)

UNIT-II (6 Hrs)

Listening Comprehension: Academic Listening (Listening to Lectures), Listening to Short Talks and Listening to Presentations, Note Taking Tips

Learning Outcomes: At the end of this unit, students should be able to

- Comprehend different academic lectures. (L3)
- Take notes while listening to short talks and lectures. (L3)
- Improve comprehension skills through listening to short talks and presentations. (L3)

UNIT-III (6 Hrs)

Communicating in everyday life: Asking for and giving information, Offering and responding to offers, Requesting and responding to requests, Congratulating people on their success, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving,

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate expressions to communicate in everyday life. (L3)
- Communicate effectively in different contexts of conversations. (L3)
- Participate in role plays and situational dialogues with an exposure to social and professional contexts. (L3)

UNIT- IV (6 Hrs)

Presentation Skills: Giving Short Talks, Preparing power point presentation, Greeting and Introducing in presentations, Presenting a paper, Participating in group discussions (dos & don'ts)

Learning Outcomes: At the end of this unit, students should be able to

- Prepare a power point presentation effectively. (L3)
- Present a paper in a seminar. (L3)
- Participate in Group Discussions efficiently. (L3)

UNIT-V (6 Hrs)

Non-verbal Communication: Personal Appearance, Gestures, Postures, Facial Expression, Eye Contact, Body Language (Kinesics), Silence, Tips for Improving Non-Verbal Communication

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of body language in communication (L2)
- Improve non-verbal communication skills (L3)
- Understand how body language and non-verbal communication affects the personality of an individual in a social and professional set-up. (L2)

TEXTBOOKS:

1. "Technical Communication – Principles and Practice", Meenakshi Raman, Sangeeta Sharma, Oxford University Press

REFERENCE BOOKS:

1. "A Textbook of English Phonetics for Indian Students", T. Balasubramanian, Mc Millan India Pvt
2. "English Vocabulary in Use", Michael McCarthy, Cambridge University Press
3. "Strengthen your English", Bhaskaran, Horsburgh, Oxford University Press
4. "Practical English Usage", Michael Swan, Oxford University Press

ONLINE LEARNING RESOURCES:

1. https://learnenglish.britishcouncil.org/skills/listening
2. https://agendaweb.org/listening/comprehension-exercises.html
3. https://www.123listening.com/
4. https://www.linguahouse.com/learning-english/skill-4-learners/listening
5. https://www.talkenglish.com/listening/listen.aspx
6. https://ed.ted.co

Course Code	BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to CE, ME, CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A020304			0	0	3	1.5
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To Verify Kirchoff's laws and Superposition theorem
- To learn performance characteristics of DC Machines and 1- Phase Transformer
- To Study the I – V Characteristics of Solar PV Cell
- To analyze the characteristics of Diodes, BJT, MOSFET, UJT
- To design the amplifier circuits from the given specifications.
- Exposed to linear and digital integrated circuits

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Understand Kirchoff's Laws & Superposition theorem.

CO2: Analyze the various characteristics on 1-phase transformer and DC Machines by conducting various tests.

CO3: Analyze I – V Characteristics of PV Cell

CO4: Learn the characteristics of basic electronic devices like PN junction diode, Zener diode & BJT.

CO5: Construct and analyze the various diode rectifiers, clippers and clampers and other circuits.

CO-PO MAPPING;

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO2	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO3	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO4	3	2	1	-	1	3	2	-	-	-	-	1	-	-
CO5	3	2	1	-	1	3	2	-	-	-	-	1	-	-

PART A: ELECTRICAL ENGINEERING

LIST OF EXPERIMENTS:

1. Verification of Kirchhoff laws.
2. Verification of Superposition Theorem.
3. Magnetization characteristics of a DC Shunt Generator.
4. Speed control of DC Shunt Motor.
5. OC & SC test of 1 – Phase Transformer.
6. Load test on 1-Phase Transformer.
7. I – V Characteristics of Solar PV cell
8. Brake test on DC Shunt Motor.

PART B: ELECTRONICS ENGINEERING

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.
2. Zener diode characteristics and Zener as voltage Regulator.
3. Full Wave Rectifier with & without filter.
4. Wave Shaping Circuits. (Clippers & Clampers)
5. Input & Output characteristics of Transistor in CB / CE configuration.
6. Frequency response of CE amplifier.
7. Inverting and Non-inverting amplifiers using Op-AMPs.
8. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
9. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs all the required active devices

Note: Minimum of Six Experiments to be performed in each section.

Course Code	ADVANCED DATA STRUCTURES THROUGH C++ LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050305			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	II			

COURSE OBJECTIVES:

- To familiarize Advanced data structures using C++.
- To train the students on the sorting techniques
- To introduce Trees.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved.
CO2: Design applications in C++ using Trees.
CO3: Modularize the problem and also solution.
CO4: Design applications in C++ using Searching Techniques
CO5: Explore various operations on Linked Lists

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

1. Write a C++ program to sort the given data elements using bubble sort technique.
2. Write a C++ program to sort the given data elements using selection sort technique.
3. Write a C++ program to search a given element from the list of elements using linear search technique.
4. Write a C++ program to search a given element from the list of elements using binary search technique.
5. Write a C++ program to implement Stack ADT using an array.
6. Write a C++ program to implement Linear Queue ADT using an array.
7. Write a C++ program to implement Circular Queue ADT using an array.
8. Write a C++ program to implement Deque ADT using an array.
9. Write a C++ program to create a Single linked list ADT and display the elements.
10. Write a C++ program to create a Double linked list ADT and display the elements.
11. Write a C++ program to create a Circular single linked list and display the elements.
12. Write a C++ program to create a Circular double linked list and display the elements.
13. Write a C++ program to implement Stack ADT using linked list.
14. Write a C++ program to implement Linear Queue ADT using linked list.

15. Write a C++ program to create a binary search tree with the given data elements 23, 54, 12, 43, 56, 10, 52, 35 and apply In-order, Preorder and Post-order tree traversal techniques.

TEXTBOOKS:

1. "Data structures, Algorithms and Applications in C++", S. Sahni, University Press (India) Pvt. Ltd, 2nd edition.
2. "Data structures and Algorithm Analysis in C++", Mark Allen Weiss, Pearson Education Ltd., 2nd edition.
3. "Data structures and Algorithms in C++", Michael T. Goodrich, R. Tamassia and Mount, John Wiley and Sons, Wiley student edition

REFERENCE BOOKS:

1. "Data structures and algorithms in C++", 3rd Edition, Adam Drozdek, Thomson
2. "Data structures using C and C++", Langsam, Augenstein and Tanenbaum, PHI.
3. "Problem solving with C++ The Object of Programming", W. Savitch, Pearson education, Fourth edition

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
21A000001	(Common to CE, ME, EEE, ECE, CSE, CSE-IOT)		2	0	0	0
Pre-requisite	NIL	Semester	II			

COURSE OBJECTIVES:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Grasp multidisciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2: Understand flow and bio-geo- chemical cycles and ecological pyramids.

CO3: Understand various causes of pollution and solid waste management and related preventive measures.

CO4: About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.

CO5: Casus of population explosion, value education and welfare programmes.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO2	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO3	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO4	-	-	-	-	-	1	2	1	-	-	-	-	-	-
CO5	-	-	-	-	-	1	2	1	-	-	-	1	-	-

UNIT – I (10 Hrs)

Multidisciplinary Nature of Environmental Studies: Definition, Scope and Importance, Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associatedproblems–Forestresources–Useandover–exploitation,deforestation,casestudies - Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

Learning Outcomes: At the end of this unit, students should be able to

- Know the importance of public awareness (L1)
- Know about the various resources (L1)

UNIT–II (10 Hrs)

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Learning Outcomes: At the end of this unit, students should be able to

- Know about various echo systems and their characteristics (L1)
- Know about the biodiversity and its conservation (L1)

UNIT – III (10 Hrs)

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the various sources of pollution. (L1)
- Know about the various sources of solid waste and preventive measures. (L1)
- Know about the different types of disasters and their managerial measures. (L1)

UNIT- IV (10 Hrs)

Social Issues and The Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, water shed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the social issues related to environment and their protection acts. (L1)
- Know about the various sources of conservation of natural resources. (L1)
- Know about the wild life protection and forest conservation acts. (L1)

UNIT – V (10 Hrs)

Human Population and The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the population explosion and family welfare programmes. (L1)
- Identify the natural assets and related case studies. (L1)

TEXTBOOKS:

1. "Text book of Environmental Studies for Undergraduate Courses", Erach Bharucha for University Grants Commission, Universities Press.
2. "Environmental Studies", Palani swamy, Pearson education
3. "Environmental Studies", S. Azeem Unnisa, Academic Publishing Company
4. "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", K. Raghavan Nambiar, SCITECH Publications (India), Pvt. Ltd.

REFERENCE BOOKS:

1. "Textbook of Environmental Science", Deeksha Dave and E. Sai Baba Reddy, Cengage Publications.

2. "Text book of Environmental Sciences and Technology", M. Anji Reddy, BS Publication.
3. "Comprehensive Environmental studies", J. P. Sharma, Laxmi publications.
4. "Environmental Sciences and Engineering", J. Glynn Henry and Gary W. Heinke, Prentice Hall of India Private limited
5. "A Text Book of Environmental Studies", G. R. Chatwal, Himalaya Publishing House
6. "Introduction to Environmental Engineering and Science", Gilbert M. Masters and Wendell P. Ela, Prentice Hall of India Private limited.

Course Code	MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A110111			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To explain about the Boolean algebra, Graph theory and Recurrence relations.
- To demonstrate the application of basic methods of discrete mathematics in Computer Science problem solving.
- To elucidate solving mathematical problems from algorithmic perspective.
- To introduce the mathematical concepts which will be useful to study advanced courses
- Design and Analysis of Algorithms, Theory of Computation, Cryptography and Software Engineering etc.
- To reveal how solutions of graph theory can be applied to computer science problems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Evaluate elementary mathematical arguments and identify fallacious reasoning

CO2: Understand the properties of Compatibility, Equivalence and Partial Ordering relations, Lattices and Hassee Diagrams and the general properties of Algebraic Systems

CO3: Design solutions for problems using Permutations and Combinations

CO4: Solve the homogeneous and non-homogeneous recurrence relations

CO5: Apply the concepts of functions to identify different types of Graphs and trees

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	P012	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	-	-	-

UNIT-I (12 Hrs)

Statements and Notation, **Connectives**- Negation, Conjunction, Disjunction, Conditional and Bi-conditional, Statement formulas and Truth Tables. Well-formed formulas, Tautologies, Equivalence of Formulas, Duality Law, Tautological Implications.

Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Principal Disjunctive Normal Forms (PDNF), Principal Conjunctive Normal Forms (PCNF), Ordering and Uniqueness of Normal Forms.

The Theory of Inference for the Statement Calculus: Rules of Inference, Consistency of Premises and Indirect Method of Proof. The predicate Calculus, Inference theory of the Predicate Calculus

Learning Outcomes: At the end of this unit, students should be able to

- Describe logical sentences in terms of predicates, quantifiers, and logical connectives (L1)
- Evaluate basic logic statements using truth tables and the properties of logic (L5)
- Apply rules of inference to test the consistency of premises and validity of arguments (L3)
- Verify the equivalence of two formulas and their duals (L4)
- Find the Principal Conjunctive and Principal Disjunctive Normal Forms of a statement formula. (L1)

UNIT-II (12 Hrs)

Set Theory: Basic concepts of Set Theory, Representation of Discrete structures, Relations and Ordering, Functions, Recursion.

Lattices and Boolean algebra: Lattices as Partially Ordered Sets, Boolean algebra, Boolean Functions, Representation and Minimization of Boolean Functions.

Algebraic Structures: Algebraic Systems: Examples and General Properties, Semi Groups and Monoids, Groups.

Learning Outcomes: At the end of this unit, students should be able to

- Describe equivalence, partial order and compatible relations (L1)
- Compute Maximal Compatibility Blocks (L3)
- Identify the properties of Lattices (L2)
- Evaluate Boolean functions and simplify expression using the properties of Boolean Algebra (L5)
- Infer Homomorphism and Isomorphism (L4)
- Describe the properties of Semi groups, Monoids and Groups (L1)

UNIT-III (10 Hrs)

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with repetitions, Enumerating Permutations and Combinations with constrained Representations, Binomial Coefficients, The Binomial and Multinomial Theorems, The Principle of Inclusion and Exclusion

Learning Outcomes: At the end of this unit, students should be able to

- Explain fundamental principle of counting (L2)
- Examine the relation between permutation and combination (L4)
- Solve counting problems by applying elementary counting techniques using the product and sum rules (L3)
- Apply permutations, combinations, the pigeon-hole principle, and binomial expansion to solve counting problems (L3)

UNIT-IV (10 Hrs)

Recurrence Relations: Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The method of Characteristic Roots, Solution of Inhomogeneous Recurrence Relations.

Learning Outcomes: At the end of this unit, students should be able to

- Find the generating functions for a sequence (L1)
- Design recurrence relations using the divide-and-conquer algorithm (L6)
- Solve linear recurrence relations using method of Characteristic Roots (L3)
- Outline the general solution of homogeneous or Inhomogeneous Recurrence Relations using substitution and method of generating functions (L2)
- Solve problems using recurrence relations and recursion to analyze complexity of Algorithms (L3)

UNIT-V (10 Hrs)

Graphs: Basic Concepts, Isomorphism and Sub graphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatics Number, The Four-Color Problem

Learning Outcomes: At the end of this unit, students should be able to

- Investigate if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic (L4)
- Describe complete graph and complete bipartite graphs (L1)
- Identify Euler Graphs, Hamilton Graph and Chromatic Number of a graph (L2)
- Apply the concepts of functions to identify the Isomorphic Graphs (L3)
- Apply depth-first and breadth-first search (L3)
- Apply Prim's and Kruskal's algorithms to find a minimum spanning tree (L3)

TEXTBOOKS:

1. "Discrete Mathematics for Computer Scientists & Mathematicians", Joe L. Mott. Abraham Kandel and Theodore P. Baker, Pearson, 2008, 2nd Edition,
2. "Discrete Mathematical Structures with Applications to Computer Science", J P Trembly and R Manohar, McGraw Hill, 2017, 1st Edition.

REFERENCE BOOKS:

1. "Discrete and Combinatorial Mathematics, an Applied Introduction", Ralph P. Grimaldi and B.V. Ramana, Pearson, 2016, 5th Edition.
2. "Graph Theory with Applications to Engineering", Narsingh Deo, Prentice Hall, 1979.
3. "Discrete Mathematics theory and Applications", D.S. Malik and M.K. Sen, Cengage Learning, 2012, 1st Edition.

4. "Elements of Discrete Mathematics, A computer Oriented approach", C L Liu and D P Mohapatra, McGraw Hill, 2018, 4th edition.

Course Code	DIGITAL LOGIC DESIGN AND COMPUTER ORGANIZATION (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050401			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To understand the basic theoretical concepts of digital systems like the binary system and Boolean algebra.
- To express real life problem in logic design terminology.
- To use Boolean algebraic formulations to design digital systems. To design using combinational/sequential circuits
- To understand the Instruction execution stages.
- To explain the functions of the various computer hardware components.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the basic functional units and different ways of interconnecting to form a computer system.

CO2: Design; understand the number systems, combinational sequential circuits.

CO3: Inspect the Computer Arithmetic operations performed on fixed point and floating-point numbers.

CO4: Apply effective memory management strategies

CO5: Describe various techniques for I/O data transfer methods and interrupt handling mechanisms.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	-	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	2	1		-	-	-	-	-	-	-	-	-

UNIT- I (12 Hrs)

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations.

Data Representation: Binary Numbers, Fixed Point Representation. Floating – Point Representation. Number base conversions, Octal and Hexadecimal Numbers, complements, Signed binary numbers, Binary codes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify the basic functional units and different ways of interconnecting to form a computer system. (L2)

- Summarize the binary number system (L2)
- Illustrate various binary codes (L3)

UNIT- II (12 Hrs)

Digital Logic Circuits - I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. Flip-flops, Combinational Circuits.

Digital Logic Circuits - II: Registers, Shift Registers, Binary counters, Decoders, Multiplexers, Programmable Logic Devices.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop a logic diagram using gates from a Boolean function (L3)
- Apply the map method for simplifying Boolean Expressions. (L2)
- Analyze and design combinational circuits. (L3)
- Explain the functionalities of latch and different flip-flops (L2)

UNIT- III (12 Hrs)

Computer Arithmetic: Algorithms for fixed point and floating-point addition, subtraction, multiplication and division operations, Hardware Implementation of arithmetic and logic operations, High performance arithmetic.

Instruction Set & Addressing: Memory Locations and Addresses, Machine addresses and sequencing, Various Addressing Modes, Instruction Formats, Basic Machine Instructions, IA-32 Pentium example.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Illustrate various addressing modes for accessing register and memory operands. (L3)
- Describe the instruction sequencing and various types of instructions. (L2)
- Describe the operations performed on floating point numbers. (L2)

UNIT- IV (11 Hrs)

Processor Organization: Introduction to CPU, Register Transfers, Execution of Instructions, Multiple Bus Organization, Hardwired Control, Microprogrammed Control.

Memory Organization: Concept of Memory, RAM, ROM memories, memory hierarchy, cache memories, virtual memory, secondary storage, memory management requirements.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between hardwired and micro programmed control units. (L3)
- Recognize the various types of memories. (L2)
- Analyze the performance of cache memory. (L3)
- Apply effective memory management strategies (L2)

UNIT- V (11 Hrs)

Input / Output Organization: Introduction to I/O, Interrupts- Hardware, Enabling and disabling Interrupts, Device Control, Direct memory access, buses, interface circuits, standard I/O Interfaces.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Examine the basics of I/O data transfer synchronization. (L3)
- Analyze the interrupt handling mechanisms of various processors. (L3)
- Describe various techniques for I/O data transfer methods. (L2)

TEXTBOOKS:

1. "Computer Organization", Carl Hamacher, ZvonkoVranesic, SafwatZaky, McGraw Hill, 5th edition.
2. "Computer Architecture and Organization- An Integrated Approach", Miles Murdocca, Vincent Heuring, Wiley India, Second Edition.
3. "Computer Systems Architecture", M. Morris Mano, Pearson, 3rd Edition.

REFERENCE BOOKS:

1. "Computer Organization and Architecture", William Stallings, Pearson, Sixth Edition,
2. "Computer - organization and Design", David A. Paterson and John L. Hennessy, Elsevier.
3. "Fundamentals or Computer Organization and Design", Sivarama Dandamudi, Springer Int. Edition.
4. "Digital Design", M. Morris Mano, Pearson Education/PHI, Third Edition
5. "Fundamentals of Logic Design", Roth, Thomson, 5th Edition.

Course Code	DATABASE MANAGEMENT SYSTEMS		L	T	P	C
21A050402	(Common for CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Train in the fundamental concepts of database management systems, database modelling and design, SQL, PL/SQL and system implementation techniques.
- Enable students to model ER diagram for any customized application
- Inducting appropriate strategies for optimization of queries.
- Provide knowledge on concurrency techniques
- Demonstrate the organization of Databases

COURSE OUTCOMES

After completion of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		-	-	-	-	-	-	-	2	1	-
CO2	3	2	3	3	-	-	-	-	-	-	3	3	1	-
CO3	-	2	3	3	-	-	-	-	-	-	2	-	1	-
CO4	-	2	-	3	2	-	-	-	-	-	-	-	-	2
CO5	-	-	-	3	3	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction: Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information Retrieval, Specialty Databases, Database users and Administrators.

Introduction to Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages, Relational Operations

***Learning Outcomes*:** At the end of this unit, students should be able to

- Distinguish between Database and File System (L3)
- Categorize different kinds of data models (L4)
- Define functional components of DBMS (L1)

UNIT-II (12 Hrs)

Introduction to SQL: Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Modification of the Database. Intermediate SQL**:** Joint Expressions, Views, Transactions, Integrity Constraints, SQL Data types and schemas, Authorization.

Advanced SQL: Accessing SQL from a Programming Language, Functions and Procedures, Triggers, Recursive Queries, OLAP, Formal relational query languages.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Outline the elements of the relational model such as domain, attribute, tuple, relation, and entity (L4)
- Distinguish between various kinds of constraints like domain, key, and integrity (L4)
- Define relational schema (L1)
- Develop queries using Relational Algebra and SQL (L6)
- Perform DML operations on databases (L3)

UNIT-III (12 Hrs)

Database Design and the E-R Model: Overview of the Design Process, The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues.

Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms

***Learning Outcomes*:** At the end of this unit, students should be able to

- Develop E-R model for the given problem (L6)
- Derive tables from E-R diagrams (L6)
- Differentiate between various normal forms based on functional dependency (L4)
- Apply normalization techniques to eliminate redundancy (L3)

UNIT-IV (11 Hrs)

Query Processing: Overview, Measures of Query cost, Selection operation, sorting, Join Operation, other operations, Evaluation of Expressions.

Query optimization: Overview, Transformation of Relational Expressions, Estimating statistics of Expression results, Choice of Evaluation Plans, Materialized views, Advanced Topics in Query Optimization.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Identify variety of methods for effective processing of given queries. (L2)
- Obtain knowledge related to optimization techniques. (L6)

UNIT-V (12 Hrs)

Transaction Management: Transactions: Concept, A Simple Transactional Model, Storage Structures, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Isolation and Atomicity, Transaction Isolation Levels, Implementation of Isolation Levels, Transactions as SQL Statements.

Concurrency Control: Lock based Protocols, Deadlock Handling, Multiple granularities, Timestamp based Protocols, Validation based Protocols.

Recovery System: Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Non-volatile Storage, Early Lock Release and Logical Undo Operations.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand various properties of transaction. (L2)
- Design atomic transactions for an application. (L6)
- Gain the knowledge about log mechanism and check pointing techniques for system recovery. (L6)

TEXTBOOKS:

1. "Database System Concepts" A. Silberschatz, H. F. Korth, S. Sudarshan, TMH, 2019, 6/e.

REFERENCE BOOKS:

1. "Database Management System", Shamkant B. Navathe, Ramez Elmasri, PEA, 6/e.
2. "Database Principles Fundamentals of Design Implementation and Management", Carlos Coronel, Steven Morris, Peter Robb, Cengage Learning.
3. "Database Management Systems", Raghurama Krishnan, Johannes Gehrke, TMH, 3/e.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA (Common for CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050403			3	0	0	3
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

COURSE OUTCOMES:

Students will be able to:

CO1: To solve real world problems using OOP techniques.
CO2: To apply code reusability through inheritance, packages, and interfaces
CO3: To develop applications by using parallel streams for better performance.
CO4: To solve problems using java collection framework and I/O classes.
CO5: To develop applets for web applications, to build GUIs and handle events generated by user interactions, to use the JDBC API to access database

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	3	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	3	-	-	-	-	-	3	3	-	2

UNIT–I (12 Hrs)

Introduction: Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the syntax, semantics, and features of Java Programming Language. (L2)
- Learn object-oriented features and understanding type conversion and casting. (L2)
- Understand different types of string handling functions and its usage. (L2)

UNIT–II (10 Hrs)

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, finding packages and CLASSPATH, Access Protection, Importing packages.

Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Implement types of Inheritance and developing new classes based on existing classes (L3)
- Distinguish between system packages and user defined packages. (L4)
- Demonstrate features of interfaces to implement multiple inheritances. (L3)

UNIT – III (12 Hrs)

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, reading console Input and Writing Console Output, File class, Reading and
writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Learn what exceptions are and how they are handled. (L2)
- Learn when to use exception handling and how to create user defined exceptions (L6)
- Learn the difference between various files and streams. (L4)

UNIT – IV (12 hrs)

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hash table, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand concurrency, parallelism, and multithreading (L2)
- Learn the importance of collections and use prebuilt generic data structures from framework. (L3)

UNIT-V (12 hrs)

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window,

passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirm dialog, show input dialog, show option dialog, jdialog, create a modeles sdialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Learning Outcomes: At the end of this unit, students should be able to

- Learn how to use the Nimbuslook-and-feel (L3)
- Understand the GUI programming. (L2)
- Understand basic steps in developing JDBC applications (L2)

TEXTBOOKS:

1. "Java The complete reference", Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd, 9th edition.
2. "Java How to Program", Paul Dietel, Harvey Dietel, Pearson Education,10th Edition.

REFERENCE BOOKS:

1. "Understanding Object-Oriented Programming with Java", T. Budd, Pearson Education, updated edition.
2. "Core Java Volume – 1 Fundamentals", Cay S. Horstmann, Pearson Education.
3. "Java Programming for core and advanced learners", Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. "Introduction to Java programming", Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java", P. Radha Krishna, "University Press.
6. "Programming in Java", S. Malhotra, S. Choudhary, Oxford Univ. Press, 2nd edition.
7. "Java Programming and Object-oriented Application Development", R.A. Johnson, Cengage Learning.

Course Code	FUNDAMENTALS OF DATA COMMUNICATIONS		L	T	P	C
21A350301			3	0	0	3
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To have a detailed study of various analog and digital modulation and demodulation techniques
- To have a thorough knowledge of various multiplexing schemes and Data communication protocols
- To know about the standards and mechanisms of television systems.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Different modulation techniques to improve the bandwidth and their properties.
CO2: Networking and different protocol systems.
CO3: Error estimation and correction, asynchronous and synchronous protocols.
CO4: Multiplexing techniques, different networking connections and interfacing devices.
CO5: Multiple access techniques and analysis.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

UNIT – I (12 Hrs)

Introduction To Data Communications And Networking: Standards Organizations for Data Communications, Layered Network Architecture, Open Systems Interconnection, Data Communications Circuits, Serial and parallel Data Transmission, Data communications Networks, Alternate Protocol Suites:

Signals, Noise, Modulation, And Demodulation: Signal Analysis, Electrical Noise and Signal-to- Noise Ratio, Analog Modulation Systems, Information Capacity, Bits, Bit Rate, Baud, and M-ary Encoding, Digital Modulation.

Learning Outcomes: At the end of this unit, students should be able to

- Learn data representation in data networks (L2)
- Understand OSI-ISO Reference Model (L2)
- Understand basic steps in data transmissions (L3)
- Learn about Modulation techniques (L2)

UNIT – II (12 Hrs)

Metallic Cable Transmission Media: Metallic Transmission Lines, Transverse

Electromagnetic Waves, Characteristics of Electromagnetic Waves

Optical Fiber Transmission Media: Advantages of Optical Fiber cables, Disadvantages of Optical Fiber Cables, Electromagnetic spectrum, Optical Fiber Communications System Block Diagram, Optical Fiber construction, Propagation of Light Through an Optical fiber Cable, Optical Fiber Modes and Classifications, Optical Fiber Comparison, Losses in Optical Fiber Cables, Light sources, Light Detectors, Lasers.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about types of transmission media (L3)
- Understand the modality of Electromagnetic waves (L2)
- Learn about Fiber Transmission in detail (L3)
- Understand the functionality of Light Sources (L2)

UNIT – III (11 Hrs)

Digital Transmission: Pulse Modulation, Pulse code Modulation, Dynamic Range, Signal Voltage to- Quantization Noise Voltage Ratio, Linear Versus Nonlinear PCM Codes, Companding, PCM Line Speed, Delta Modulation PCM and Differential PCM.

Multiplexing And T- Carriers: Time- Division Multiplexing, T1 Digital Carrier System, Digital Line Encoding, T Carrier systems, Frequency- Division Multiplexing, Wavelength-Division Multiplexing, Synchronous Optical Network.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about Pulse Modulation Techniques (L3)
- Understand the codes used in Transmission (L2)
- Understand basic steps in Multiplexing and T-Carriers (L2)

UNIT – IV (10 Hrs)

Wireless Communications Systems: Electromagnetic Polarization, Electromagnetic Radiation, Optical Properties of Radio Waves, Terrestrial Propagation of Electromagnetic Waves, Skip Distance, Free-Space Path Loss, Microwave Communications Systems, Satellite Communications Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about wireless communication systems (L3)
- Understand Optical properties in radio waves (L2)
- Understand basic steps in Microwave communication systems (L2)
- Understand basic steps in Satellite communication systems (L2)

UNIT –V (10 Hrs)

Telephone Instruments And Signals: The Subscriber Loop, Standard Telephone Set, Basic Telephone Call Procedures, Call Progress Tones and Signals, Cordless Telephones, Caller ID, Electronic Telephones, Paging systems.

Cellular Telephone Systems: First- Generation Analog Cellular Telephone, Personal Communications system, Second-Generation Cellular Telephone Systems, N-AMPS, Digital Cellular Telephone, Interim Standard, Global system for Mobile Communications.

Learning Outcomes: At the end of this unit, students should be able to

- Learn about Telephone working procedures (L3)
- Understand the paging systems (L2)
- Understand basic steps in Cellular Telephone systems (L2)

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Wayne Tomasi, Pearson Education.

REFERENCE BOOKS:

1. "Data Communications and Networking", Behrouz A Forouzan, TMH, Fourth Edition.
2. "Data and Computer communications", William Stallings, PHI, 8/e.
3. "Computer Communications and Networking Technologies", Gallow, Thomson, Second Edition
4. "Computer Networking and Internet", Fred Halsll, Lingana Gouda Kulkarni, Pearson Education, Fifth Edition.

Course Code	DATABASE MANAGEMENT SYSTEMS LAB		L	T	P	C
21A050404	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- To implement the basic knowledge of SQL queries and relational algebra.
- To construct database models for different database applications.
- To apply normalization techniques for refining of databases.
- To practice various triggers, procedures, and cursors using PL/SQL.
- To design and implementation of a database for an organization

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design a database for a real-world information system
CO2: Define transactions which preserve the integrity of the database
CO3: Generate tables for a database
CO4: Organize the data to prevent redundancy
CO5: Pose queries to retrieve the information from database.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

I. CREATION OF DATA BASE TABLES

1. Create a table called Employee with fields (Empno, Ename, Job, Mgr, Sal)
    a. Add a column commission with domain to the Employee table.
    b. Insert any five records into the table.
    c. Update the column details of job
    d. Rename the column of Employ table using alter command.
    e. Delete the employee whose empno is 19

2. Create department table with fields (Deptno, Deptname, Location).
    a. Add column designation to the department table.
    b. Insert values into the table.
    c. List the records of emp table grouped by dept no.

d. Update the record where dept no is 9.
e. Delete any column data from the table.

II: EXECUTING QUERIES USING DDL AND DML COMMANDS

1. a. Create a user and grant all permissions to the user on employee table.
   b. Insert the any three records in the employee table and use rollback. Check the result.
   c. Add primary key constraint and not null constraint to the employee table.
   d. Insert null values to the employee table and verify the result.
   e. By using the group by clause, display the names who belongs to dept no 10 along with average salary.
   f. Display lowest paid employee details under each department.
   g. Display number of employees working in each department and their department number
2. a. Create a user and grant all permissions to the user on department table
   b. Insert values in the department table and use commit.
   c. Add constraints like unique and not null to the department table.
   d. Insert repeated values and null values into the table.
   e. Calculate the average salary for each different job.
   f. Show the average salary of each job excluding manager.
   g. Show the average salary for all departments employing more than three people.
   h. Display employees who earn more than the lowest salary in department30

III. CASE STUDIES:

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

REFERENCE BOOKS:

1. "Database Systems", Ramez Elmasri, Shamkant, B. Navathe, Pearson Education, 6th Edition, 2013.
2. "Database System Concepts" Peter Rob, Carles Coronel, Cengage Learning, 7th Edition, 2008.

Course Code	OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050405			0	0	3	1.5
Pre-requisite	C Programming & Data Structures	Semester	III			

COURSE OBJECTIVES:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Recognize the Java programming environment.
CO2: Develop efficient programs using multithreading.
CO3: Design reliable programs using Java exception handling features.
CO4: Extend the programming functionality supported by Java.
CO5: Select appropriate programming construct to solve a problem.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	-	-	-	-	-	-	-	-	-	2

LIST OF APPLICATIONS

1. E-commerce Platform
2. Inventory Management
3. Railway System
4. Hospital Data Management
5. Course management system
6. Library Data Management
7. Bank management system
8. Payroll Management Solution
9. Saving Student Records
10. Supply chain management system

For Every Application:

The following Tasks need to be done:

1. Write a java program to create classes and declare variables?
2. Write a java program to create a constructor?
3. Write a java program to perform exception handling to catch runtime exceptions?
4. Write a java program to implement inheritance for increasing reusability of code?
5. Write a java program to create interfaces for achieving data abstraction?
6. Write a java program to create files for input and output data storage?
7. Write a java program for implementing collection framework for effective management of data objects?
8. Write a java program for creating Graphical User Interface using swings?
9. Write a java program for implementing jdbc connectivity for application connecting with database?

Note-1: The above applications need to be executed on data base connectivity (JDBC/ODBC)

Note-2: The complete details of the applications cited above will be available in the Lab Manuals.

Course Code	COMMUNICATION SYSTEMS LAB		L	T	P	C
21A350302			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Various analog modulation and demodulation schemes
- Verify sampling theorem
- Analyze various modulated schemes by using spectrum analyzer
- Various associated circuits of analog modulation schemes
- Demonstrate the action of PLL

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Integrate and test AM and FM modulators and demodulators
CO2: Illustrate sampling theorem in different conditions
CO3: Analyze AM and FM signals using Spectrum analyzer
CO4: Test associated circuits such as AGC, pre-emphasis and de-emphasis
CO5: Integrate and test various pulse modulation and demodulation schemes and Estimate lock range and capture range of PLL.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2		-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	3	-	3	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

LIST OF EXPERIMENTS

Week-1

Amplitude Modulation - Mod. & Demod.

Week-2

AM - DSB SC - Mod. & Demod.

Week-3

Spectrum Analysis of Modulated signal using Spectrum Analyser

Week-4

Diode Detector

Week-5

Pre-emphasis & De-emphasis

Week-6

Frequency Modulation - Mod. & Demod.

Week-7

AGC Circuits

Week-8

Sampling Theorem

Week-9

Pulse Amplitude Modulation - Mod. & Demod.

Week-10

PWM, PPM - Mod. & Demod.

Week-11

PLL

Week-12

Radio receiver characteristics

Note: All Twelve experiments should be performed. The students have to calculate the relevant parameters using a) Hardware b) MATLAB Simulink c) MATLAB Communication tool box

Course Code	GRAPHICS DESIGN USING PHOTOSHOP		L	T	P	C
21A050702	(Common to CSE, CSE-IOT)		1	0	2	2
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES:

- Acquaint with graphic design techniques, principles of page layout and design, and photo editing.
- Various software, including Adobe Photoshop
- Adobe Illustrator.

COURSE OUTCOMES:

After completing the course student will be able to:

CO1: Identify the analysis tools
CO2: Describes the use of graphics in Animation
CO3: Understand the difficulty of representing and designing games.
CO4: Understand the latest technologies for linking, describing and searching the web.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week–1 & Week–2: Photoshop Basics
Week–3 & Week–4: Intro to Design Elements
Week–5 & Week–6: Font Portfolio
Week–7 & Week–8: Logos and Ads
Week–9 & Week–10: Photoshop Movie Posters
Week–11 & Week–12: Adobe Illustrator

Course Code	CONSTITUTION OF INDIA		L	T	P	C
21A000002	(Common to all branches)		2	0	0	0
Pre-requisite	NIL	Semester	III			

COURSE OBJECTIVES

- To Enable the student to understand the importance of constitution
- To understand the structure of executive, legislature and judiciary
- To understand philosophy of fundamental rights and duties
- To understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
- To understand the central-state relation in financial and administrative control

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand historical background of the constitution making and its importance for building a democratic India.

CO2: Understand the functioning of three wings of the government i.e., executive, legislative and judiciary.

CO3: Understand the value of the fundamental rights and duties for becoming good citizen of India.

CO4: Analyze the decentralization of power between central, state and local self-government

CO5: Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO2	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO3	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO4	-	-	-	-	-	3	-	2	1	-	-	1	-	-
CO5	-	-	-	-	-	3	-	2	1	-	-	1	-	-

UNIT-I (10 Hrs)

Introduction to Indian Constitution – Constitution -Meaning of the term - Indian Constitution-Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Indian constitution (L1)
- Apply the knowledge on directive principle of state policy (L3)
- Analyze the History and features of Indian constitution (L4)
- Learn about Preamble, Fundamental Rights and Duties (L1)

UNIT-II (10 Hrs)

Union Government and its Administration Structure of the Indian Union - Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat –Lok Sabha - Rajya Sabha - The Supreme Court and High Court - Powers and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of Indian government (L1)
- Differentiate between the state and central government (L4)
- Explain the role of President and Prime Minister (L2)
- Know the Structure of supreme court and High court (L1)

UNIT-III (10 Hrs)

State Government and its Administration - Governor - Role and Position -CM and Council of ministers - State Secretariat-Organization Structure and Functions

Learning Outcomes: At the end of this unit, students should be able to

- Understand the structure of state government (L1)
- Analyze the role of Governor and Chief Minister (L4)
- Explain the role of State Secretariat (L2)
- Differentiate between structure and functions of state secretariat (L4)

UNIT-IV (10 Hrs)

Local Administration - District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation Panchayati Raj - Functions– PRI –Zilla Parishath - Elected officials and their roles – CEO, Zilla Parishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

Learning Outcomes: At the end of this unit, students should be able to

- Understand the local Administration (L1)
- Compare and contrast district administration's role and importance (L4)
- Analyze the role of Mayor and elected representatives of Municipalities (L4)
- Learn about the role of Zilla Parishath block level organization (L1)

UNIT-V (10 Hrs)

Election Commission - Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

Learning Outcomes: At the end of this unit, students should be able to

- Know the role of Election Commission (L1)

- Contrast and compare the role of Chief Election commissioner and Commissionerate (L4)
- Analyze the role of state election commission (L4)
- Evaluate various commissions viz SC/ST/OBC and women (L6)

TEXTBOOKS:

1. "Introduction to the Constitution of India", Durga Das Basu, Prentice Hall of India Pvt. Ltd. New Delhi
2. "Indian Constitution", Subash Kashyap, National Book Trust

REFERENCE BOOKS:

1. "Dynamics of Indian Government & Politics", J.A. Siwach,
2. "Constitutional Law of India", H.M.Sreevai, 4th edition in 3 volumes (Universal Law Publication)
3. "Indian Government and Politics", J.C. Johari, Hans India

Course Code	INTERNET OF THINGS		L	T	P	C
21A050406			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Introduce the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT Platforms
- Create a basic understanding of the communication protocols in IoT communications.
- Familiarize the student with application program interfaces for IoT.
- Enable students to create simple IoT applications.

COURSE OUTCOMES:

After the completion of the course, the student will be able to

CO1: Choose the sensors and actuators for an IoT application
CO2: Select protocols for a specific IoT application
CO3: Utilize the cloud platform and APIs for IoT applications
CO4: Experiment with embedded boards for creating IoT prototypes
CO5: Design a solution for a given IoT application

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	-	-	-	-	-	-	-	1	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	3	2	3	-	-	2	-	-	-	-	-	2

UNIT – I (12 Hrs)

Overview of IoT:

The Internet of Things: An Overview, The Flavor of the Internet of Things, the "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, who is Making the Internet of Things?

Design Principles for Connected Devices: Calm and Ambient Technology, Privacy, Web Thinking for Connected Devices, Affordances.

Prototyping: Sketching, Familiarity, Costs Vs Ease of Prototyping, Prototypes and Production, Open-source Vs Close source, Tapping into the community.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L2)
- Interpret the design principles that govern connected devices (L2)
- Summarize the roles of various organizations for IoT (L2)
- Interpret the significance of Prototyping (L2)

UNIT – II (12 Hrs)

Embedded Devices: Electronics, Embedded Computing Basics, Arduino, Raspberry Pi, Mobile phones and tablets, Plug Computing: Always-on Internet of Things.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basics of microcontrollers (L2)
- Outline the architecture of Arduino (L2)
- Develop simple applications using Arduino (L3)
- Outline the architecture of Raspberry Pi (L2)
- Develop simple applications using Raspberry Pi (L3)
- Select a platform for a particular embedded computing application (L3)

UNIT – III (11 Hrs)

Communication in the IoT:

Internet Communications: An Overview, IP Addresses, MAC Addresses, TCP and UDP Ports, Application Layer Protocols

Prototyping Online Components: Getting Started with an API, Writing a New API, Real-Time Reactions, Other Protocols Protocol

Learning Outcomes: At the end of this unit, students should be able to

- Interpret different protocols and compare them (L2)
- Select which protocol can be used for a specific application (L3)
- Utilize the Internet communication protocols for IoT applications (L3)
- Select IoT APIs for an application (L3)
- Design and develop a solution for a given application using APIs (L6)
- Test for errors in the application (L4)

UNIT - IV (11 Hrs)

Business Models: A short history of business models, The business model canvas, Who is the business model for, Models, Funding an Internet of Things startup, Lean Startups.

Manufacturing: What are you producing, Designing kits, Designing printed circuit boards.

Learning Outcomes: At the end of this unit, students should be able to

- Plan the business model (L6)
- Predict the market value (L6)
- Build the product (L6)

UNIT - V (11 Hrs)

Manufacturing continued: Manufacturing printed circuit boards, Mass-producing the case and other fixtures, Certification, Costs, Scaling up software.

Ethics: Characterizing the Internet of Things, Privacy, Control, Environment, Solutions.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the manufacturing techniques (L2)
- Adapt the Ethics of the IoT (L6)

TEXT BOOK:

1. "Designing the Internet of Things, Adrian McEwen", Hakim Cassimally, Wiley Publications, 2012

REFERENCE BOOKS:

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.
2. "The Internet of Things, Enabling technologies and use cases", Pethuru Raj, Anupama C. Raman, CRC Press.

ONLINE LEARNING RESOURCES:

1. https://www.arduino.cc/

Course Code	SOFTWARE ENGINEERING & OOAD		L	T	P	C
21A050407	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- The students will have a broad understanding of the discipline of software engineering and its application to the development of and management of software systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models such as the waterfall and evolutionary models. understanding of the role of project management including planning, scheduling, risk management, etc.

CO2: Understanding of software requirements and the SRS document. Understanding of different software architectural styles.

CO3: Understanding of implementation issues such as modularity and coding standards. Understanding of approaches to verification and validation including static analysis, and reviews.

CO4: Understanding of software testing approaches such as unit testing and integration testing. Understanding of software evolution and related issues such as version management. Understanding on quality control and how to ensure good quality software.

CO5: Understanding of some ethical and professional issues that are important for software engineers. Development of significant teamwork and project-based experience

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	1		-	-	-	-	-	-	-	-	2

UNIT- I (12 Hrs)

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

Learning Outcomes: At the end of this unit, students should be able to

- Recognize the basic issues in commercial software development. (L3)
- Summarize software lifecycle models. (L5)
- Infer Workout project cost estimates using COCOMO and schedules using PERT and GANTT charts (L3)

UNIT- II (12 Hrs)

Requirements Engineering: Software Requirements, Requirements engineering Process, Requirement's elicitation, Requirements Analysis, Structured Analysis, Data Oriented Analysis, Object oriented Analysis, Prototyping Analysis, Requirements Specification, Requirements Validation, requirement Management.

Learning Outcomes: At the end of this unit, students should be able to

- Identify basic issues in software requirements analysis and specification. (L3)
- Develop SRS document for sample problems using IEEE 830 format. (L5)
- Develop algebraic and axiomatic specifications for simple problems. (L6)

UNIT- III (12 Hrs)

Software Design: Software Design Process, Characteristics of Good Software Design, Design Principles, Modular Design, Design Methodologies, Structured Design, Object-Oriented Design: Object oriented Analysis and Design Principles. UML Diagrams, Basic Behavioural Modelling: Interactions, Interaction diagrams. Case Study: The Unified Library application.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in software design. (L3)
- Apply the structured, object-oriented analysis and design (SA/SD) technique. (L5)
- Recognize the basic issues in user interface design. (L4)

UNIT- IV (12 Hrs)

Implementation: Coding Principles, Coding Process, Code verification, Code documentation Software Testing: Testing Fundamentals, Test Planning, Black Box Testing, White Box Testing, Levels of Testing, Usability Testing, Regression testing, Debugging approaches.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in coding practice. (L3)
- Recognize the basic issues in software testing. (L5)
- Design test cases for black box and white box testing. (L6)

UNIT- V (11 Hrs)

Software Project Management: Project Management Essentials, What is Project management, Software Configuration Management. Project Planning and Estimation: Project Planning

activities, Software Metrics and measurements, Project Size Estimation, Effort Estimation Techniques

Learning Outcomes: At the end of this unit, students should be able to

- Identify the basic issues in Software Project Management. (L3)
- Learn and practice project planning activities. (L5)
- Design and develop software metrics and Estimations. (L6)

TEXTBOOKS:

1. "Fundamentals of Software Engineering", Rajib Mall, PHI, 5th Edition, 2018.
2. "Software Engineering- Practioner Approach", Pressman R, McGraw Hill.
3. "Fundamentals of Object-Oriented Design in UML", Meilir Page-Jones, Pearson Education.

REFERENCE BOOKS:

1. "Software Engineering", Somerville, Pearson
2. "Software Engineering Concepts", Richard Fairley, Tata McGraw Hill.
3. "An integrated approach to Software Engineering", Jalote Pankaj, Narosa

Course Code	PYTHON PROGRAMMING & DATA SCIENCE (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050306			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To learn the fundamentals of Python.
- To discuss the concepts of Functions and Exceptions.
- To familiarize with Python libraries for Data Analysis and Data Visualization.
- To introduce preliminary concepts in Pattern Recognition and Machine learning.
- To provide an overview of Deep Learning and Data Science models.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO2: Demonstrate proficiency in handling Strings and File Systems.

CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO4: Interpret the concepts of NumPy, MatPlotLib, & Pandas as used in Python.

CO5: Implement exemplary applications related to Machine Learning, Deep learning and Data Science Models in Python.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

UNIT-I (15 Hrs)

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() Function and Is Operator, Dynamic and Strongly Typed Language,

Control Flow Statements: The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions used on Lists, List Methods, The del Statement.

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples
Learning outcomes: At the end of this unit, the students will be able to

- List the basic constructs of Python. (L1)
- Apply the conditional execution of the program (L3)
- Use the data structure lists, Dictionaries and Tuples (L3)

UNIT-II (10 Hrs)
Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings,
Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters.
Errors and Exceptions: What Are Exceptions? Exceptions in Python, Detecting and Handling Exceptions, Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions
Learning Outcomes: At the end of this unit, students should be able to

- Design programs for manipulating strings (L6)
- Solve the problems by applying the modularity principle. (L3)
- Classify exceptions and explain the ways of handling them. (L4)

UNIT-III (10 hrs)
Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files,
Introduction to **NumPy, Pandas, Matplotlib**.
Exploratory Data Analysis (EDA): Data Science life cycle, Descriptive Statistics, Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA.
Data Visualization: Scatter plot, bar chart, histogram, boxplot, heat maps, etc.
Learning Outcomes: At the end of this unit, students should be able to

- Creating file handling scripts. (L6)
- Demonstrate various mathematical operations on arrays using NumPy (L2)
- Analyze and manipulate Data using Pandas (L4)
- Creating static, animated, and interactive visualizations using Matplotlib. (L6)

UNIT-IV (15 hrs)
Introduction to Pattern Recognition and Machine Learning: Patterns, features, pattern representation, the curse of dimensionality, dimensionality reduction.

Classification—linear and non-linear. Bayesian, Nearest neighbor classifier, Logistic regression, Naïve-Bayes, decision trees and random forests; boosting and bagging.
Clustering---partitional and hierarchical; k-means clustering. Regression.
Cost functions, Cross-validation, Confusion matrix, evaluation metrics
Learning Outcomes: At the end of this unit, students should be able to

- Define Patterns and their representation (L1)
- Describe the Classification and Clustering (L2)
- Illustrate cost functions and class imbalance (L3)

UNIT-V (10 hrs)
Introduction to Deep Learning: Perceptron, Multilayer perceptron. Back propagation. Loss functions. Hyper parameter tuning, Overview of RNN, CNN and LSTM.
Overview of Data Science Models: Applications to text, images, recommender systems, image classification, Social network graphs
Learning Outcomes: At the end of this unit, students should be able to

- Describe RNN, CNN and LSTM (L2)
- Explain the applications of Data Science (L2)

TEXTBOOKS:

1. "Think Python", Allen B. Downey, SPD/O'Reilly, 2nd edition, 2016
2. "Doing Data Science, Straight Talk from the Frontline", Cathy O'Neil, Rachel Schutt, O'Reilly, 2013.
3. "Pattern Recognition and Machine Learning", Christopher Bishop, Springer, 2007.

REFERENCE BOOKS:

1. "Introduction to Python Programming", Gowri Shankar S, Veena A, CRC Press/Taylor & Francis, 1st Edition, 2018. ISBN-13: 978-0815394372,
2. "Python Data Science Handbook: Essential Tools for Working with Data", Jake Vander Plas, O'Reilly Media, 1st Edition, 2016. ISBN-13: 978-1491912058
3. "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Aurelien Geron, O'Reilly Media, 2nd Edition, 2019. ISBN – 13: 978-9352139057
4. "Core Python Applications Programming", Wesley J Chun, Pearson Education India, 3rd Edition, 2015. ISBN-13: 978-9332555365.
5. "Flask Web Development: Developing Web Applications with Python", Miguel Grinberg, O'Reilly Media, 2nd Edition, 2018. ISBN-13: 978-1491991732.

Course Code	MICROPROCESSORS AND MICROCONTROLLERS (Common to CSE, CSE-IOT)		L	T	P	C
21A050309			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To introduce fundamental architectural concepts of microprocessors and microcontrollers
- To impart knowledge on addressing modes, instruction set and assembly language programming of 8086 and 8051
- To demonstrate memory and I/O interfacing with 8086
- To describe the architecture and features of Intel 8051 microcontroller
- To explain the interfacing of external I/O devices with 8051 microcontrollers

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the concepts of 8086 microprocessors

CO2: Explain addressing modes of 8086 and develop assembly language programs for various problems

CO3: Describe the interfacing of 8086 with memory and peripheral devices

CO4: Distinguish between microprocessor and microcontroller and explain the concepts of 8051 microcontrollers

CO5: Explain the interfacing of external devices with 8051 microcontrollers and develop assembly language programs for various problems

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	3	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	3	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	3	-	2

UNIT-I (12 Hrs)

Introduction to 8086 Microprocessor: 8086 Architecture, Block Diagram, Register Organization, Flag Register, Pin Diagram, Timing and Control Signals, System Timing Diagrams, Memory Segmentation, Interrupt structure of 8086 and Interrupt Vector Table.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize features of 8086 microprocessor (L2)
- Describe about interrupt structure of 8086 and Interrupt Vector Table (L2)
- Explain the memory segmentation (L2)

UNIT-II (12 Hrs)

8086 Microprocessor Instruction Set and Addressing Modes, Instruction Set of 8086, Assembly Language Programming, Simple programs, Assembler Directives, Procedures and Macros, String manipulation instructions, Simple ALPs.

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8086 microprocessor (L1)
- Explain addressing modes of 8086 (L2)
- Develop assembly language programs for various problems (L2)

UNIT-III (12 Hrs)

8086 Interfacing: Programmable Peripheral Interface 8255, Programmable Interval Timer 8253, Programmable Interrupt Controller 8259, Programmable Communication Interface 8251 USART, DMA Controller 8257.

Case Study:

1. 8255 – PPI and its interfacing program– Stepper motor interfacing
2. Interfacing of 7-Segment Display with 8086 microprocessor using 8255.

Learning Outcomes: At the end of this unit, students should be able to

- Demonstrate memory & I/O interfacing with 8086 (L2)
- Describe interfacing of 8086 with peripheral devices (L2)

UNIT-IV (10 Hrs)

Intel 8051 Microcontroller, Microprocessor vs Microcontroller, 8051 Microcontroller Architecture, 8051 pin diagram, 8051 Ports, Alternate functions of I/O pins, Memory organization, Internal RAM structure, Stack operation, Counters and Timers, Serial Communication in 8051, interrupts in 8051.

Learning Outcomes: At the end of this unit, students should be able to

- Describe architecture and features of Intel 8051 microcontroller (L2)
- Develop assembly language programs to perform various operations using 8051 (L2)
- Distinguish between microprocessor and a microcontroller (L5)

UNIT-V (12 Hrs)

8051 Instruction Set and Programming: Introduction, Addressing modes of 8051, Instruction set of 8051, Data Transfer Instructions, Data and Bit-Manipulation Instructions, Arithmetic Instructions, simple programs, Interfacing Examples: External memory interfacing in 8051, interfacing of push button switches and LEDS, Interfacing of Relay, Interfacing of seven segment displays, Interfacing of Key board.

Case Study:

1. Interfacing of Seven segment display with 8051 microcontroller
2. Switch interfacing with 8051 microcontroller

3. Relay interfacing with 8051 microcontroller

Learning Outcomes: At the end of this unit, students should be able to

- Understand instruction set of 8051 microcontroller (L1)
- Explain addressing modes of 8051 (L2)
- Develop assembly language programs for various problems (L2)
- Explain the interfacing of 8051 with external devices (L2)

TEXTBOOKS:

1. "Advanced Microprocessors and Peripherals", K M Bhurchandi, A K Ray, McGraw Hill Education, 2017, 3rd edition.
2. "Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson, 2012, 2nd edition.

REFERENCE BOOKS:

1. "Microprocessor and Interfacing: Programming and Hardware", Douglas V. Hall, McGraw Hill
2. "The 8051 Microcontroller", Kenneth J. Ayala, Cengage Learning, 3rd edition, 2004.
3. "Microprocessors and Interfacing 8086, 8051, 8096 and advanced processors", Senthil Kumar, Saravanan, Jeevanathan, Shah, Oxford University Press, 1st edition, 2012.

Course Code	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to all branches)		L	T	P	C
21A110203			3	0	0	3
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To inculcate the basic knowledge of microeconomics and financial accounting.
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost.
- To know the various types of Market Structures & pricing methods and its strategies.
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

COURSE OUTCOMES:

After completion of the course the student will be able to:

CO1: Analyse the consumer behaviour with regard to their product or services and measure demand of a particular product or services by applying various methods in given situation

CO2: Determine Break Even Point (BEP) of an enterprise Assess the cost behaviour, costs useful for managerial decision making

CO3: Determine the price of a product or services in given market condition

CO4: Analyze the financial position by using different types of ratios and interpret the financial accounting

CO5: Evaluate the investment proposals under payback period, ARR, IRR, NPV & PI methods

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	1	1	-	1	-	-	-	-	-
CO2	-	2	2	-	-	1	2	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	2	-	2	-	1	1	-	-
CO4	1	-	1	1	-	-	1	-	2	-	-	2	-	-
CO5	1	-	2	-	-	1	2	-	-	-	-	1	-	-

UNIT- I (11 Hrs)

Introduction to Managerial Economics and Demand Analysis: Managerial Economics– Definition – Nature & Scope - Contemporary importance of Managerial Economics - Demand Analysis - Concept of Demand - Demand Function - Law of Demand - Elasticity of Demand - Significance - Types of Elasticity - Measurement of Elasticity of Demand- Demand Forecasting- Factors governing Demand Forecasting - Methods of Demand Forecasting - Relationship of Managerial Economics with Financial Accounting and Management.

Learning Outcomes: At the end of this unit, students should be able to

- Know the nature and scope of Managerial Economics and its importance. (L1)
- Understand the concept of demand and its determinants. (L2)
- Analyse the elasticity and degree of elasticity. (L4)
- Evaluate demand forecasting methods. (L5)
- Design the process of demand estimation for different types of demand. (L6)

UNIT- II (10 Hrs)

Theory of Production and Cost Analysis:

Production Function – Short-run and Long-run Production Function -Isoquants and Iso costs, MRTS –Least cost combination of Inputs, Cobb-Douglas Production Function - Laws of Returns – Internal and External Economies of scale – **Cost & Break-Even Analysis** - Cost concepts and Cost behavior - Break-Even Analysis (BEA)–Determination of Break-Even Point (Simple Problems)-Managerial significance of Break-Even Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Know the production function, Input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)
- Develop Profit appropriation for different levels of business activity. (L6)

UNIT- III (11 Hrs)

Introduction to Markets and New Economic Environment:

Market structures Types of Markets-Perfect and Imperfect Competition- Features of Perfect Competition– Monopoly -Monopolistic Competition –Oligopoly-Price-Output Determination-Pricing Methods and Strategies- Forms of Business Organizations - Sole Proprietorship - Partnership – Joint Stock Companies-Public Sector Enterprises - New economic Environment - **Economic Liberalization – Privatization – Globalization.**

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know the production function, input-output relationship and different cost concepts. (L1)
- Apply the least-cost combination of inputs. (L3)
- Analyse the behaviour of various cost concepts. (L4)
- Evaluate BEA for real time business decisions. (L5)

UNIT- IV (10 Hrs)

Capital and Capital Budgeting: Concept of Capital-Significance-Types of Capital-Components of Working Capital - Sources of Short-term and Long-term Capital -Estimating Working capital requirements-**Capital Budgeting**–Features of Capital Budgeting Proposals – Methods and Evaluation of Capital Budgeting Projects – Pay Back Method – Accounting Rate

of Return (ARR) – Net Present Value (NPV) – Internal Rate Return (IRR) Method (simple problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept of Capital Budgeting and its importance in business (L1)
- Contrast and compare different investment appraisal methods. (L4)
- Analyse the process of selection of investment alternative using different appraisal methods. (L4)
- Evaluate methods of Capital budgeting techniques. (L5)
- Design different investment appraisals and make wise investments. (L6)

UNIT–V (10 Hours)

Introduction to Financial Accounting and Analysis: Financial Accounting – Concept – Emerging need and Importance - Double-Entry Book Keeping, Journal, Ledger, Trial Balance - Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet (with simple adjustments). ***Financial Analysis*** **-** Ratios- Liquidity, Leverage, Profitability and Activity Ratios (Simple Problems)

Learning Outcomes: At the end of this unit, students should be able to

- Know the concept and convention and significance of accounting. (L1)
- Apply the fundamental knowledge of accounting while posting the Journal entries. (L3)
- Analyze the process and preparation of Financial Accounts and Financial Ratios. (L4)
- Evaluate the Financial performance of an enterprise by using financial statements. (L5)

TEXTBOOKS:

1. "Managerial Economics", Varshney & Maheswari, S. Chand, 2013.
2. "Managerial Economics and Financial Analysis", Aryasri, MGH, 4th edition, 2019

REFERENCE BOOKS:

1. "Managerial economics", Ahuja HL, S. Chand, 3rd edition, 2013.
2. "Managerial Economics and Financial Analysis", S. A. Siddiqui and A. S. Siddiqui, New Age International, 2013.
3. "Principles of Business Economics", Joseph G. Nellis and David Parker, Pearson, 2nd edition, New Delhi.
4. "Managerial Economics in a Global Economy", Dominick Salvatore, Cengage Learning, 2013.

Course Code	INTERNET OF THINGS LAB		L	T	P	C
21A050410			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- Learn the fundamental concepts of IoT and physical computing
- Expose the student to a variety of embedded boards and IoT platforms
- Create an environment of the communication protocols in IoT
- Familiarize the student with application program interfaces for IoT
- Enable students to create simple IoT applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Choose the sensors and actuators for an IoT application
CO2: Select protocols for a specific IoT application
CO3: Utilize the cloud platform and APIs for IoT application
CO4: Experiment with embedded boards for creating IoT prototypes
CO5: Design a solution for a given IoT application

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

EXPERIMENTS LIST:

Week 1

Select any one development board (Eg., Arduino or Raspberry Pi) and control LED using the board.

Week 2

Using the same board as in (1), read data from a sensor. Experiment with both analog and digital sensors.

Week 3

Control any two actuators connected to the development board using Bluetooth.

Week 4

Read data from sensor and send it to a requesting client. (Using socket communication) Note: The client and server should be connected to same local area network.

Week 5
Create any cloud platform account, explore IoT services and register a thing on the platform.

Week 6
Push sensor data to cloud.

Week 7
Control an actuator through cloud.

Week 8
Accesses the data pushed from sensor to cloud and apply any data analytics or visualization services.

Week 9
Create a mobile app to control an actuator.

Week 10
Design an IoT based air pollution control system which monitors the air pollution by measuring carbon monoxide, ammonia, etc and gives alarm or sends message when the pollution level is more than permitted range.

Week 11
Design an IoT based system which measures the physical and chemical properties of the water and displays the measured values.

Week 12
Identify a problem in your local area or college which can be solved by integrating the things you learned and create a prototype to solve it (Mini Project).

Week 13
Design a business model canvas for a digital display

TEXTBOOKS:

1. "Designing the Internet of Things", Adrian McEwen, Hakim Cassimally, Wiley Publications, 2012.
2. "Business Model Generation", Alexander Osterwalder and Yves Pigneur, Wiley, 2011.

REFERENCE BOOKS:

1. "Internet of Things: A Hands-On Approach", Arshdeep Bahga, Vijay Madisetti, Universities Press, 2014.
2. "The Internet of Things, Enabling technologies and use cases", Pethuru Raj, Anupama C. Raman, CRC Press.

ONLINE LEARNING RESOURCES:

1. https://www.arduino.cc/
2. https://www.raspberrypi.org/

Course Code	SOFTWARE ENGINEERING & OOAD LAB		L	T	P	C
21A050411	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To Learn and implement the fundamental concepts of software Engineering.
- To explore functional and non-functional requirements through SRS.
- To practice the various design diagrams through appropriate tool.
- To learn to implement various software testing strategies.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the basic concepts of Software Engineering.
CO2: Identify basic issues in software requirements analysis and specification
CO3: Apply the structured, object-oriented analysis and design (SA/SD) technique.
CO4: Design test cases for black box and white box testing.
CO5: Learn and practice project planning activities.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	2	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	-	-	-	-	-	-	-	-	-	-	2

SE LAB Experiments List

Week-1

Draw the Work Breakdown Structure for the system to be automated

Week-2

Using COCOMO model estimate effort.

Week-3

a) Calculate effort using FP oriented estimation model.
b) Analyze the Risk related to the project and prepare RMMM pla

Week-4

Develop Time-line chart and project table using PERT or CPM project scheduling methods.

Week-5

Draw E-R diagrams, and DFD for the project.
Design of Test cases based on requirements and design.

Week-6

Test a piece of code which executes a specific functionality in the code to be tested and asserts a certain behavior or state using Junit.

Week-7

a) Test the percentage of code to be tested by unit test using any code coverage tools
b) Write C/C++/Java/Python program for classifying the various types of coupling.

Week-8

a) Write a C/C++/Java/Python program for classifying the various types of cohesion.
b) Write a C/C++/Java/Python program for object oriented metrics for design proposed Chidamber and kremer . (Popularly called as CK metrics)

OOAD LAB Experiments List

Take three case studies:

- Customer Support System (in the Object-Oriented Analysis & Design with the Unified Process by Satzinger, Jackson & Burd Cengage Learning)
- Point-Of-Sale Terminal (in Larman textbook)
- Library Management System (in the reference book no. 2 i.e., UML toolkit)

Week-9

Familiarization with Rational Rose or *UML

Week-10

For each case study:
a) Identify and analyse events
b) Identify Use cases

Week-11

For each case study:
a) Develop event table
b) Identify & analyse domain classes

Week-12

For each case study:

a) Represent use cases and a domain class diagram using Rational Rose

b) Develop CRUD matrix to represent relationships between use cases and problem domain classes

Course Code	PYTHON PROGRAMMING & DATA SCIENCE LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050307			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

COURSE OBJECTIVES:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- Practical understanding of building different types of models and their evaluation

COURSE OUTCOMES:

After completing the course, the student will be able to

CO1: Illustrate the use of various data structures. (L3)
CO2: Analyze and manipulate Data using Pandas (L4)
CO3: Creating static, animated, and interactive visualizations using Matplotlib. (L6)
CO4: Understand the implementation procedures for the machine learning algorithms. (L2)
CO5: Apply appropriate data sets to the Machine Learning algorithms (L3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	3	-	-	-	-	-	-	-	1	-
CO2	2	2	2	1	3	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	3	-	-	-	-	-	-	-	1	-
CO4	2	2	2	2	3	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Week 1
Write a program to demonstrate a) Different numeric data types and b) To perform different Arithmetic Operations on numbers in Python.

Week 2
Write a program to create, append, and remove lists in Python.

Week 3
Write a program to demonstrate working with tuples in Python.

Week 4
Write a program to demonstrate working with dictionaries in Python.

Week 5
Write a program to demonstrate a) arrays b) array indexing such as slicing, integer array indexing and Boolean array indexing along with their basic operations in NumPy.

Week 6

Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.

Week 7

Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be the input that to be written to the second file.

Week 8

Write a program to demonstrate Regression analysis.

Week 9

Write a program to demonstrate the working of the decision tree-based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Week 10

Write a program to implement the Naïve Bayesian classifier for a sample training data set stored as a .CSV file.

Week 11

Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set.

Week 12

Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file. Compare the results of various "k" values for the quality of clustering.

Week 13

Write a program to build Artificial Neural Network and test the same using appropriate data sets.

TEXTBOOKS:

1. "Deep Learning with Python", Francois Chollet, Manning Publications Company, 1/e, 2017.
2. "How to Think Like a Computer Scientist: Learning with Python 3", Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, 3rd edition. URL: http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf
3. "Head First Python a Brain Friendly Guide", Paul Barry, O'Reilly, 2nd Edition, 2016
4. "Pandas for Everyone Python Data Analysis", Daniel Y. Chen, Pearson Education, 2019

Course Code	ADVANCED JAVA (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050703			1	0	2	0
Pre-requisite	C Programming & Data Structures	Semester	IV			

COURSE OBJECTIVES:

- The course is designed to provide programming fundamentals using JAVA

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement object-oriented programming concepts
CO2: Use and create package and interfaces in a java program.
CO3: Understanding of advance website development tools.
CO4: Use Graphical user interface in java program.
CO5: Creates applets.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	3	1	-
CO2	2	3	3	-	-	3	-	-	-	-	3	-	1	-
CO3	-	-	3	-	2	-	-	-	-	-	3	3	1	-
CO4	-	-	2	3	3	-	-	-	-	-	3	3	-	2
CO5	-	-	3	3	2	-	-	-	-	-	3	3	-	2

Topics to be covered

1. **Introduction of OOPs:** Summarized overview of Object-Oriented programming Technique.

2. **Class and its objects:** Define class and its object, Constructor, types of Constructors, Default Constructor, method over loading, constructor overloading.

3. **Inheritance:** Define inheritance and its type. Constructor in inheritance, super keyword, method overriding.

4. **Package and interface:** Define Package, how to use it, how to access multiple inheritance using interface, dynamic binding

5. **Variables and Inner Classes:** Types of variables, use of static keyword, Inner classes and its importance.

6. **Exception Handling:** Define Exception, how to handle exception, checked and unchecked exception, custom exception, try, catch and finally keywords.

7. **Java I/O:** How to take input from different devices. Hierarchy of java io class.

8. **String:** String methods, StringBuffer class and its methods.

9. **Multithreading:** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread.

10. **applets:** Defining the applet and Applet class, life cycle of applets, Font class, Graphics.

11. **Event Handling:** Define Event and its class, Listener, Adapter, MouseListener, MouseMotionListener, KeyListener.

12. **Swing and its Component Layout:** Swing components and Container, different layout, FlowLayout, BorderLayout, GridLayout.

Experiments List

Week 1

Develop a Java Program to implement the concept OOP

Week 2

Develop a Java Program to implement the concept of Inheritance

Week 3

Develop a Java Program to implement the Packages & Interfaces

Week 4

Develop a Java Program to implement Exception handling

Week 5

Develop a Java Program to implement the concept of Java I/O

Week 6

Develop a Java Program to demonstrate Text File Reading and Writing

Week 7

Develop a Java Program to demonstrate the Strings handling

Week 8

Develop a Java Program to implement the concept Multithreading

Week 9

Develop a Java Program to implement the concept of applet

Week 10

Develop a Java Program to implement Event Handling

Week 11

Develop a Java Program to implement a Simple Calculator

Week 12

Develop a Java Program to demonstrate Swing and its Component Layout

REFERENCE BOOKS:

1. "SCJP Sun Certified Programmer", Kathy Sierra and Bert Bates
2. "The Complete Reference", TMH.
3. "Java SE8 for Programmers", Paul Deitel and Harvey Deitel, Deitel Developer Series, 3rd Edition
4. www.tutorialspoint.com/java/
5. www.javatpoint.com/java-tutorial
6. www.udemy.com/java-tutorial/

Course Code	OPERATING SYSTEMS		L	T	P	C
21A050409	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Provide good insight on various memory management techniques
- Expose the students with different techniques of handling deadlocks
- Explore the concept of file-system and its implementation issues
- Familiarize with the basics of Linux operating system
- Implement various schemes for achieving system protection and security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Realize how applications interact with the operating system. Analyze the functioning of a kernel in an Operating system. **(K3)**

CO2: Summarize resource management in operating systems. Analyze various scheduling algorithms **(K2)**

CO3: Examine concurrency mechanism in Operating Systems. Apply memory management techniques in design of operating systems **(K4)**

CO4: Understand the functionality of file system. Compare and contrast memory management techniques. **(K2)**

CO5: Understand the deadlock prevention and avoidance. Perform administrative tasks on Linux based systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems

System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

Learning Outcomes: At the end of this unit, students should be able to

- Identify major components of operating systems (L2)

- Understand the types of computing environments (L2)
- Explore several open-source operating systems (L3)
- Recognize operating system services to users, processes and other systems (L3)

UNIT – II (12 Hrs)

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples.
Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers' problem, Readers and writers problem.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance, features of a process and methods of communication between processes. (L2)
- Improving CPU utilization through multi programming and multithreaded programming (L3)
- Examine several classical synchronization problems (L3)

UNIT – III (12 Hrs)

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the various techniques of allocating memory to processes (L3)
- Summarize how paging works in contemporary computer systems (L3)
- Understanding the benefits of virtual memory systems. (L2)

UNIT – IV (14 Hrs)

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

Learning Outcomes: At the end of this unit, students should be able to

- Investigate methods for preventing/avoiding deadlocks (L3)
- Examine file systems and its interface in various operating systems (L2)
- Analyze different disk scheduling algorithms (L3)

UNIT – V (14 Hrs)

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Learning Outcomes*:* At the end of this unit, students should be able to

- Infer various schemes available for achieving system protection. (L2)
- Acquiring knowledge about various countermeasures to security attacks (L3)
- Outline protection and security in Linux and Microsoft Windows. (L2)

TEXTBOOKS:

1. "Operating System Concepts", Silberschatz A, Galvin P B, and Gagne G, Wiley, 9th edition, 2016.
2. "Modern Operating Systems", Tanenbaum A S, Pearson Education, 3rd edition, 2008.

REFERENCE BOOKS:

1. "Operating Systems Design and Implementation", Tanenbaum A S, Woodhull A S, PHI, 3rd edition, 2006.
2. "Operating Systems A Concept Based Approach", Dhamdhere D MTata McGraw-Hill, 3rd edition, 2012.
3. "Operating Systems -Internals and Design Principles", Stallings W, Pearson Education, 6th edition, 2009
4. "Operating Systems", Nutt G, Pearson Education, 3rd edition, 2004

Course Code	SOFTWARE TESTING		L	T	P	C
21A050414	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Software Engineering & OOAD	Semester	V			

COURSE OBJECTIVES:

- To understand what is testing? and Software development model.
- To describe different approaches to Testing and testing methodologies.
- To demonstrate how to write and execute test plans
- To illustrate the basic concepts of automation testing
- To discuss about Test NG and other important concepts in automation testing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts of testing and SDLC Models. **(K2)**
CO2: Examine STLC and different types of testing and defects. **(K3)**
CO3: Analyze automation testing and its elements and time functions. **(K4)**
CO4: Demonstrate different Popups in automation testing. **(K3)**
CO5: Analyze various Test NG Frameworks. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Manual Testing: Introduction, Error, Defect, Bug, Verification, Validation. Testing: Types of Testing, White box and Black box Testing. Software Development Life Cycle: Introduction to Software Development Life Cycle, Models for SDLC, Metrics for Projects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain types of testing, verification and validation concepts. (L2)
- Describe about Software Development Life Cycle. (L2)

UNIT – II (9 Hrs)

Software Testing Life Cycle: Basic Concepts of Software Testing Life Cycle, Testing Methodologies, Test Plans, Test Cases, Test Executions and Defect Reports. **Defects:** Types of Defects, Defect Life Cycle, Levels vs Builds, Priority and Severity. **Types of Testing:** Functionality Testing, Security Testing, Smoke Testing, Sanity Testing, Adhoc Testing, Exploratory Testing, Load Testing, Stress Testing, Regression Testing, Retesting.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about Software Testing Life Cycle. (L2)

- Examine various types of Testing and Defects. (L3)

UNIT – III (10 Hrs)

Automation Testing: Introduction to Selenium, Components in Selenium, Installation Process, Cross Browser, Parallel Testing, Web Driver Methods and Locators.

Working on the Elements: Links, Dropdown, Radio Buttons, Check Boxes, Web Tables, Actions. **Time Functions:** Implicit, Explicit, Page Load Functions, Scroll Functions.

Learning Outcomes: Student should be able to

- Analyze basic components in selenium (L4)
- Illustrate about different elements and time functions in selenium. (L3)

UNIT – IV (10 Hrs)

Working On Popups: Alerts, Prompts, Confirmation, Working on Frames and Windows, Introduction to Test NG Designs, Annotations in TestNG. Apache POI Jar Files 3.17 for Reading, Writing Excel Files. Page Object Model-Property List.

Learning Outcomes: Student should be able *to*

- Understand the popups in automation testing. (L2)
- Illustrate about TestNG Designs. (L3)

UNIT – V (11 Hrs)

Test NG Frameworks : Framework Designing Structure, Keyword Framework, Data Driven Framework, Linear Framework, Modular Framework, Hybrid Framework. Working on Maven Project – Creating Extent Reports, Basics of Github and Jenkins.

Learning Outcomes: Student should be able to

- Explain various kinds of Test NG Frameworks (L3)
- Describes Marven projects, Github and Jenkins. (L2)

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press

REFERENCE BOOKS:

1. "Software testing techniques", Boris Beizer, Dreamtech, 2nd Edition, 2002.
2. "The craft of software testing", Brian Marick, Pearson Education.
3. "Software Testing", Yogesh Singh, Cambridge
4. "Software Testing", P.C. Jorgensen , 3rd Edition, Aurbach Publications (Dist.by SPD).

Course Code	COMPUTER NETWORKS		L	T	P	C
21A050408	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Familiarize with the applications of Internet
- Explore the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Elucidate the design issues for a computer network

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the software and hardware components of a Computer network **(K3)**
CO2: Develop new routing, and congestion control algorithms **(K3)**
CO3: Assess critically the existing routing protocols **(K5)**
CO4: Explain the functionality of each layer of a computer network **(K2)**
CO5: Choose the appropriate transport protocol based on the application requirements **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)

Computer Networks and the Internet: What is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol Layers and their Service Models, Networks under attack, History of Computer Networking and the Internet

Learning Outcomes: At the end of this unit, students should be able to

- Enumerate the hardware components of a computer network (L1)
- List the layers of a Computer Network (L1)
- Identify the performance metrics of a computer network (L3)

UNIT – II (12 Hrs)

Application Layer Principles of Network Applications, The web and HTTP, File transfer: FTP, Electronic mail in the internet, DNS-The Internet's Directory Service, Peer-to-Peer Applications

Learning Outcomes: At the end of this unit, students should be able to

- Design new applications of a computer network (L6)
- Analyze the application protocols (L4)
- Extend the existing applications (L2)

UNIT – III (14 Hrs)

Transport Layer: Introduction and Transport-Layer Services, Multiplexing and De-multiplexing, Connectionless Transport: UDP, Principles of Reliable Data transfer, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control

Learning Outcomes: At the end of this unit, students should be able to

- Design Congestion control algorithms (L6)
- Select the appropriate transport protocol for an application (L3)
- Identify the transport layer services (L2)

UNIT – IV (12 Hrs)

The Network Layer: Introduction, Virtual Circuit and Datagram Networks, The Internet Protocol (IP): Forwarding and Addressing in the Internet, Routing Algorithms, Routing in the Internet, Broadcast and Multicast Routing

Learning Outcomes: At the end of this unit, students should be able to

- Compare routing algorithms (L4)
- Design routing algorithms (L6)
- Extend the existing routing protocols (L2)

UNIT – V (12 Hrs)

The Layer: Links, Access Networks, and LANs Introduction to the Link Layer, Error-Detection and Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request

Learning Outcomes: At the end of this unit, students should be able to

- Compare medium access protocols (L4)
- Classify the computer networks (L2)
- Design a Data Centre for an organization (L6)

TEXTBOOKS:

1. "Computer Networking: A Top-Down Approach", James F. Kurose, Keith W. Ross, Pearson, 6th edition, 2019.

REFERENCE BOOKS:

1. "Data communications and Networking", Forouzan, McGraw Hill Publication, 5th Edition.
2. "Computer Networks", Andrew S. Tanenbaum", David J. Wetherall, Pearson, 5th Edition.
3. "Networks for Computer Scientists and Engineers", Youlu Zheng, Shakil Akthar, Oxford Publishers, 2016.

Course Code	SENSORS AND INTERNET OF THINGS		L	T	P	C
21A350401			3	0	0	3
Pre-requisite	Basic Electrical and Electronics Engineering, Applied Physics	Semester	V			

COURSE OBJECTIVES:

- To provide knowledge on Sensor Principles.
- To provide familiarity with different sensors and their application in real life.
- To understand the Basics of IoT, and enabling technologies.
- To design IoT applications using Arduino and Raspberry pi.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate knowledge on the characteristics of sensors. **(K3)**
CO2: Select appropriate sensors for the given application development. **(K2)**
CO3: Understand principles of IoT & Design basic IoT Applications using Arduino. **(K2)**
CO4: Design IoT Applications using Raspberry Pi. **(K5)**
CO5: Perform Data Acquisition and analyse using Cloud and Tkinter. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	1	-	1	-	-	-	-	-	-	-	2	1
CO2	3	1	3	1	3	-	-	-	2	-	-	3	2	1
CO3	3	3	2	1	-	-	-	-	2	1	-	2	-	2
CO4	3	3	2	1	-		-	-	2	1	-	2	-	2
CO5	-	3	2	2	1	-	-	-	2	2	2	2	2	2

UNIT – I (10 Hrs)

Introduction to Sensors: Sensors, Criteria to choose a Sensor, Generation of Sensors.

Optical Sources and Detectors: ***Optical sources***- LED, Semiconductor lasers, Fiber optic sensors, ***Detectors***- Thermal detectors, Photomultipliers, photoconductive detectors.

Strain, Force, Torque, and Pressure sensors: Strain gages, strain gage beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo-resistive and capacitive pressure sensor, vacuum sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the sensors and its Criteria to choose a Sensor, Generation of Sensors. (L2)
- Understand the different sensors and its principle of operations. (L2)
- Understand the different sensors and its Sources and Detectors. (L2)

UNIT – II (9 Hrs)

TYPES OF SENSORS AND APPLICATIONS

Position, Direction, Displacement, Level sensors, Velocity, Acceleration sensors and

Temperature sensors: Thermo-resistive, thermo-electric, semiconductor and optical, Piezoelectric temperature sensor.

Wearable Sensors: Introduction from fibers to textile sensors - Interlaced network -Textile sensors for physiological state monitoring - Biomechanical sensing –Non-invasive sweat monitoring by textile sensors and other applications. FBG sensor in Intelligent Clothing.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the different sensors and its principle of operations. (L2)
- Understand the different sensors Sources and Detectors. (L2)
- Apply the different Wearable Sensors on applications. (L3)

UNIT – III (10 Hrs)

Introduction to Internet of Things: Characteristics of IoT, Design principles of IoT, IoT Architecture and Protocols, Enabling Technologies for IoT, IoT levels and IoT vs M2M.

IoT Design Methodology: Design methodology, Challenges in IoT Design, IoT System Management, IoT Servers.

Basics of Arduino: Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, Connecting LEDs with Arduino, Connecting LCD with Arduino.

Learning Outcomes: At the end of this unit, students should be able to

- Understand about the Principles of Internet of Things (L2)
- Understand about the IoT Design Methodology(L3)
- Understand the basics of Arduino and its IoT Applications using Arduino (L3)

UNIT – IV (8 Hrs)

IOT APPLICATION DEVELOPMENT

Basics of Raspberry Pi: Introduction to Raspberry pi, Installation of NOOBS on SD Card, Installation of Raspbian on SD Card, Terminal Commands, Installation of Libraries on Raspberry Pi, Getting the static IP address of Raspberry Pi, Run a Program on Raspberry Pi, Installing the Remote Desktop Server, Face Recognition using Raspberry Pi, Installation of I2C driver on Raspberry Pi, SPI (serial peripheral interface) with Raspberry Pi, Programming a Raspberry Pi, Play with LED and Raspberry Pi, Reading the digital input, Reading an edge triggered input, Interfacing of Relay with Raspberry Pi, Interfacing of Relay with Raspberry Pi, Interfacing of LCD with Raspberry Pi, Interfacing LCD with Raspberry Pi in I2C mode, Interfacing of DHT11 sensor with Raspberry Pi

Interfacing of ultrasonic sensor with Raspberry Pi, Interfacing of camera with Raspberry pi.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the architecture and basic concepts of Raspberry Pi((L2)
- Apply the different devices and sensors Interfacing with Raspberry Pi((L3)
- Analyse IoT Applications using Raspberry Pi. (L4)

UNIT – V (8 Hrs)

DATA ACQUISTION AND CLOUD

Data Acquisition with Python and Tkinter: Basics-CSV file, Storing Arduino data with CSV file, plotting random numbers using matplotlib, plotting real-time from Arduino, Integrating the plots in the Tkinter window.

Connecting to the Cloud: Smart IoT Systems, DHT11 Data Logger with ThingSpeak Server, Ultrasonic Sensor Data Logger with ThingSpeak Server, Air Quality Monitoring System and Data Logger with ThingSpeak Server, Landslide Detection and Disaster Management System.

Learning Outcomes: At the end of this unit, students should be able to

- Apply the Data Acquisition with Python and Tkinter ((L3)
- Analyse the Connecting to the Cloud (L4)
- Evaluate the IoT Applications using Raspberry Pi. (L5)

TEXTBOOKS:

1. "Handbook of Modern Sensors: Physical, Designs, and Applications", J. Fraden, AIP Press, Springer, 4th Edition, 2010.
2. "Internet of Things with Raspberry Pi and Arduino", Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, CRC Press, 2019.

REFERENCE BOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Publication, New Delhi,2003.
2. "From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence", Jan Holler and Vlasios Tsiatsis, Elsevier Ltd., 2014.
3. "IoT Fundamentals: Networking Technologies, Protocols,and Use Cases for the Internet of Things", David Hanes and Gonzalo Salgueiro, Cisco Press, 2017

ONLINE LEARNING RESOURCES:

1. https://www.guru99.com/iot-tutorial.html
2. https://developer.ibm.com/technologies/iot/tutorials/

Course Code	SAP		L	T	P	C
21A050417	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To bridge the gap between the Academics and Industries
- To create job ready manpower resource pool with the skills of SAP
- To enhance employability by meeting the skill requirement of industry to address ever changing business needs.
- To build knowledge based Economy with cost effective program for World's best IT Company
- To understand industry best practices supported by SAP ERP – "Be future ready"

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic concepts of ERP (Enterprise Resource Planning) & SAP (Systems Applications and Products in Data Processing) **(K3)**

CO2: Analyze the SAP Net-Weaver Architecture for designing ABAP (Advanced Business Application Programming) **(K4)**

CO3: Categorize the various components of SAP & Client Administration **(K4)**

CO4: Solve the general administration and monitoring problems **(K3)**

CO5: Cconnect new versions of SAP like SAP HANA for Cloud Data. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	2	1	-	-	-	-	-	-	-	-	-	2
CO2	2	1	3	3	1	-	-	-	-	-	-	-	-	2
CO3	2	1	3	2	-	-	-	-	-	-	-	-	-	2
CO4	1	-	2	2	1	-	-	-	-	-	-	-	2	-
CO5	2	1	3	3	2	-	-	-	-	-	-	-	2	-

UNIT – I (9 Hrs)

ERP Introduction: ERP and its background, Different types of ERPs, Evolution of SAP, Different versions of SAP, New dimensional components of SAP, Modules of each SAP component.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of ERP (L2)
- Understand the evolution and versions of SAP (L2)
- Analyse the various modules of SAP (L3)

UNIT-II (9 Hrs)

SAP Net-Weaver Architecture: NW Introduction, Components of NW & Core Architecture, Application servers, Central Instance, Dialog instance, ABAP and Java Stacks, Message servers, Dispatchers, WPs and the types, System Landscape

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the different components of NW (L3)
- Analyse the architecture of Net-Weaver (L3)
- Understand the ABAP and creating servers (L2)

UNIT – III (9 Hrs)

SAP Components: Core Component and functionality, Modules of SAP components, Roles in SAP application, Basis introduction to SAP technical work flow.

Client Administration: Client Concept, Create clients, Client Export/Import, Copy Logs, Monitoring of Client Copy

Learning Outcomes: At the end of this unit, students should be able to

Understand the components of SAP & Applications (L2)

- Analyse the workflow of SAP (L3)
- Plan the Client Administration like importing and exporting data (L5)

UNIT – IV (9 Hrs)

General Administration: Daily, weekly and monthly monitoring the system health, T-Codes related to System monitoring, Background Jobs administration, Spool architecture and administration, Performance tuning methods and implantation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the General monitoring and administration methods (L2)
- Analyse the spool architecture and administration (L3)
- Applying the performance monitoring methods (L3)

UNIT – V (8 Hrs)

Database administration: Oracle Database concepts, Monitoring Table spaces, SAPDBA/BR Tools, DB Activities and T-Codes, SAP HANA.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the database administration methods (L2)
- Analyse the SAPDBA Tools (L3)
- Comparing latest versions of SAP like SAP HANA (L2)

TEXTBOOKS:

1. "The Beginner's Guide to sap", Peter Moxon, SAPPROUK Limited
2. "SAP HANA: An Introduction", Bjarne Berg, Penny Silvia, Galilio Press, 3rd Edition

REFERENCE BOOKS:

1. "SAP HANA 2.0: An Introduction", Denys Van Kempen
2. "SAP HANA 2.0 Administration", Bert Vanstechelman

3. "ABAP Development for SAP HANA (SAP PRESS)", Mohsin Ahmed, Sumit Naik, 1st Edition

Course Code	MOBILE COMPUTING		L	T	P	C
21A050418	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Computer Networks	Semester	V			

COURSE OBJECTIVES:

- To understand mobile ad hoc networks, design and implementation issues, and available solutions
- To acquire knowledge of sensor networks and their characteristics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Determine the implementation issues in LANS and PANS of wireless networks.**(K3)**

CO2: Organizing and differentiating various MAC Protocols usage in Adhoc Wireless Networks. **(K4)**

CO3: Analyse Various Routing and Security Protocols in Wireless Networks.**(K4)**

CO4: Classification of QOS and Energy management in Wireless Networks.**(K4)**

CO5: Comparing various Protocols in wireless Sensor Networks and their characteristics. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	2	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Wireless LANS and PANS: Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

Wireless Internet: Wireless Internet, Mobile IP, TCP in Wireless Domain, WAP, Optimizing Web over Wireless.

Learning Outcomes: At the end of this unit, students should be able to

- Distinguish LANs, WLANs and PANS. (L5)
- Examine about IEEE 802 Standards, Hiperlans and Bluetooth. (L3)

UNIT – II (9 Hrs)

AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet.

MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention –

Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that use Directional Antennas, Other MAC Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about AD HOC Wireless Networks. (L3)
- Analyse MAC Protocols for Ad Hoc Wireless Networks. (L4)

UNIT – III (9 Hrs)

Routing Protocols: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding, Flooding: Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols.

Transport Layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks, Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Routing Protocols. (L2)
- Explain different classifications of Routing Protocols. (L4)
- Illustrate various Transport Layer and Security Protocols. (L4)

UNIT – IV (9 Hrs)

Quality of Service: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks.

Energy Management: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes, Transmission Power Management Schemes, System Power Management Schemes.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Quality of Service in Ad Hoc Wireless Networks. (L2)
- Explain about Energy Management concepts in Wireless Networks. (L6)

UNIT – V (8 Hrs)

Wireless Sensor Networks: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Describe Wireless Sensor Networks. (L2)
- Explain various MAC Protocols for Wireless Sensor Networks. (L4)

TEXTBOOKS:

1. "Ad Hoc Wireless Networks: Architectures and Protocols", C. Siva Ram Murthy and B. S. Manoj, PHI, 2004.
2. "Wireless Ad-hoc and Sensor Networks: Protocols, Performance and Control", Jagannathan Sarangapani, CRC Press.

REFERENCE BOOKS:

1. "Ad hoc Mobile Wireless Networks", Subir Kumar sarkar, T G Basvaraju, C Puttamadappa, Auerbach Publications, 2012.
2. "Wireless Sensor Networks", C. S. Raghavendra, Krishna M. Sivalingam, Springer, 2004.
3. "Ad-Hoc Mobile Wireless Networks: Protocols & Systems", C.K. Toh, Pearson Education.

Course Code	SOFTWARE TESTING LAB		L	T	P	C
21A050419	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	Object Oriented Programming through Java	Semester	V			

COURSE OBJECTIVES:

- To understand the fundamentals for various testing methodologies.
- To describe the principles and procedures for designing test cases.
- To explore debugging methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the basic testing procedures. **(K2)**
CO2: Formulate test cases and test suites **(K6)**
CO3: Choose Selenium tools to perform testing **(K3)**
CO4: Construct and test simple programs. **(K6)**
CO5: Describe bug tracking **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO2	2	-	-	-	2	-	-	-	-	-	-	-	1	-
CO3	3	2	3	2	-	2	-	-	-	-	-	-	2	1
CO4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO5	-	3	3	-	-	2	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

MANUAL TESTING: (USING C LANGUAGE)

1. Write a 'C' program to demonstrate the working of the following constructs:
a). do…while
b). while
c). if …else
d). switch
e). for Loops in C language.
2. A program written in c language for matrix multiplication fails "Introspect the causes for its failure and write down the possible reasons for its failure".
3. Take any system (e.g. ATM system) and study its system specifications and report the various bugs.
4. Write the test cases for any known application (e.g. Banking application)
5. Create a test plan document for any application (e.g. Library Management System).

AUTOMATION TESTING : (using Selenium)

1. Write a script to open google.com and verify that title is Google and also verify that it is redirected to google.co.in.
2. Write a script to open google.co.in using chrome browser (ChromeDriver).
3. Write a script to open google.co.in using internet explorer (InternetExplorerDriver).
4. Write a script to login Next Generation Automation.
5. Write a script to close all the browsers without using quit() method.
6. Write a script to test the cookie creation.
7. Write a script to test the Gmail Login & Logout procedure.
8. Write a script to test the Facebook Account Creation.
9. Write a script to test the Google Cache Selection.
10. Write a script to test the Gmail Composing Dynamically.

TEXTBOOKS:

1. "Software Testing: Principles and Practices", Srinivasan Desikan, Gopalaswamy Ramesh, 1st Edition, Pearson Education.
2. "Software Testing: Principles and Practices", Naresh Chauhan, 2nd Edition, Oxford University Press
3. "Java Complete Reference", Herb Schildt, 9th Edition, Oracle press.

Course Code	COMPUTER NETWORKS & OPERATING SYSTEMS LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050412			0	0	3	1.5
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand the working of character and bit stuffing
- To understand the Dijkstra's algorithm and its performance
- To analyze the performance of DES encryption algorithms
- To understand CPU scheduling algorithms and page replacement algorithms

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand how data is transmitted and checking of errors. **(K2)**

CO2: Understand Inter process communication including shared memory, pipes and messages **(K2)**

CO3: Simulate CPU Scheduling Algorithms. (FCFS, RR, SJF, Priority, Multilevel Queuing) **(K6)**

CO4: Simulate Banker's Algorithm for Deadlock Avoidance, Prevention Program for FIFO, LRU, and OPTIMAL page replacement algorithm. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	1	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	1	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	2

PART-A

Week 1

Implement the data link layer framing methods such as character, character stuffing and bit stuffing.

Week 2

Implement on a data set of characters the three CRC polynomials – CRC 12, CRC 16 and CRC CCIP.

Week 3

Implement Dijkstra 's algorithm to compute the Shortest path thru a graph.

Week 4

a) Take an example subnet graph with weights indicating delay between nodes. Now obtain Routing table art each node using distance vector routing algorithm

b) Take an example subnet of hosts. Obtain broadcast tree for it.

Week 5

a) Take a 64-bit playing text and encrypt the same using DES algorithm.
b) Write a program to break the above DES coding

Week 6

Using RSA algorithm Encrypt a text data and Decrypt the same.

PART-B

Week7

Simulate the following CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority

Week 8

Simulate all file allocation strategies a) Sequential b) Indexed c) Linked

Week 9

Simulate MVT and MFT

Week 10

Simulate all File Organization Techniques a) Single level directory b) Two level c) Hierarchical d) DAG

Week 11

a) Simulate Bankers Algorithm for Dead Lock Avoidance
b) Simulate Bankers Algorithm for Dead Lock Prevention

Week 12

Simulate all page replacement algorithms a) FIFO b) LRU c) LFU Etc. …

Week 13

a) Simulate Paging Technique of memory management.
b) Experiments on fork, shared memory and semaphores

TEXTBOOKS:

1. "Introduction to Data Communications and Networking", Behrouz Forouzan, Tata McGraw Hill, 2015, 5th Edition.

2. "Data and Computer Communications", Stallings, PHI, 2015, 10th Edition.

REFERENCE BOOKS:

1. "Data Communication", William Schewber, McGraw Hill, 1987.
2. "Computer Networks", Tanenbaum, PHI, 5th Edition, 2011.
3. "Operating System Concepts", Abraham Silberchatz, Peter B. Galvin, Greg Gagne, John Wiley, Eight Edition
4. "Operating Systems: Internals and Design Principles", Stallings, Pearson Education, Sixth Edition, 2009.
5. "Modern Operating Systems", Andrew S Tanenbaum, PHI, Second Edition.

ONLINE LEARNING RESOURCES:

1. http://www.cse.iitk.ac.in/users/dheeraj/cs425/
2. http://www.tcpipguide.com/free/t_OSIReferenceModelLayers.htm
3. http://iit.qau.edu.pk/books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
4. http://www.networkdictionary.com/protocols/osimodel.php

Course Code	PROGRAMMING IN EMBEDDED C		L	T	P	C
21A010701			1	0	2	2
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To impart technical skills to the students right from the basics to advanced level, such that, by the end of the program the student is developed as the finished product, ready to join the industry.
- To describe what an embedded system is, what makes them different, and what embedded systems designers need to know to develop embedded systems
- To provide the student with a life cycle view for designing multi-objective, multi-discipline embedded systems
- To impart a solid understanding of the role of embedded systems and embedded systems design and development in modern day's technology-enabled society
- To understand the role of embedded systems in the context of complex engineering systems

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Transfer the executable code to the embedded hardware and test the system **(K)**

CO2: Describe Keil hardware simulator will allow you to simulate suitable hardware for use with the program. **(K)**

CO3: Describe how to use an object-oriented style of programming with C programs. **(K)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1														
CO2														
CO3														

UNIT – I

Programming embedded systems in C: Introduction, what is an embedded system? Which processor should you use? Which programming language should you use? Which operating system should you use?, How do you develop embedded software?.

Hello, embedded world: Introduction, Installing the Keil software and loading the project, Configuring the simulator, Building the target, Running the simulation, Dissecting the program, aside: Building the hardware.

UNIT – II

Reading switches: Introduction Basic techniques for reading from port pins, Example: Reading and writing bytes, Example: Reading and writing bits (simple version), Example: Reading and writing bits (generic version), The need for pull-up resistors, dealing with switch bounce, Example: Reading switch inputs (basic code), Example: Counting goats.

UNIT – III

Adding structure to your code: Introduction, Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: Restructuring the 'Hello Embedded World' Example: Restructuring the goat-counting example, Further examples.

UNIT – IV

Meeting real-time constraints: The need for 'timeout' mechanisms, creating loop timeouts, Example: Testing loop timeouts, Example: A more reliable switch interface, creating hardware timeouts, Example: Testing a hardware timeout.

Multi-state systems and function sequences: Introduction, implementing a Multi-State (Timed) system, Example: Traffic light sequencing, Example: Animatronic dinosaur, implementing a Multi-State (Input/Timed) system, Example: Controller for a washing machine.

UNIT – V

Using the serial interface: Introduction, what is RS-232? Does RS-232 still matter? The basic RS-232 protocol, Asynchronous data transmission and baud rates, Flow control, the software architecture, Using the on-chip UART for RS-232 communications, Memory requirements, Example: Displaying elapsed time on a PC, The Serial-Menu architecture, Example: Data acquisition, Example: Remote-control robot.

LIST OF EXPERIMENTS:

1. Program to transmit message from microcontroller to PC serially using RS232
2. Program to interface Elevator.
3. Program to interface keypad. Whenever a key is pressed, it should be displayed on LCD
4. Program to receive a message from PC to microcontroller serially using RS232
5. Program to interface a switch and a buzzer to two different pins of a port such that the buzzer should sound as long as the switch is pressed.
6. Interrupt programming through GPIOs
7. PWM generation using Timer on MSP430 GPIO
8. Interfacing potentiometer with MSP430
9. a) Interfacing DC motor. b) Interfacing Relay. c) Interfacing Servo d) Interfacing Stepper motor.
10. Write a random number generation function using assembly language. Call this function from a C program to produce a series of random numbers and save them in the memory
11. Design a Water level controller using Microcontroller
12. Design a Bio metric Attendance System
13. Design a Fingerprint based Security system

TEXTBOOKS:

1. "Embedded Systems", Michael J. Pont, Pearson Education, 2015

REFERENCE BOOKS:

1. "Embedded C Programming: Techniques and Applications of C and PIC MCUS", Mark Siegesmund, 2014.
2. "Embedded C Programming and the Atmel AVR", Richard H. Barnett, Sarah Cox, Larry O'Cull, 2006.

ONLINE LEARNING RESOURCES:

1. https://www.javatpoint.com/embedded-system-c-programming
2. https://www.udemy.com/course/embedded-system-programming-on-arm-cortex-m3m4/

Course Code	UNIVERSAL HUMAN VALUES (Common to all branches)		L	T	P	C
21A000003			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the significance and need of values in the society. **(K2)**

CO2: Understand the meaning of Harmony in the Self the Co-existence of Self and Body. **(K2)**

CO3: Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society **(K2)**

CO4: Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. **(K3)**

CO5: Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	-	-	-	-	-

UNIT – I (7 Hrs)

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the significance and need of values in the society. (L2)

UNIT – II (6 Hrs)

Understanding Harmony in the Human Being - Harmony in Myself: Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programs to ensure self-regulation and Health.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the meaning of Harmony in the Self the Co-existence of Self and Body. (L2)
- Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail. (L2)

UNIT – III (5 Hrs)

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order

Learning Outcomes: At the end of this unit, students should be able to

- Understanding the value of harmonious relationships and explore their role in ensuring a harmonious society (L2)

UNIT – IV (6 Hrs)

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at all Levels, and the Holistic Perception of Harmony in Existence.

Learning Outcomes: At the end of this unit, students should be able to

- Examine the harmony in nature and existence, and work out their mutually fulfilling participation in the nature. (L3)

UNIT – V (6 Hrs)

Implications of the above Holistic Understanding of Harmony on Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Learning Outcomes: At the end of this unit, students should be able to

- Identify the scope and characteristics of people friendly and eco-friendly production systems. (L2)
- Develop appropriate technologies and management patterns for above production systems. (L3)

- Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work. (L3)

TEXTBOOKS:

1. "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2. "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2.

REFERENCE BOOKS:

1. "Jeevan Vidya: Ek Parichaya", A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. "Human Values", A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. "The Story of My Experiments with Truth", Mohandas Karamchand Gandhi
5. "Small is Beautiful", E. FSchumacher.
6. "Slow is Beautiful", Cecile Andrews
7. "Economy of Permanence", J C Kumarappa
8. "Bharat Mein Angreji Raj", Pandit Sunderlal
9. "Rediscovering India", Dharampal,
10. "Hind Swaraj or Indian Home Rule", Mohandas K. Gandhi,
11. "India Wins Freedom", Maulana Abdul Kalam Azad
12. "Vivekananda", Romain Rolland (English)
13. "Gandhi", Romain Rolland (English)

ONLINE LEARNING RESOURCES:

1. http://www.uhv.org.in/
2. https://vvce.ac.in/wp-content/uploads/2021/04/Realising-Aspirations-of-NEP2020-UHV.pdf
3. https://www.studocu.com/in/document/dr-apj-abdul-kalam-technical-university/universal-human-valuestechnical-communication/uhv-best-notes/31376289

Course Code	ARTIFICIAL INTELLIGENCE		L	T	P	C
21A050421	(Common to CSE, CSE-IOT)		3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To define Artificial Intelligence and establish the cultural background for study
- To understand various learning algorithms
- To explore the searching and optimization techniques for problem solving
- To provide basic knowledge on Natural Language Processing and Robotics

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply searching techniques for solving a problem **(K4)**
CO2: Design Intelligent Agents **(K3)**
CO3: Develop Natural Language Interface for Machines **(K3)**
CO4: Design mini robots **(K3)**
CO5: Summarize past, present and future of Artificial Intelligence **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	-	-	-	-	-	2
CO2	3	3	3	2	1	1	-	-	-	-	-	-	-	2
CO3	2	3	3	2	1	-	-	-	-	-	-	-	2	2
CO4	3	3	2	2	1	-	-	-	-	-	-	-	2	-
CO5	3	3	2	2	1	-	-	-	-	-	-	-	2	-

UNIT – I (9Hrs)

Introduction: What is AI, Foundations of AI, History of AI, The State of Art. **Intelligent agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the history of Artificial Intelligence (L2)
- Analyse the nature of Agent behaviour and its environment (L3)
- Recognize rationality of agent working (L2)
- Identify the requirement to implement agent structure (L2)

UNIT – II (10 Hrs)

Solving problems by searching: Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, **Beyond Classical Search:** Local Search Algorithms and Optimization Problems, Local Search

in Continues Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the searching methodology using agents (L2)
- Differentiate informed and uninformed search strategies (L3)
- Apply search strategy in non-deterministic environment (L4)
- Use agents to solve complex searching problems (L3)

UNIT – III (9 Hrs)

Reinforcement learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL **Natural language processing**: Language Models, Text Classification, Information Retrieval, Information Extraction.

Learning Outcomes: At the end of this unit, students should be able to

- Examine how an agent can learn from success and failure, reward and punishment (L5)
- Compare and apply active and passive types of reinforcement learning (L3)
- Apply Natural Language Processing in Text, Information retrieval and Extraction systems (L4)

UNIT – IV (9 Hrs)

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition **Perception**: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

Learning Outcomes: At the end of this unit, students should be able to

- Use natural language for augmenting grammars, speech recognition and syntactic analysis (L5)
- Identify the object, image using perception concepts (L3)
- Develop programs that translate from one language to another, or recognize spoken words. (L6)
- Recognize the structural information using Vision concepts (L3)

UNIT – V (8 Hrs)

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains **Philosophical Foundations**: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Understand the Robotics architecture and its working in real world applications (L2)
- Apply robotics operations in different application domains (L5)
- List the main philosophical issues in AI. (L1)
- Analyse various variations in strong and weak AI (L4)

TEXTBOOKS:

1. "Artificial Intelligence A Modern Approach", Stuart J. Russell, Peter Norvig, Pearson Education, 3rd Edition, 2019.

REFERENCE BOOKS:

1. "Artificial intelligence: a new synthesis", Nilsson, Nils J., and Nils Johan Nilsson, Morgan Kaufmann, 1998.
2. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence", Johnson, Benny G., Fred Phillips, and Linda G. Chase, Journal of Accounting Education, 2009

Course Code	MOBILE APPLICATION DEVELOPMENT		L	T	P	C
21A050422	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify mobile application development software development tools. **(K3)**

CO2: Analyse various widgets in mobile applications**. (K3)**

CO3: Compare various layouts in mobile application design. **(K3)**

CO4: Utilize multimedia, camera and Location based services in Android App. **(K3)**

CO5: Build mobile application with dialogs and Fragments and Design and develop menus with database in mobile applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

Introduction to Android: The Android 4.1 jelly Bean SDK, Understanding the Android Software Stack, installing the Android SDK, Creating Android Virtual Devices, Creating the First Android Project, Using the Text view Control, Using the Android Emulator, The Android Debug Bridge(ADB), Launching Android Applications on a Handset.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Android architecture. (L3)
- Summarize the various features for Android (L2)

UNIT – II (9 Hrs)

Basic Widgets: Understanding the Role of Android Application Components, Overview of the Android Project Files, Understanding Activities, Role of the Android Manifest File, Creating the User Interface, Commonly Used Layouts and Controls, Event Handling, Displaying Messages

Through Toast, Creating and Starting an Activity, Using the Edit Text Control, Choosing Options with Checkbox, Choosing Mutually Exclusive Items Using Radio Buttons.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the basic Widgets (L4)
- Discover the Need for Event Handling in different Mobile Applications (L3)
- Choose the controls for the mobile Applications (L3)

UNIT – III (9 Hrs)

Building Blocks for Android Application Design: Introduction to Layouts, Linear Layout, Relative Layout, Absolute Layout, Using Image View, Frame Layout, Table Layout, Grid Layout, Adapting to Screen orientation.

Utilizing Resources and Media: Resources, Creating Values Resources, Using Drawable Resources, Switching States with Toggle Buttons, Creating an Images Switcher Application, Scrolling Through Scroll View, playing Audio, Playing Video, Displaying Progress with Progress Bar, Using Assets.

Learning Outcomes: At the end of this unit, students should be able to

- Choose the building blocks for Android Application Design (L3)
- Select the resources and media for the mobile Applications (L3)
- Illustrating the mobile design (L4)

UNIT – IV (9 Hrs)

Using Selection widgets and Debugging: Using List View, Using the Spinner control, Using the GridView Control, Creating an Image Gallery Using the ViewPager Control, Using the Debugging Tool: Dalvik Debug Monitor Service(DDMS), Debugging Application, Using the Debug Perspective.

Displaying And Fetching Information Using Dialogs and Fragments: What Are Dialogs?, Selecting the Date and Time in One Application, Fragments, Creating Fragments with java Code, Creating Special Fragments

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the debugging process (L3)
- Choose the selection widgets for mobile applications (L3)
- Illustrate Dialogs and Fragments (L4)

UNIT – V (9 Hrs)

Building Menus and Storing Data: Creating Interface Menus and Action Bars, Menus and Their Types, Creating Menus Through XML, Creating Menus Through Coding, Applying a Context Menu to a List View, Using the Action Bar, Replacing a Menu with the Action Bar, Creating a Tabbed Action Bar, Creating a Drop-Down List Action Bar

Using Databases: Using the SQLite Open Helper class, Accessing Databases with the ADB, Creating a Data Entry Form,

Communicating with SMS and Emails: Understanding Broadcast Receivers, Using the Notification System, Sending SMS Messages with Java Code, Receiving SMS Messages, Sending Email, Working With Telephony Manager.

***Learning Outcomes**:* At the end of this unit, students should be able to

- Create Menus and Storing Data (L6)
- Analyse Databases for mobile applications (L4)
- Analyse Communications with SMS and Emails (L4)

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

REFERENCE BOOKS:

1. "Android application Development for Java Programmers", James C Sheusi, Cengage Learning
2. "Android In Action", W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz., Dreamtech.
3. "Professional Android 4 applications development", Reto Meier, Wiley India, 2012.
4. "Beginning Android 4 applications development", Wei Meng Lee, Wiley India,2013
5. "Beginning Android Development: Create Your Own Android", PawPrints Learning Technologies, Apps Today, 2014.
6. "Android Programming: Pushing the Limits", Erik Hellman, John Wiley and sons ltd, 2014.
7. "Introduction to Android Application Development", Joseph Annuzzi, Jr, Lauren Darcey, Addison-Wesley, 4th Edition.

Course Code	CLOUD COMPUTING		L	T	P	C
21A050423	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Database Management Systems, Python Programming and Data science	Semester	VI			

COURSE OBJECTIVES:

- Define cloud services and models
- Demonstrate design the architecture for new cloud application.
- Explain how to re-architect the existing application for the cloud.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate Fundamentals of Cloud Computing **(K3)**
CO2: Analyze Cloud Services, Platforms and Map Reduce Framework **(K4)**
CO3: Examine the Cloud Application Design and Live Apps **(K3)**
CO4: Analyze Python usage for Cloud Platforms and Django Framework **(K4)**
CO5: Illustrate Cloud Application Development in Python **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	3	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Cloud Computing: Characteristics of Cloud Computing, Cloud Models, Cloud Services Examples, Cloud based services and Applications, Cloud Concepts and Technologies, Virtualization, Load Balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined networking, Network function virtualization, Map Reduce, Identity and Access Management, Service Level Agreements, Billing.

Learning Outcomes: At the end of this unit, students should be able to:

- Outline the Cloud characteristics and models (L2)
- Classify different models, different technologies in cloud (L2)

UNIT – II (9 Hrs)

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application Services, Content Delivery Services, Analytics Services, Deployment and Management Services, Identity and Access Management Services, Open Source Private Cloud Software, Apache Hadoop, Hadoop MapReduce Job Execution, Hadoop Schedulers, Hadoop Cluster Setup.

Learning Outcomes: At the end of this unit, students should be able to:

- Summarize the Services and Platform of cloud (L3)
- Demonstrate Hadoop Cluster Setup (L4)

UNIT – III (9 Hrs)

Cloud Application Design: Design Considerations, Reference Architectures, Cloud Application Design Methodologies, Data Storage Approaches,

Multimedia Cloud: Introduction, Case Study: Live Video Streaming App, Streaming Protocols, Case Study: Video Transcoding APP.

Learning Outcomes: At the end of this unit, students should be able to:

- Design and build cloud applications (L3)
- Describe the multimedia cloud. (L2)

UNIT – IV (9 Hrs)

Python for Amazon Web Services, Python for Google Cloud Platform, Python for Windows Azure, Python for MapReduce, Python Packages of Interest, Python Web Application Framework – Django, Designing a RESTful Web API.

Learning Outcomes: At the end of this unit, students should be able to:

- Select different cloud services from different vendors (L3)
- Utilize Python language to access cloud services (L4)

UNIT – V (8 Hrs)

Cloud Application Development in Python, Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App, Cloud Application Benchmarking and Tuning, Cloud Security, Cloud Computing for Education.

Learning Outcomes: At the end of this unit, students should be able to:

- Investigate different Cloud applications. (L4)
- Design cloud applications using Python. (L4)

TEXTBOOKS:

1. "Cloud Computing A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action", Chris Hay, Brian Prince, Manning Publications, 2010.
2. "Introducing Windows Azure", Henry Li, Apress, 1st Edition, 2009.
3. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform" Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. "Developing with Google App Engine", Eugene Ciurana, Apress, 2009.

5. "Using Google App Engine", Charles Severance, O'Reilly Media, 1st Edition, 2009.

Course Code	WIRELESS AND ADHOC NETWORKS		L	T	P	C
21A350402			3	1	0	3
Pre-requisite	Computer Networks	Semester	VI			

COURSE OBJECTIVES:

- To introduce the Concept of Algorithm and use it to solve computational problems
- To illustrate the basic concepts of C Programming language
- To demonstrate the use of Control structures of C Programming language
- To discuss the concepts of Arrays, Functions, Pointers and Structures
- To familiarize with Stack, Queue and Linked lists data structures

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solve computational problems, choose appropriate control structure depending on the problem to be solved. **(K)**

CO2: Design applications in C using Arrays and Strings. **(K)**

CO3: Modularize the problem and also solution. **(K)**

CO4: Design applications in C using Functions, Pointers, and Structures. **(K)**

CO5: Explore various operations on Stacks, Queues and Linked lists. **(K)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

ADHOC WIRELESS NETWORKS AND ITS APPLICATIONS: IEEE 802 Networking Standard. Fundamentals of WLANs, IEEE 802.11 standard. What is Wireless Internet? Mobile IP, Cellular and Ad-hoc Wireless Networks, Applications of Adhoc Networks, Issues in Ad Hoc Wireless Networks, Ad Hoc Wireless Internet.

Learning Outcomes: At the end of this unit, students should be able to

- Explain different wireless networks. (L2)
- Examine wireless LAN Standard IEEE 802.11.(L4)

UNIT – II (9 Hrs)

MAC PROTOCOLS IN ADHOC WIRELESS NETWORKS: Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks, Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, Classification of MAC Protocols, Contention Based Protocols, Contention-Based

Protocols with Reservation Mechanisms, Contention-Based MAC Protocols with Scheduling Mechanisms, MAC Protocols that used Directional Antennas, Other MAC Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the limitations of existing MAC protocols when applied to adhoc networks. (L3)
- Analyse the existing MAC Protocols for Adhoc networks. (L3)

UNIT – III (10 Hrs)

ROUTING PROTOCOLS IN ADHOC WIRELESS NETWORKS: Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table-Driven Routing Protocols, On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols, Power-Aware Routing Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Compare different routing protocols. (L2)
- Choose the routing protocol based on network characteristics. (L5)

UNIT – IV (9 Hrs)

TRANSPORT PROTOCOL IN ADHOC WIRELESS NETWORKS: Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions. TCP over Ad Hoc Wireless Networks, Other Transport Layer Protocols for Ad Hoc Wireless Networks

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the issues in designing a multicast Routing Algorithms (L2)
- Propose new Transport protocols for adhoc networks(L6)

UNIT – V (8 Hrs)

SECURITY AND WIRELESS SENSOR NETWORKS: Security in Ad Hoc Wireless Networks, Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management, Secure Routing in Ad Hoc Wireless Networks. Wireless Sensor Networks- Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other issues.

Learning Outcomes: At the end of this unit, students should be able to

- Define the sensor networks. (L1)

TEXTBOOKS:

1. "Ad hoc wireless networks: Architectures and protocols", Murthy, C. Siva Ram, and B. S. Manoj, Pearson Education India, 2004.

REFERENCE BOOKS:

1. "Ad Hoc & Sensor Networks: Theory and Applications", Carlos De Morais Cordeiro, Dharma Prakash Agrawal, World Scientific Publishing Company, 2006
2. "Wireless Sensor Networks", Feng Zhao and Leonides Guibas, Elsevier Publication, 2002.
3. "Protocols and Architectures for Wireless Sensor Networks", Holger Karl and Andreas Willig, Wiley, 2005

ONLINE LEARNING RESOURCES:

1. https://en.wikipedia.org/wiki/Wireless_ad_hoc_network
2. https://study.com/academy/lesson/what-is-an-ad-hoc-wireless-network-explanation-examples.html

Course Code	REAL TIME SYSTEMS (Common to CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A310413			3	0	0	3
Pre-requisite	Operating Systems	Semester	VII			

COURSE OBJECTIVES:

- To develop an understanding of various Real Time systems Application
- To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of real-time systems
- To get in-depth hands-on experience in designing and developing a real operational system

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand concepts of Real-Time systems and modeling. **(K2)**

CO2: Recognize the characteristics of a real-time system. **(K4)**

CO3: Understand and develop document on an architectural design of a real-time system **(K3)**

CO4: Develop and document Task scheduling, resource management, real-time operating systems and fault tolerant applications of Real-Time Systems. **(K4)**

CO5: Understand features of RTOS and using different data bases related to RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the dead line, Timing constraint (L3)
- Differentiation between Hard vs Soft Real Time Systems (L3)
- Understand the temporal parameters (L4)
- Implement Periodic Task Model (L2)

UNIT – II (8 Hrs)

Real Time Scheduling: Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Apply different types of Approaches for Real time Scheduling (L3)
- Understand the different algorithms for Real time Scheduling (L3)
- Differentiate between Offline Versus Online Scheduling (L3)

UNIT – III (9 Hrs)

Resources Sharing: Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic terminology of Resource Sharing (L2)
- Apply different protocols for accessing the resources (L3)
- Control the Concurrent Accesses to Data Objects (L5)

UNIT – IV (8 Hrs)

Real Time Communication: Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority-Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Soft and Hard RT Communication systems (L6)
- Design Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols. (L6)
- Use Internet and Resource Reservation Protocols (L3)

UNIT – V (9 Hrs)

Real Time Operating Systems and Databases: Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.

Learning Outcomes*:* At the end of this unit, students should be able to

- Use UNIX as RTOS(L2)
- Understand the Characteristic of Temporal data(L6)
- Apply the different data bases in Real Time Systems. (L6)

TEXTBOOKS:

1. "Real Time Systems", Jane W. S. Liu, Pearson Education Publication

REFERENCE BOOKS:

1. "Real Time Systems", Mall Rajib, Pearson Education
2. "Real-Time Systems: Scheduling, Analysis, and Verification", Albert M. K. Cheng, Wiley.

Course Code	EMBEDDED SYSTEMS FOR IOT		L	T	P	C
21A350403			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of IoT and embedded system including essence, basic design strategy and process modeling.
- To introduce students a set of advanced topics in embedded IoT and lead them to understand research in network.
- To develop comprehensive approach towards building small low cost embedded IoT system.
- To understand fundamentals of security in IoT
- To learn to implement secure infrastructure for IoT
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement an architectural design for IoT for specified requirement **(K2)**

CO2: Solve the given societal challenge using IoT **(K4)**

CO3: Understand and Choose between available technologies and devices for stated IoT challenge **(K3)**

CO4: Develop and document different application modules in IoT. **(K4)**

CO5: Understand features of IoT and using different datasets related to RTOS **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

INTRODUCTION TO EMBEDDED AND IOT SYSTEMS: Introduction Embedded and IoT systems, Definition, Examples and components of embedded and IoT Systems, Embedded and IoT Systems Design Process, Various Embedded and IoT cores controllers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Components of ES & IoT(L3)
- Differentiate between ES vs IoT (L3)
- Understand the ES Applications (L4)
- Implement Model in IoT (L2)

UNIT – II (8 Hrs)

HARDWARE/SOFTWARE CO-DESIGN FOR EMBEDDED AND IOT SYSTEMS: Microcontrollers for embedded systems, Arduino embedded platform, Peripheral interfacing and programming with Arduino platform, Sensors and Actuator interfacing, Cloud support with Arduino platform.

Learning Outcomes: At the end of this unit, students should be able to

- Knowledge about different microcontrollers (L3)
- Understand the different Interfacing Techniques (L3)
- Differentiate between Arduino and Cloud support (L3)

UNIT – III (9 Hrs)

PROTOCOLS FOR EMBEDDED AND IOT SYSTEMS: Serial protocols, UART, I2C, and SPI. NFC, Wireless protocols like, RFID, Zig-bee, IEEE 802.15.4e, Thread, 6LoWPAN, Constrained Application Protocol (CoAP), Extensible Messaging Protocol (XMPP), WebSocket, Advanced Message Queueing Protocol (AMQP), Message Queue Telemetry Transport (MQTT), Web Real Time Communications (WebRTC), LoRa, SIGFOX, Z Wave.

Learning Outcomes: At the end of this unit, students should be able to

- Various protocols in Embedded and IoT systems (L2)
- Study of different protocols (L3)
- Application Data on various protocol sets (L5)

UNIT – IV (8 Hrs)

OS BASED SOFTWARE DEVELOPMENT: Programming in higher level languages on embedded OS platform, Python and C programming, Various aspects of the OS designed for the IoT environment, open-source OS for IoT such as Contiki OS, TinyOS etc.

Learning Outcomes: At the end of this unit, students should be able to

- Programming in Embedded systems (L6)
- Design aspects of OS in IoT environment. (L6)
- Use of different open-source OS (L3)

UNIT – V (9 Hrs)

IOT BASED EMBEDDED SYSTEMS: Basic architecture of an IoT based Embedded Systems., Embedded Hardware for IoT applications, like Raspberry Pi, Arduino, and Raspberry Pi based development board, IoT Cloud Platform and IoT client applications on mobile phones.

Learning Outcomes: At the end of this unit, students should be able to

- Basic architecture of IoT based ES (L2)
- Understand the IoT applications (L6)
- Apply the different data bases in IoT and Cloud platform. (L6)

TEXTBOOKS:

1. "Embedded Programming Using C Language", Muhammad Ali Mazidi Shujen Chen, Sepehr Naimi Sarmad Naimi, 1st Edition, Freescale ARM Cortex-M

REFERENCE BOOKS:

1. "Embedded System: Architecture, Programming and Design", Rajkamal, TMH3
2. "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", Dr. OvidiuVermesan, Dr. Peter Friess, River Publisher

Course Code	MOBILE APPLICATION DEVELOPMENT LAB (Common to CSE, CSE-AI, AIML, CSE-IOT)		L	T	P	C
21A050427			0	0	3	1.5
Pre-requisite	Object Oriented Programming through Java	Semester	VI			

COURSE OBJECTIVES:

- To understand fundamentals of android operating systems.
- To illustrate the various components, layouts and views in creating android applications.
- To understand fundamentals of android programming.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Build a native application using GUI components and Mobile application Development **(K3)**

CO2: To demonstrate their skills of using Android software development tools and construct an application using multimedia **(K3)**

CO3: Explore the android studio IDE, Build mobile application with dialogs and Fragments and design, develop menus with database in mobile applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	-	1	2	2	1	1	-	2	3	3
CO2	3	2	2	-	-	1	2	2	1	1	-	2	3	3
CO3	3	2	2	-	-	1	2	2	1	1	-	2	2	3

LIST OF EXPERIMENTS:

1. Setting Up the Development Environment Download & Install the SDK and the SDK Platform Components
2. Create "Hello World" Application Create a new Android Project Run "Hello World" on the Emulator and On a Physical Device Greeting the User.
2. Create Application by Using Widgets Creating the Application by using the Activity class
   (i) onCreate() (ii) onStart() (iii) onResume() (iv) onPause() (v) onStop() (vi) onDestroy() (vii) onRestart()
3. Creating the Application by using Text Edit control.
4. Creating the Application Choosing Options
   (i) CheckBox (ii) RadioButton (iii) RadioGroup (iv) Spinner
5. Create Application by Using Building Blocks for Android Application Design. Design the Application by using
   (i) Linear Layout (ii) Relative Layout (iii) Absolute Layout
6. Create the Application to play the Audio and Video clips.

7. Create Application by Using Building Menus and Storing Data.
8. Design the Application for Menus and Action Bar.
9. Design the application to display the Drop-Down List Action Bar.

TEXTBOOKS:

1. "Android Programming", B.M Harwani, Pearson Education, 2013

Course Code	ARTIFICIAL INTELLIGENCE LAB		L	T	P	C
21A050428	(Common to CSE, CSE-IOT)		0	0	3	1.5
Pre-requisite	Advanced Data Structures through C++	Semester	VI			

COURSE OBJECTIVES:

- To explore the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms
- To demonstrate building of intelligent agents

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Implement search algorithms **(K3)**
CO2: Solve Artificial intelligence problems **(K3)**
CO3: Design chatbot and virtual assistant **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	1	1	-	2	3	2	3	3	2
CO2	3	3	3	2	1	1	-	-	2	-	3	3	3	3
CO3	2	3	3	2	1	-	-	-	2	-	2	2	2	3

LIST OF EXPERIMENTS:

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for travelling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for wampus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot which provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string:

```
# Count the number of times string s1 is found in string s2
def countsubstring(s1,s2):
count = 0
for i in range(0,len(s2)-len(s1)+1):
```

```
if s1 == s2[i:i+len(s1)]:
count += 1
return count
```

For instance, countsubstring('ab','cabalaba') returns 2.
Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).

13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count(lambda x: x>2, [1,2,3,4,5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher-order function.
14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 ..... 5 and a random value in the range 1 ..... 10.

    Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of the problem slightly more or less demanding.

    How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer? Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.
15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitly large).

    Write a function layout(N,C,L) that can give a table placement (ie. a number from 0 : : :C -1) for each guest such that there will be no social mishaps.

    For simplicity we assume that you have a unique number 0 .....N-1 for each guest and that the list of restrictions is of the form [(X,Y), ...] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

ONLINE LEARNING RESOURCES:

1. Tensorflow: https://www.tensorflow.org/
2. Pytorch: https://pytorch.org/, https://github.com/pytorch
3. Keras: https://keras.io/, https://github.com/keras-team
4. Theano: http://deeplearning.net/software/theano/, https://github.com/Theano/Theano
5. Cafee2: https://caffe2.ai/, https://github.com/caffe2
6. Deeplearning4j: https://deeplearning4j.org/
7. Scikit-learn: https://scikit-learn.org/stable/, https://github.com/scikit-learn/scikit-learn
8. Deep Learning AI: https://www.deeplearning.ai/
9. OpenCv: https://opencv.org/, https://github.com/qqwweee/keras-yolo3
10. YOLO: https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/
11. nVIDIA CUDA: https://developer.nvidia.com/cuda-math-library
12. "Computational Intelligence : a logical approach", David Poole, Alan Mackworth, Randy Goebel, Oxford University Press, 2004.
13. "Artificial Intelligence: Structures and Strategies for complex problem solving", G. Luger, Pearson Education, 4th Edition, 2002.
14. "Artificial Intelligence: A new Synthesis", J. Nilsson, Elsevier Publishers, 1998.
15. "Artificial Neural Networks", B. Yagna Narayana, PHI
16. "Artificial Intelligence", E. Rich and K. Knight, TMH, 2nd Edition.
17. "Artificial Intelligence and Expert Systems", Patterson, PHI

Course Code	CLOUD COMPUTING LAB		L	T	P	C
21A050429	(Common to CSE, CSE-AI, AIML, CSE-IOT)		0	0	3	1.5
Pre-requisite	Database Management Systems, Python Programming and Data science	Semester	VI			

COURSE OBJECTIVES:

- To be familiar with developing web services/Applications.
- To learn to run SaaS Services
- To learn to run PaaS Services and virtual machines of different configuration

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Design and Implement Web applications in Django Framework **(K4)**

CO2: Design and Run SaaS baes Application in Google Cloud **(K3)**

CO3: Program with PaaS Services on Microsoft Azure Cloud **(K3)**

CO-PO MAPPING:

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

LIST OF EXPERIMENTS:

I. Web Development using DJANGO Framework

a. Django Framework Packages Installation and Setting Environment to Run the Server
b. Python Program to develop Hello World Application in Django Framework
c. Python Program to develop Hello World Application in Django Framework with Templates
d. Python Program to develop Login Screen with Validation in Django Framework
e. Python Program to generate Prime Numbers up to a given number in Django Framework
f. Python Program to develop Login Screen with Validation in Django Framework using Data Bases

II. Programs on SaaS

a. Create a word document of your class time table and store locally and on the cloud with doc, and pdf format. (Use www.zoho.com and docs.google.com***)***
b. Create a spread sheet which contains employee salary information and calculate gross and total sal using the formula
   DA=10% OF BASIC
   HRA=30% OF BASIC
   PF=10% OF BASIC IF BASIC<=3000

12% OF BASIC IF BASIC>3000
TAX=10% OF BASIC IF BASIC<=1500
=11% OF BASIC IF BASIC>1500 AND BASIC<=2500
=12% OF BASIC IF BASIC>2500
(Use www.zoho.com and docs.google.com)
NET_SALARY=BASIC_SALARY+DA+HRA-PF-TAX

c. Prepare a ppt on cloud computing –introduction, models, services and architecture. Ppt should contain explanations, images and at least 20 pages (Use www.zoho.com and docs.google.com)
d. Create your resume in a neat format using google and zoho cloud

III. Programs on PaaS

a. Develop Web Application to generate n even numbers and deploy it to Azure cloud
b. Develop Web Application to multiply two matrices deploy it to Azure cloud
c. Develop Web Application in php to validate login (username, password) and deploy to Azure cloud
d. Develop Web Application to display nth largest no from the given list of numbers and deploy it into Azure cloud
e. Develop Web Application in php to validate Login Screen using mysql data base and deploy it into Azure cloud

TEXTBOOKS:

1. "Cloud Computing A Hands-on Approach", Arshadeep Bhaga, Vijay Madisetti, Universities Press, 2018.

REFERENCE BOOKS:

1. "Azure in Action". Chris Hay, Brian Prince, Manning, 2010.
2. "Introducing Windows Azure", Henry Li, Apress, 1st Edition, 2009.
3. "Developing Applications for the Cloud on the Microsoft Windows Azure Platform", Matias Woloski, Microsoft Press, 1st Edition, 2010.
4. "Developing with Google App Engine", Eugene Ciurana, Apress, 1st Edition, 2009.
5. "Using Google App Engine", Charles Severance, O'Reilly Media; 1st Edition, 2009.

Course Code	ARDUINO PROGRAMMING		L	T	P	C
21A350702			1	0	2	2
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things and its building blocks along with their characteristics
- To understand the recent application domains of IoT in day-to-day life
- To understand the protocols and standards designed for IoT

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the programming of basic Arduino examples. **(K2)**
CO2: Develop prototype circuits and connect them to the Arduino. **(K6)**
CO3: Practice the Arduino microcontroller to make the circuits work. **(K3)**
CO4: Execute the given example code and online resources for extending knowledge about the capabilities of the Arduino. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	-	-	-	-	-	-	-	-	-
CO2	3	3	2	3	1	-	-	-	-	-	-	-	-	-
CO3	3	3	-	3	1	-	-	-	-	-	-	-	-	-
CO4	3	3	-	3	1	-	-	-	-	-	-	-	-	2

LIST OF EXPERIMENTS:

Module-1: Arduino

- Introduction to Arduino
- Pin configuration and architecture.
- Device and platform features.
- Concept of digital and analog ports.
- Familiarizing with Arduino Interfacing Board
- Introduction to Embedded C and Arduino platform

Module-2: Arduino Displays

- Working with Serial Monitor
- Line graph via serial monitor
- Interfacing a 8 bit LCD to Arduino
- Fixed one-line static message display.
- Running message display.
- Using the LCD Library of Arduino**.**

Module-3: Arduino Sensors

- Arduino – Humidity Sensor
- Arduino – Temperature Sensor
- Arduino – Water Detector / Sensor
- Arduino – PIR Sensor
- Arduino – Ultrasonic Sensor
- Arduino – Connecting Switch (Magnetic relay switches)

Case Study-1: Arduino Ping Pong Game

Design ping pong game using an Arduino Uno and Colour OLED display. The main objective of this game is to gain the highest score. This game is an interesting addictive fun game. This is a human vs human two-player game, and the players have to play from both sides with the help of up and down keys. The game ends whenever the player fails to touch the ball and it touches the other part of the screen. Also, the player must play the game turn-wise and use some strategy to win the game.

Source Link: https://www.youtube.com/watch?v=ZRL0GUqebFs

Case Study-2: Control Light & Fan with Clap using Arduino

Design a IoT application which controls the home appliances like Fan, TV, light and etc using sound effect. This project is very useful for elderly and differently abled persons to control their room with depending one other.

Source link: https://www.youtube.com/watch?v=hzUFnP3Xt7c

Case Study-3: Rain Alert System using Arduino

Design a system to alert the people when is raining. This system is very useful for vehicles to switch on the vipers as well as many places where the device working based on rain.

Source link: https://www.youtube.com/watch?v=YlIH1ti4Vy0

Case Study-4: Theft Alert System using Arduino

Design a system to alert the people using IR sensor when the motion is detected. This system is useful for high security areas. This system

Source link: https://www.youtube.com/watch?v=zOmsl-dTq8M

Case Study-5: Water Level Meter using Water Level Sensor

Design a sensor which can sense the water levelin tanks where the motor pumps are used. There is no specific method to checkthe level of the water.

Source Link: https://www.youtube.com/watch?v=n7WRi5U5lQk

REFERENCE BOOKS:

1. https://www.tutorialspoint.com/internet_of_things/index.htm
2. https://www.javatpoint.com/iot-internet-of-things
3. https://www.guru99.com/iot-tutorial.html

Course Code	RESEARCH METHODOLOGY (Common to all branches)		L	T	P	C
21A000004			2	0	0	0
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the basic concepts of research and research problem
- To make the students learn about various types of data collection and sampling design
- To enable them to know the method of statistical evaluation
- To make the students understand various testing tools in research
- To make the student learn how to write a research report
- To create awareness on ethical issues n research

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know how to define a Research problem, select suitable design and experimental approach. **(K1)**
CO2: Formulate sampling design and various techniques implemented on data collection. **(K6)**
CO3: Correlate any two variables and find the solution using regression analysis. **(K4)**
CO4: Examine hypothesis testing procedure, Analyze the significance of variance and covariance. **(K4)**
CO5: Write a report on research work for seminars, conferences formats. **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	3	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	3	-	-	-	-	-	-	-	-	-
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	-
CO5	2	3	2	2	2	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Meaning of Research – Objectives of Research – Types of Research – Research Approaches – Guidelines for Selecting and Defining a Research Problem – Research Design – Concepts related to Research Design – Basic Principles of Experimental Design.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of research and its process. (L2)
- Explain various types of research. (L2)
- Explain the steps involved in research design. (L2)
- Understand the different research approaches. (L2)

UNIT – II (9 Hrs)

Sampling Design – steps in Sampling Design –Characteristics of a Good Sample Design – Random Sampling Design. Measurement and Scaling Techniques-Errors in Measurement – Tests of Sound Measurement – Scaling and Scale Construction Techniques – Time Series Analysis – Interpolation and Extrapolation. Data Collection Methods – Primary Data – Secondary data – Questionnaire Survey and Interviews.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of sampling and sampling design. (L2)
- Explain various techniques in measurement and scaling. (L2)
- Understand various methods of data collection. (L2)
- Design survey questionnaires for different kinds of research. (L3)
- Analyze the questionnaires. (L4)

UNIT – III (9 Hrs)

Correlation and Regression Analysis – Method of Least Squares – Regression vs Correlation – Correlation vs Determination – Types of Correlations and Their Applications

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of correlation and regression. (L2)
- Compare and contrast correlation and regression. (L3)
- Explain various types of correlation. (L3)
- Apply the knowledge of C&R Analysis to get the results. (L3)

UNIT – IV (9 Hrs)

Statistical Inference: Tests of Hypothesis – Parametric vs Non-parametric Tests – Hypothesis Testing Procedure – Sampling Theory – Sampling Distribution – Chi-square Test – Analysis of variance and Co-variance – Multivariate Analysis

Learning Outcomes: At the end of this unit, students should be able to

- Understand the hypothesis testing procedure. (L2)
- Compare and contrast Parametric and Non-parametric Tests. (L3)
- Understand the use of chi-square test in investigating the distribution of categorical variables. (L2)
- Analyze the significance of variance and covariance. (L4)

UNIT – V (9 Hrs)

Report Writing and Professional Ethics: Interpretation of Data – Report Writing – Layout of a Research Paper – Techniques of Interpretation- Making Scientific Presentations in Conferences and Seminars – Professional Ethics in Research.

Learning Outcomes: At the end of this unit, students should be able to

- Understand how to write a report and research paper. (L2)
- Explain various techniques of interpretation. (L2)
- Understand the importance of professional ethics in research. (L2)
- Design a scientific paper to present in the conferences/seminars. (L3)

TEXTBOOKS:

1. "Research Methodology: Methods and Techniques", C.R.Kothari, New Age International Publishers, 2nd Edition,.
2. "Research Methodology: A Step-by-Step Guide for Beginners", Ranjit Kumar, Sage Publications

REFERENCE BOOKS:

1. "Research Methodology and Statistical Tools", P. Narayana Reddy and G. V. R. K. Acharyulu, Excel Books, New Delhi, 1st Edition.
2. "Business Research Methods", Donald R. Cooper & Pamela S Schindler, 9th Edition.
3. "Fundamentals of Statistics", S C Gupta, Himalaya Publications, 7th Edition

Course Code	MACHINE LEARNING		L	T	P	C
21A050430	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Artificial Intelligence	Semester	VII			

COURSE OBJECTIVES:

- To understand basic concepts of Machine Learning
- To study different learning algorithms
- To illustrate evaluation of learning algorithms
- To gain knowledge on various machine learning algorithms and apply the same on real time data extracted from confined sources.
- To familiarize the students with Python programming packages pertaining to Machine Learning.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and paradigms of machine learning. **(K2)**
CO2: Identify machine learning techniques suitable for a given problem **(K2)**
CO3: Apply the classification models on discrete data and analyze the efficiency. **(K3)**
CO4: Apply the regression models on continuous data and analyze the efficiency. **(K3)**
CO5: Apply clustering algorithms over the data with appropriate pre-processing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	3	3	-	-	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Introduction to Machine Learning &Preparing to Model: Introduction, What is Human Learning? Types of Human Learning, what is Machine Learning? Types of Machine Learning, Problems Not to Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools in Machine Learning, Issues in Machine Learning.

Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic idea of Machine Learning (L3)
- Prepare a model based on the real time requirement(L4)
- Describe the data pre-processing techniques (L2)

UNIT – II (9 Hrs)

Modelling and Evaluation &Basics of Feature Engineering: Introduction, selecting a Model,

training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model.

Basics of Feature Engineering: Introduction, Feature Transformation, Feature Subset Selection

Learning Outcomes: At the end of this unit, students should be able to

- Select a best model for solving the real time problem (L2)
- Evaluate the performance of a model (L6)

UNIT – III (9 Hrs)

Bayesian Concept Learning: Classification - Introduction, Why Bayesian Methods are Important? Bayes' Theorem, Bayes' Theorem and Concept Learning, Bayesian Belief Network.

Supervised Learning: Classification - Introduction**,** Example of Supervised Learning**,** Classification Model**,** Classification Learning Steps**,** Common Classification Algorithms-*k*-Nearest Neighbour (*k*NN), Decision tree, Random forest model, Support vector machines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic terminology of supervised learning (L3)
- Apply classification model for solving the problem (L3)
- Apply Bayesian belief network for solving the real time application (L3)

UNIT – IV (9 Hrs)

Supervised Learning: Regression - Introduction, Example of Regression, Common Regression Algorithms-Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the difference between simple, multiple and polynomial regression (L3)
- Facilitate efficient utilization polynomial regression (L6)
- Apply regression algorithms for solving the real time application(L3)

UNIT – V (9 Hrs)

Unsupervised Learning: Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering – Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods,

K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods- DBSCAN Finding Pattern using Association Rule- Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules

Learning Outcomes*:* At the end of this unit, students should be able to

- Describe the different types of clustering techniques (L2)
- Find the pattern using association rule (L3)

- Apply clustering algorithms for solving the real time application (L3)

TEXTBOOKS:

1. "Machine Learning", SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, Pearson, 2019.
2. "Machine Learning", Tom Mitchell, McGraw Hill, 1997.

REFERENCE BOOKS:

1. "Introduction to Machine Learning", Ethern Alpaydin, MIT Press, 2004.
2. "Machine Learning -An Algorithmic Perspective", Stephen Marsland, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2nd Edition,2014.
3. "Introduction to Machine Learning with Python: A Guide for Data Scientists", Andreas C. Müller and Sarah Guido, Oreilly.

ONLINE LEARNING RESOURCES:

1. https://www.deeplearning.ai/machine-learning-yearning/
2. https://www.cse.huji.ac.il/~shais/UnderstandingMachineLearning/index.html

Course Code	BIG DATA ANALYTICS USING HADOOP		L	T	P	C
21A050431	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To familiarize with the installation of Hadoop and how to analyze the Big Data
- To understand the design concepts of HDFS
- To provide good insight for developing a MapReduce applications
- To understand Hadoop environment.
- To explore the concepts of Pig, Hive, Spark and HBase

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the basic concepts and importance of Big Data **(K2)**
CO2: Develop applications by installing and working with VMWare and Hadoop environment **(K4)**
CO3: Design MapReduce application with various input and output formats **(K4)**
CO4: Demonstrate cluster and Hive environment **(K3)**
CO5: Implement Pig, Spark and HBase applications **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	-	-	-	-	-	2	-
CO2	2	3	2	2	1	-	-	-	-	-	-	-	2	-
CO3	2	3	3	2	2	-	-	-	-	-	-	-	1	2
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	3	3	2	2	1	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction to Big Data: What is Big Data? Why Big Data is Important? Meet Hadoop, Data, Data Storage and Analysis, Comparison with other systems, History of Apache Hadoop, Hadoop Ecosystem, VMWare Installation of Hadoop. Analyzing the Data with Hadoop, Scaling Out.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the characteristics of datasets. (L3)
- Compare trivial data and big data for various applications. (L4)
- Choose and implement various ways of selecting suitable model parameters. (L1)

UNIT – II (9 Hrs)

HDFS: The Design of HDFS, HDFS Concepts, The Command-Line Interface, Hadoop File systems, The Java Interface, Data flow.

MapReduce: Developing a MapReduce application, The Configuration API, setting up the Development Environment, Running Locally on Test Data, Running on a Cluster

Learning Outcomes: At the end of this unit, students should be able to

- Understand and apply scaling up Hadoop techniques and associated technologies (L2)
- Estimate suitable test data. (L5)
- Apply the MapReduce application on a cluster. (L3)

UNIT – III (9 Hrs)

How MapReduce Works: Anatomy of a MapReduce, Job Run, Failures, Shuffle and Sort, Task Execution.

MapReduce Types and Formats: MapReduce Types, Input formats, output formats.

Learning Outcomes: At the end of this unit, students should be able to

- Explore the Anatomy of MapReduce. (L5)
- Illustrate various input and output formats of MapReduce. (L2)
- List various MapReduce types. (L1)

UNIT – IV (9 Hrs)

Hadoop Environment: Setting up a Hadoop Cluster, Cluster specification, Cluster Setup and Installation, Hadoop Configuration, Security.

Pig: Installing and Running Pig, an Example, Comparison with Databases, Pig Latin, User Defined Functions, Data Processing Operators.

Learning Outcomes: At the end of this unit, Student should be able to

- Show the cluster setup and installation. (L2)
- Demonstrate the Configure the Hadoop. (L2)
- Compare Hadoop with various Databases. (L5)

UNIT – V (8 Hrs)

Hive: Installing Hive, Running Hive, Comparison with traditional Databases, HiveQL, Tables, Querying Data.

Spark: Installing Spark, Resilient Distributed Datasets, Shared Variables, Anatomy of a Spark Job Run.

HBase: HBasics, Installation, clients, Building an Online Query Application.

Learning Outcomes: At the end of this unit, students should be able to

- Explain various frameworks of Big Data. (L2)
- Compare Hive with traditional Databases. (L4)
- Learn how to build an online query application. (L1)

TEXTBOOKS:

1. "Hadoop: The Definitive Guide", Tom White, 4th Edition, O'reilly Media, 2015

2. "Big Data, Big Analytics: Emerging business intelligence and analytic trends for today's businesses", Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj, Wiley Cio Series

REFERENCE BOOKS:

1. "Making Sense of Data", Glenn J. Myatt, John Wiley & Sons, 2007
2. "Big Data Glossary", Pete Warden, O'Reilly, 2011.
3. "Intelligent Data Analysis", Michael Berthold, David J.Hand, Spingers, 2007.
4. "Understanding Big Data : Analytics for Enterprise Class Hadoop and Streaming Data", Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, McGraw Hill Publishing, 2012.
5. "Mining of Massive Datasets", Anand Rajaraman and Jeffrey David UIIman, Cambridge University Press, 2012.

Course Code	DEEP LEARNING		L	T	P	C
21A050432	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Artificial Intelligence	Semester	VII			

COURSE OBJECTIVES:

- To demonstrate the major technology trends driving Deep Learning
- To build, train, and apply fully connected deep neural networks
- To implement efficient (vectorized) neural networks
- To analyse the key parameters and hyper parameters in a neural network's architecture

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Demonstrate the mathematical foundation of neural network. **(K2)**
CO2: Describe the machine learning basics **(K4)**
CO3: Differentiate architecture of deep neural network **(K3)**
CO4: Build a Convolution Neural Network **(K4)**
CO5: Build and train RNN and LSTMs **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	1	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	2
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	2

UNIT – I (9 Hrs)

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms,Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' ule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the tensors, SVD (L3)
- Differentiation between SVD and PCA (L3)
- Understand the different types of pdfs (L4)
- Implementation of Optimization(L2)

UNIT – II (9 Hrs)

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators,

Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the validation sets, maximum likely hood (L3)
- Differentiation between Supervised and Unsupervised Learning (L3)
- Implementation of MLP and Solution to XOR problem (L2)

UNIT – III (9 Hrs)

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Constrained Optimization (L3)
- Optimization for Training deep models (L4)
- Implement of Meta Algorithms(L2)

UNIT – IV (9 Hrs)

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the CNN algorithm and its applications in Image Processing (L3)
- Defining the structured outputs (L2)
- Implementation of CNN(L2)

UNIT – V (8 Hrs)

Sequence Modelling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the RNN structures (L3)
- Differentiation between LSTM, Gated RNN (L3)
- Implement Deep Generative Models(L2)

TEXTBOOKS:

1. "Deep Learning", Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
2. "Deep learning: A practitioner's approach", Josh Patterson and Adam Gibson, O'Reilly Media, First Edition, 2017.

REFERENCE BOOKS:

1. "Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms", Nikhil Buduma, O'Reilly, Shroff Publishers, 2019.
2. "Deep learning Cook Book, Practical recipes to get started Quickly", Douwe Osinga, O'Reilly, Shroff Publishers, 2019.

ONLINE LEARNING RESOURCES:

1. https://keras.io/datasets/
2. http://deeplearning.net/tutorial/deeplearning.pdf
3. https://arxiv.org/pdf/1404.7828v4.pdf
4. https://www.cse.iitm.ac.in/~miteshk/CS7015.html
5. https://www.deeplearningbook.org
6. https://nptel.ac.in/courses/106105215

Course Code	COMPUTER VISION WITH OPENCV		L	T	P	C
21A350404			3	0	0	3
Pre-requisite	Python Programming & Data Science	Semester	VII			

COURSE OBJECTIVES:

- To understand the basic issues in computer vision and major approaches
- To address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic concepts, terminology, theories, models and methods in the field of computer vision **(K2)**

CO2: Describe known principles of human visual system **(K2)**

CO3: Describe basic methods of computer vision related to multi-scale representation, edgedetection and detection of other primitives, stereo, motion and object recognition **(K2)**

CO4: Design a computer vision system for a specific problem **(K6)**

CO5: Design a computer vision system **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	1	3	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	-	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	-	-

UNIT – I (8 Hrs)

LINEAR FILTERS: Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT – II (9 Hrs)

EDGE DETECTION: Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners

UNIT – III (9 Hrs)

TEXTURE: Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes

UNIT – IV (8 Hrs)

SEGMENTATION BY CLUSTERING: What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph-Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT – V (8 Hrs)

RECOGNITION BY RELATIONS BETWEEN TEMPLATES: Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

TEXTBOOKS:

1. "Computer Vision – A modern Approach", David A. Forsyth, Jean Ponce, PHI, 2003.

REFERENCE BOOKS:

1. "Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics", Sommer, Springer, 1st Edition, 2001.
2. "Digital Image Processing and Computer Vision", Sonka, 1st Edition.
3. "Computer Vision and Applications: Concise Edition", Jack Academy Press, 2000.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/106105216https://nptel.ac.in/courses/108103174

Course Code	DESIGN PATTERNS		L	T	P	C
21A050435	(Common to CSE, CSE-AI, AIML, CSE-IOT)		3	0	0	3
Pre-requisite	Object Oriented Programming through Java	Semester	VII			

COURSE OBJECTIVES:

- To understand design patterns and their underlying objects oriented concepts.
- To learn the day-to-day problems faced by object-oriented designers and how design patterns solve them
- To provide an interface for creating families of related objects without specifying their concrete classes.
- To know the consequences of combining patterns on the overall quality of a system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Solving various Problems Using Design Patterns. **(K3)**
CO2: Applying various patterns to problems in designing lexi. **(K3)**
CO3: Comparing various structural patterns. **(K4)**
CO4: Applying Behavioral Patterns to various design issues. **(K3)**
CO5: Analysing and comparing various Patterns. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	2
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	-
CO4	3	3	3	2	1	-	-	-	-	-	-	-	3	-
CO5	1	2	3	1	-	-	-	-	-	-	-	-	3	-

UNIT – I (9 Hrs)

Introduction to Design Patterns: Design Pattern Definition, Design Patterns in Small Talk MVC, Describing Design Patterns, Catalog of Design Patterns, Organizing the Catalog, Solving of Design Problems using Design Patterns, Selection of a Design Pattern, Use of Design Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Develop design patterns in Small Talk MVC (L6).
- How to select and use a Design Pattern (L1).
- Solve problems using design patterns (L3).

UNIT – II (9 Hrs)

Designing A Document Editor: Design problems, Document structure, Formatting, Embellishing the User Interface, Supporting Multiple Look and Feel standards, Supporting

Multiple Window Systems, User Operations, Spelling Checking and Hyphenation. Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Apply eight different patterns to Document editor's design. (L3).
- Specify the kinds of objects to create new objects using prototype(L4).

UNIT - III (9 Hrs)

Structural Patterns: Structural Patterns-1: Adapter, Bridge, Composite. Structural Patterns-2: Decorator, Facade, Flyweight, Proxy, Discuss of Structural Patterns.

Learning Outcomes: At the end of this unit, students should be able to

- Understand structural patterns (L2).
- Explain adapter, bridge and composite structural patterns (L2).
- Create decorator, facade, flyweight and proxy structural patterns (L6)

UNIT – IV (9 Hrs)

Behavioural Patterns: Behavioural Patterns-1: Chain of Responsibility, Command, Interpreter, Iterator. Behavioural Patterns-2: Mediator, Memento, Observer.

Learning Outcomes: At the end of this unit, students should be able to

- Define behavioural patterns (L1).
- Demonstrate object scope behavioural patterns (L2).
- Justify description for different types of behavioural patterns (L5).

UNIT – V (8 Hrs)

Behavioural Patterns and History: Behavioural Patterns-2(cont'd): State, Strategy, Template Method, Visitor, and Discussion of Behavioural Patterns. What to Expect from Design Patterns, a Brief History. The Pattern Community, An Invitation, A Parting Thought

Learning Outcomes: At the end of this unit, students should be able to

- Identify behavioural patterns (L6).
- Justify different types of behavioural patterns (L5).
- Determine community for patterns (L4).

TEXTBOOKS:

1. "Design Patterns", Erich Gamma, Pearson Education.

REFERENCE BOOKS:

1. "Patterns in JAVA", Vol-I , Mark Grand, Wiley DreamTech.
2. "Patterns in JAVA", Vol-II, Mark Grand, Wiley DreamTech.
3. "JAVA Enterprise Design Patterns", Vol-III, Mark Grand, Wiley DreamTech.

4. "Pattern Oriented Software Architecture", Buschmann & others, John Wiley & Sons.

ONLINE LEARNING RESOURCES:

1. https://refactoring.guru/design-patterns
2. https://www.geeksforgeeks.org/software-design-patterns/
3. https://en.wikipedia.org/wiki/Software_design_pattern

Course Code	NATURAL LANGUAGE PROCESSING		L	T	P	C
21A350405			3	0	0	3
Pre-requisite	Artificial Intelligence	Semester	VII			

COURSE OBJECTIVES:

- To explain and apply fundamental algorithms and techniques in the area of natural language processing
- To understand approaches to syntax and semantics in NLP.
- To understand current methods for statistical approaches to machine translation.
- To understand language modelling.
- To understand machine learning techniques used in NLP.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the logic behind Natural languages **(K2)**
CO2: Understand the significance of syntax and semantics of natural languages **(K2)**
CO3: Process the Natural languages **(K3)**
CO4: Verify the syntax and semantics of languages **(K3)**
CO5: Design new natural languages **(K6)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3	-	-	-	-	-	-	-	-	1	-
CO2	2	2	1	3	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	3	-	-	-	-	-	-	-	-	1	-
CO4	2	2	2	3	-	-	-	-	-	-	-	-	-	2
CO5	3	2	2	3	-	-	-	-	-	-	-	-	-	2

UNIT – I (8 Hrs)

INTRODUCTION TO NATURAL LANGUAGE: The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

Learning Outcomes: At the end of this unit, students should be able to

- Classify different Levels of Language Analysis (L1)
- Understand Natural language systems (L3)
- Study Linguistic Background (L3)

UNIT – II (8 Hrs)

GRAMMARS AND PARSING: Grammars and Parsing- Top- Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon game, Entropy and Cross Entropy.

Learning Outcomes: At the end of this unit, students should be able to

- Study different types of Grammars and Parsing (L4)
- Understand Morphological Analysis and the Lexicon(L5)
- Analyse Entropy and Cross Entropy. (L4)

UNIT – III (9 Hrs)

GRAMMARS FOR NATURAL LANGUAGE: Grammars for Natural Language, Movement Phenomenon in Language, Handling questions in Context Free Grammars, Hold Mechanisms in ATNs, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

Learning Outcomes: At the end of this unit, students should be able to

- Study different types of Grammars for NLP (L4)
- Demonstrate Handling questions in Context Free Grammar (L6)
- Analyse Shift Reduce Parsers & Deterministic Parsers. (L5)

UNIT – IV (9 Hrs)

INTERPRETATION AND MODELLING: Semantic Interpretation-Semantic & Logical form, Word senses & ambiguity, the basic logical form language, encoding ambiguity in the logical Form, Verbs & States in logical form, Thematic roles, Speech acts &embedded sentences, Defining semantics structure model theory. Language Modelling-Introduction, n-Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language-Specific Modelling Problems, Multilingual and Cross lingual Language Modelling.

Learning Outcomes: At the end of this unit, students should be able to

- Study Semantic Interpretation & Logical form (L5)
- Demonstrate speech acts & embedded sentences (L4)
- Analyse Multilingual and Cross lingual Language Modelling. (L3)

UNIT – V (9 Hrs)

MACHINE TRANSLATION AND MULTILINGUAL INFORMATION: Machine Translation Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusaraka or Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusaraka Output, Language Bridges. Multilingual Information Retrieval - Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources. Multilingual Automatic Summarization - Introduction, Approaches to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Learning Outcomes: At the end of this unit, students should be able to

- Study Machine Translation Survey (L4)
- Demonstrate Anusaraka or Language Accessor Background (L5)
- Analyse Multilingual Automatic Summarization. (L3)

TEXTBOOKS:

1. "Natural Language Understanding", James Allen, Pearson Education, 2nd Edition, 2003.
2. "Multilingual Natural Language Processing Applications: From Theory to Practice", Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. "Natural Language Processing, A paninian perspective", Akshar Bharathi, Vineet Chaitanya, Prentice Hall of India.

REFERENCE BOOKS:

1. "Statistical Language Learning", Charniack, Eugene, MIT Press, 1993.
2. "Speech and Language Processing", Jurafsky, Dan and Martin, James, Prentice Hall, 2nd Edition, 2008.
3. "Foundations of Statistical Natural Language Processing, Manning, Christopher and Henrich, Schutze, MIT Press, 1999.

ONLINE LEARNING RESOURCES:

1. http://peterindia.net/AILinks.html

Course Code	CYBER SECURITY		L	T	P	C
21A050433	(Common to CSE, CSE-IOT)		3	0	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To understand essential building blocks and basic concepts of cyber security
- To explore Web security and Network security
- To explain the measures for securing the networks and cloud
- To understand privacy principles and policies
- To describe the legal issues and ethics in computer security

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Illustrate the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection **(K3)**

CO2: Assess the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure **(K4)**

CO3: Identify the nature of secure software development and operating systems **(K3)**

CO4: Demonstrate the role security management in cyber security defense **(K2)**

CO5: Adapt the legal and social issues at play in developing solutions **(K3)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	2-
CO5	3	3	3	3	2	-	-	-	-	-	-	-	-	2

UNIT – I (10 Hrs)

Introduction: Introduction to Computer Security, Threats, Harm, Vulnerabilities, Controls, Authentication, Access Control, and Cryptography, Authentication, Access Control, Cryptography Programs and Programming: Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures.

Learning Outcomes: At the end of this unit, students should be able to

- Explain Vulnerabilities, threats and. Counter measures for computer security (L2)
- Interpret the design of the malicious code (L2)

UNIT – II (9 Hrs)

Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks.

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit.

Learning Outcomes: At the end of this unit, students should be able to

- Outline the attacks on browser, Web and email. (L2)
- Explain the security aspects of Operating Systems. (L3)

UNIT – III (9 Hrs)

Network Security: Network Concepts, Threats to Network Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management.

Cloud Computing and Security: Cloud Computing Concepts, Moving to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the network security threats and attacks. (L3)
- Design the Counter measures to defend the network security attacks. (L4)
- Analyze the security tools and techniques for Cloud computing (L4)

UNIT – IV (8 Hrs)

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, Where the Field Is Headed

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Learning Outcomes: At the end of this unit, students should be able to

- Interpret the need for Privacy and its impacts of Emerging Technologies. (L2)
- Explain how to handle incidents and deal with Disaster. (L2)

UNIT – V (8 Hrs)

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Emerging Topics: The Internet of Things, Economics, Computerized Elections, Cyber Warfare.

Learning Outcomes: At the end of this unit, students should be able to

- Adapt legal issues and ethics in computer security. (L4)
- Elaborate on the Emerging topics. (L4)

TEXTBOOKS:

1. "Security in Computing", Pfleeger, C.P., Prentice Hall, 2010, 5th Edition.

2. "Applied Cryptography", Bruce Schneier, John Wiley & Sons, 2nd Edition,1996

REFERENCE BOOKS:

1. "Information Security: The Complete Reference", Mark Rhodes-Ousley, 2nd Edition.
2. "Information Security Management: Concepts and Practice", McGraw-Hill, 2013.
3. "Roadmap to Information Security for IT and Infosec Managers", Michael E. Whitman, and Herbert J. Mattord, Boston, Course Technology, 2011

Course Code	DIGITAL FORENSICS		L	T	P	C
21A350406			3	1	0	3
Pre-requisite	Digital Logic Design & Computer Organization, Operating Systems	Semester	VII			

COURSE OBJECTIVES:

- To understand cybercrimes and their Operandi to analyze the attack.
- To Study and Describe Forensic science and Digital Forensics
- To perform digital evidence investigations
- To understand cybercrimes and their Operandi to analyze the attack
- To apply forensic analysis tools to recover important evidence for identifying computer crime.
- To be well-trained as next-generation computer crime investigators

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe Forensic science and Digital Forensic concepts **(K2)**

CO2: Undertake basic digital forensic investigation, from data acquisition and validation to evidence discovering, analyzing, validating, and presenting, by using a variety of digital forensics tools **(K4)**

CO3: Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards (K)

CO4: Apply a solid foundational grounding in computer networks, operating systems, file systems, hardware, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity **(K3)**

CO5: Analyze the digital evidence used to commit cyber offences **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	-	3	-	1	-	-	-	-	3	-	-	3	-
CO3	-	1	3	-	-	-	-	2	-	3	-	-	3	1
CO4	-	-	3	-	-	-	-	2	-	3	-	-	3	-
CO5	2	-	-	1	-	-	-	-	-	-	1	-	-	-

UNIT – I (8 Hrs)

INTRODUCTION: Understanding of forensic science, digital forensic, uses of digital forensic , Locard's exchange principle, Scientific method. Understanding of the technical concepts: Basic computer organization, File system, Memory organization concept, Data storage concepts, Computing environments

Learning Outcomes: At the end of this unit, students should be able to

- Explain the origins of forensic science (L2)
- Define and explain digital forensic procedures and investigative findings to diverse

stakeholders (L2)

- Explain the role of digital forensics and the relationship of digital forensics to traditional forensic science, traditional science and the appropriate use of scientific methods (L2)

UNIT – II (8 Hrs)

UNDERSTANDING DIGITAL FORENSICS: Forensic Laboratories ,policies and procedures, Quality assurance, Tool validation, Digital forensic tools Tool selection, Hardware and Software tools

COLLECTING EVIDENCE: Introduction to cybercrime scene, Documenting the scene and evidence, maintaining the chain of custody, forensic cloning of evidence, Live and dead system forensic, Hashing concepts to maintain the integrity of evidence, Report drafting.

Learning Outcomes: At the end of this unit, students should be able to

- Use appropriate tools and techniques to collect and recover data from a variety of digital sources (L3)
- Adhere to highest ethical standards, obey the laws and follow procedures at all times when collecting and dealing with digital evidence (L3)
- Select and use current forensic tools to perform digital investigations(L3)

UNIT – III (10 Hrs)

COMPUTER OPERATING SYSTEM ARTIFACTS: Finding deleted data, hibernating files, examining window registry, recycle bin operation, understanding of metadata, Restore points and shadow copies

ANTI FORENSICS: Hiding data, Password Attacks, Steganography, Data destruction

Learning Outcomes: At the end of this unit, students should be able to

- Identify and apply current practices for processing crime and incident scenes (L4)
- Identify and document potential security breaches of computer data that suggest violations of legal, ethical, moral, policy, and/or societal standards (L4)

UNIT – IV (9 Hrs)

LEGAL ASPECTS OF DIGITAL FORENSICS: Understanding of legal aspects and their impact on digital forensics, Electronics discovery

INTERNET AND E-MAIL: Understanding of Internet resources, Web browser, Email header forensic, social networking sites

Learning Outcomes: At the end of this unit, students should be able to

- Develop and follow suitable processes when performing incident response and conducting digital forensics investigations(L3)
- Facilitate efficient memory utilization (L5)
- Use pointers and structures to formulate algorithm and write programs (L3)

UNIT – V (9 Hrs)

NETWORK FORENSICS: Social Engineering, Network Fundamentals, Network Security Tools, Network Attacks, Incident Response, Network Evidence and Investigations.

MOBILE DEVICE FORENSICS: Cellular Networks, Operating Systems, Cell Phone Evidence, Cell Phone Forensic Tools, Global Positioning Systems (GPS)

Learning Outcomes: At the end of this unit, students should be able to

- Apply a solid foundational grounding in computer networks, operating systems, and mobile devices to digital investigations and to the protection of computer network resources from unauthorized activity (L3)

TEXTBOOKS:

1. "The basics of digital Forensics (Latest Edition) – The primer for getting started in digital Forensics", John Sammons, Elsevier Syngress Imprint
2. "Cybersecurity – Understanding of cybercrimes, computer forensics and Legal perspectives", Nina Godbole and Sunit Belapure, Wiley India Publication
3. "Practical Digital Forensics", Richard Boddington, (PACKT) Publication, Open source Community

REFERENCE BOOKS:

1. "Computer Forensics: Incident Response Essentials", Warren G. Kruse II and Jay G. Heiser, Addison Wesley, 2002.
2. "Guide to Computer Forensics and Investigations, Nelson, B, Phillips, A, Enfinger, F, Stuart, C., Thomson Course Technology, 2nd Edition, 2006.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/
2. https://www.coursera.org/
3. https://www.infosecawareness.in

Course Code	INTERNET OF THINGS AND MULTIMEDIA SYSTEMS		L	T	P	C
21A350407			3	1	0	3
Pre-requisite	Computer Networks	Semester	VII			

COURSE OBJECTIVES:

- To explore the interconnection and integration of the physical world and the cyber space.
- To design & develop IoT Devices.
- To formulate a working definition of interactive multimedia
- To demonstrate competence in using the authoring program HyperStudio
- To use animation, digitized sound, video control, and scanned images

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the Application areas of IoT **(K2)**
CO2: Understand concepts of IoT-based Multimedia Applications **(K2)**
CO3: Summarize the importance of Multimedia Application **(K2)**
CO4: Design Interactive multimedia applications **(K6)**
CO5: Predict the sound suitable for application **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	3	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
CO5	3	3	3	3	3	-	-	-	-	-	-	-	3	3

UNIT – I (9 Hrs)

INTRODUCTION TO INTERNET OF THINGS: Introduction, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies**.** Domain Specific IoTs Introduction, Home Automation, cities, Environment, Retail, Agriculture, Industry, Health & Lifestyle.

Learning Outcomes: At the end of this unit, students should be able to

- Explain IoT architecture. (L3)
- Interpret the design principles that govern connected devices (L2)
- Summarize the roles of various organizations for IoT (L2)

UNIT – II (9 Hrs)

INNOVATION IN MULTIMEDIA USING IOT SYSTEMS: Introduction, IoT-Enabled Multimedia Frameworks, IoT-based Multimedia Applications, Proposed Framework for IoT Multimedia Service Delivery, Challenges and Limitations, Open Research Issues.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the IoT-based Multimedia Applications (L4)
- Discover the Need for IoT Multimedia Service Delivery (L3)

UNIT – III (10 Hrs)

MULTIMEDIA AUTHORING: Multimedia Overview, Definition Applications and Design, Authoring (HyperStudio), Introduction to HyperStudio, The Metaphor, The Basics (Cards, Buttons, Text), HyperStudio, Resources. Multimedia Authoring- Multimedia Authoring Metaphors, Multimedia Production, Multimedia Presentation, Automatic Authoring, Some Useful Editing and Authoring Tools, Adobe Premiere, Macromedia Director, Macromedia Flash, Dreamweaver.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize the importance of Multimedia Application (L3)
- Explain the basics of multimedia and Animation. (L2)
- Understand various tools for multi-media (L2

UNIT – IV (8 Hrs)

INSTRUCTIONAL DESIGN: Objectives, Content (print, graphics, sounds, etc.), Interaction, Assessment, Closure, Screen Design: Metaphors and Themes, Colors and Backgrounds, Text (size, color, placement), Navigation, Consistency.

Learning Outcomes: At the end of this unit, students should be able to

- Design Interactive multimedia applications (L6)
- Correlate colors, backgrounds and text (L4)

UNIT – V (8 Hrs)

TRANSITIONS AND LINKS: Use of Sound, HyperStudio Sounds, Recording Your Own, Internet Resources, Graphics, Integrating Web documents, HyperStudio Tips and Tricks, Animation, Launching other applications and documents.

Learning Outcomes: At the end of this unit, students should be able to

- Integrate sound into the Multimedia Applications (L6)
- Select the sound suitable for application (L5)

TEXTBOOKS:

1. "Internet of Things a Hands-on Approach", Arshdeep Bahga and Vijay Madisetti. University Press.
2. "Multimedia Computing Systems and Virtual Reality", Rajeev Tiwari, Neelam Duhan, Mamta Mittal, Abhineet Anand and Muhammad Attique Khan. CRC Press.
3. "A Guide to Computer Animation: for TV, games, multimedia and web", Marcia Kuperberg, Focal Press (Taylor and Francis Group), 2002.

4. "Fundamentals of Multimedia", Z. N. Li and M. S. Drew, Pearson Prentice Hall

REFERENCE BOOKS:

1. "Internet of Things: Architecture, Design Principles and Applications", Raj Kamal McGraw Hill Edition.
2. "Animation from Pencils to Pixels: Classical Techniques for Digital Animators", Tony White, Focal Press (Taylor and Francis Group), 2006.
3. "Creativity, INC: Overcoming the unseen forces that stand in the way of True Inspiration", ED Catmull, Trans World Publishers, 2014.

Course Code	MANAGEMENT SCIENCE (Common to all Branches)		L	T	P	C
21A110204			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concepts and principles of management in real life industry design and develop organization chart and structure for an enterprise. **(K3)**

CO2: Apply operations management techniques in real life industry. **(K3)**

CO3: Apply the concepts of HRM in Recruitment, Selection, Training & Development. **(K3)**

CO4: Develop PERT/CPM charts for projects of an enterprise and estimate time & cost of a project and to develop Mission, Objectives, Goals & Strategies for an enterprise in dynamic environment. **(K3)**

CO5: Understand & apply modern management techniques wherever possible. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO3	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO4	-	2	-	-	-	-	-	-	-	-	3	-	-	-
CO5	-	2	-	-	-	-	-	-	-	-	3	-	-	-

UNIT – I (9 Hrs)

Introduction to Management: Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of management and organization (L2)

- Apply the concepts & principles of management in real life industry (L3)
- Analyze the organization chart & structure for an enterprise.(L4)
- Evaluate and interpret the theories and the modern organization theory (L5)

UNIT – II (10 Hrs)

Operations Management: Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the core concepts of Management Science and Operations Management (L2)
- Apply the knowledge of Quality Control, Work-study principles in real life industry (L3)
- Evaluate Materials departments & Determine EOQ (L5)
- Analyze Marketing Mix Strategies for an enterprise (L4)
- Create and design advertising and sales promotion (L5)

UNIT – III (6 Hrs)

HUMAN RESOURCES MANAGEMENT: HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning (HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of HRM in Recruitment, Selection, Training & Development (L2)
- Apply Managerial and Operative Functions (L3)
- Analyze the need of training (L4)
- Evaluate performance appraisal (L5)
- Design the basic structure of salaries and wages (L5)

UNIT – IV (12 Hrs)

Strategic & Project Management: Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical

Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

Learning Outcomes: At the end of this unit, students should be able to

- Understand Mission, Objectives, Goals & Strategies for an enterprise (L2)
- Apply SWOT Analysis to strengthen the project (L3)
- Analyze Strategy formulation and implementation (L4)
- Evaluate PERT and CPM Techniques (L5)
- Create in competing the projects within given time (L5)

UNIT – V (8 Hrs)

Contemporary Issues in Management: The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Learning Outcomes: At the end of this unit, students should be able to

- Understand modern management techniques (L2)
- Apply Knowledge in modern management (L3)
- Analyze CRM, TQM (L4)
- Evaluate Six Sigma concept and SCM (L5)

TEXTBOOKS:

1. "Management Science", A.R Aryasri, TMH, 2013
2. "Management", Stoner, Freeman, Gilbert, Pearson Education, New Delhi, 2012.

REFERENCE BOOKS:

1. "Essentials of Management", Koontz &Weihrich, TMH, 6th Edition, 2005.
2. "Management Principles and Guidelines", Thomas N. Duening & John M. Ivancevich, Biztantra.
3. "Production and Operations Management", Kanishka Bedi, Oxford University Press, 2004.
4. "Modern Management", Samuel C. Certo, 9th Edition, PHI, 2005

Course Code	HACKING TOOLS		L	T	P	C
21A050706	(Common to CSE, CSE-AI, CSE-IOT, AIML)		1	0	2	2
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the effects of Hacking
- To protect themselves from hacking
- To identify various types of Hacking Tools

.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various Hacking Threats.**(K4)**

CO2: Perform various Hacking Methods.**(K3)**

CO3: Evaluate the various types of Hacking Techniques **(K4)**.

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	-	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	3	-	-	-	-	-	-	-	-	3	2

LIST OF EXPERIMENTS:

Week 1

Network Security and Threats, Cyber Ethics Hacking Introduction

Week 2

Scanners :- What is scanning? How to perform Scanning on a demo-website.

Week 3

Viruses and worms and Trojans. Virus Analysis

Week 4

Snooping:- Email, DNS and IP

Week 5

Honey Pots: Creation and Execution

Week 6

Information Gathering , Session Hijacking

Week 7

Hacking Wireless Networks

Week 8 & 9

SQL injections and Hacking Mobiles

Week 10 & 11

Social Engineering and safety requirements

TEXTBOOKS:

1. "Hack-x-crypt: a straight forward guide towards ethical hacking and cyber-Security", Udval sahay

REFERENCE BOOKS:

1. "ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking", Hein Smith

ONLINE LEARNING RESOURCES:

1. https://www.synopsys.com/glossary/what-is-ethical-hacking.html#:~:text=Definition,and%20actions%20of%20malicious%20attackers.
2. https://intellipaat.com/blog/what-is-ethical-hacking/

OPEN ELECTIVE – I

Course Code	AIR POLLUTION AND CONTROL		L	T	P	C
21A010501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To identify the sources of air pollution
- To know the composition and structure of atmosphere
- To know the pollutants dispersion models
- To understand the working of air pollution control equipment
- To identify the sources of noise pollution and their controlling methods.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the sources of air pollution. **(K2)**

CO2: Explain the composition and structure of atmosphere. **(K4)**

CO3: Discuss the general characteristics of stack emissions and their behavior. **(K2)**

CO4: Understand the mechanism of Control of air pollutants. **(K2)**

CO5: Know about the noise sources, mapping, prediction equations etc. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	3	-	-	-	3	1	-	-	-	-	3	1
CO2	3	1	3	-	-	-	3	1	-	-	-	-	1	1
CO3	3	2	2	-	-	-	3	1	-	-	-	-	2	2
CO4	3	1	2	-	-	-	3	1	-	-	-	-	1	1
CO5	3	2	2	-	-	-	3	1	-	-	-	-	1	2

UNIT – I (9 Hrs)

Introduction: sources, effects on – ecosystems, characterization of atmospheric pollutants, air pollution episodes of environmental importance. Indoor Air Pollution– sources, effects.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the character of atmospheric pollutants and their effect. (L4)

UNIT – II (9 Hrs)

Meteorology - composition and structure of the atmosphere, wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature Inversions, Wind rose diagram.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the composition and structure of atmosphere. (L4)
- Write the maximum mixing depth and windrose diagram. (L6)

UNIT – III (9 Hrs)

General characteristics of stack emissions, plume behavior, heat island effect. Pollutants dispersion models – description and application of point, line and areal sources. Monitoring of particulate matter and gaseous pollutants –respirable, non-respirable and nano - particulate matter. CO, CO2, Hydrocarbons (HC), SOX and NOX, photochemical oxidants.

Learning Outcomes: At the end of this unit, students should be able to

- Express about the general characteristics of stack emissions and their behavior. (L6)
- Analyze the monitoring of particulate matter and gaseous pollutants. (L4)

UNIT – IV (9 Hrs)

Air Pollution Control equipment for particulate matter & gaseous pollutants– gravity settling chambers, centrifugal collectors, wet collectors, fabric filters, electrostatic precipitator (ESP). – Adsorption, Absorption, Scrubbers, Condensation and Combustion.

Learning Outcomes: At the end of this unit, student should be able to

- Explain the various air pollution control equipment. (L3)

UNIT – V (9 Hrs)

Noise - sources, measurements, effects and occupational hazards. Standards, Noise mapping, Noise attenuation equations and methods, prediction equations, control measures, Legal aspects of noise.

Learning Outcomes: At the end of this unit, students should be able to

- Assess the noise sources, mapping, prediction equations etc., (L5)

TEXTBOOKS:

1. "Air Pollution - Its Origin and Control", Wark K., Warner C.F., and Davis W.T, Harper & Row Publishers, New York.
2. "Environmental Engineering", H.S. Peavy, D.R. Row & G. Tchobanoglous, Mc Graw Hill International Edition

REFERENCE BOOKS:

1. "Air Pollution", Perkins H.C., McGraw Hill.
2. "Air Pollution Control Theory", Crawford M., TATA McGraw Hill.
3. "Air Pollution", Stern A.C., Volume I, II, III.
4. "Air Pollution", Seinfeld N.J., McGraw Hill.
5. "Air Quality Management", Stern A.C., Volume V.
6. "Air Pollution", M N Rao and HVN Rao, Tata McGraw Hill publication

ONLINE LEARNING RESOURCES:

1. http://www.epa.gov
2. http://www.indiaenvironmentportal.org.in
3. http://nptel.iitm.ac.in
4. http://www.filtersource.com

Course Code	ELECTRIC VEHICLES		L	T	P	C
21A020501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- Get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- Get exposed to EV system configuration and parameters
- Know about electro mobility and environmental issues of EVs
- Understand about basic EV propulsion and dynamics
- Understand about fuel cell technologies for EV and HEVs
- Know about basic battery charging and control strategies used in electric vehicles

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand and differentiate between conventional and latest trends in Electric vehicles. **(K2)**

CO2: Analyze various EV resources, EV dynamics and Battery charging. **(K4)**

CO3: Apply basic concepts of EV to design complete EV system. **(K3)**

CO4: Design EV system with various fundamental concepts. **(K5)**

CO5: Analyze the various control strategies used in battery charging in the electric vehicles. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to EV Systems and Parameters: Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

Learning Outcomes: At the end of this unit, students should be able to

- Apply basic concepts of EV to design complete EV system. (L3)
- Explain EV system configuration. (L3)
- Understand various EV parameters. (L2)

UNIT – II (9 Hrs)

EV and Energy Sources: Electro mobility and the environment, history of Electric power

trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand electro mobility and environmental issues of EVs. (L2)
- Explain the history of Electric power trains. (L3)
- Compare conventional, battery, hybrid and fuel cell electric systems. (L3)

UNIT – III (9 Hrs)

EV Propulsion and Dynamics: Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi-motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of EV system. (L2)
- Choose a suitable electric propulsion system. (L2)
- Classify EV motors and their applications. (L3)

UNIT – IV (9 Hrs)

Fuel Cells: Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples.

Learning Outcomes: At the end of this unit, students should be able to

- FUEL CELLS: Explain the working principle of Fuel cells. (L3)
- Analyze fuel cell technologies for EV and HEVs. (L4)
- Compare series, series-parallel hybrid systems. (L3)

UNIT – V (9 Hrs)

Battery Charging and Control: Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modeling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand basic battery charging in Electric Vehicles. (L2)
- Analyze control strategies used in electric vehicles. (L4)

TEXTBOOKS:

1. "Modern Electric Vehicle Technology", C.C Chan, K.T Chau, Oxford University Press Inc., New York 2001.

2. "Electric Vehicle Technology Explained", James Larmenier, John Lowry, Wiley, 2003.

REFERENCE BOOKS:

1. "Electric and Hybrid Vehicles Design Fundamentals", Iqbal Husain, CRC Press 2005.
2. "Advanced Electric Drive Vehicles", Ali Emadi, CRC Press, 2015.

ONLINE LEARNING RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

Course Code	ELECTRICAL DISTRIBUTION SYSTEMS		L	T	P	C
21A020502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- The classification of distribution systems
- The aspects and design considerations in DC and AC distribution and their comparison
- Technical issues of substations such as location, ratings and bus bar arrangements
- The causes of low power factor and methods to improve power factor
- The principles in Distribution automation

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Compute the various factors associated with power distribution. **(K3)**
CO2: Make voltage drop calculations in given distribution networks. **(K3)**
CO3: Learn principles of substation maintenance. **(K2)**
CO4: Compute power factor improvement for a given system and load. **(K3)**
CO5: Understand implementation of SCADA for distribution automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Load Modeling and Characteristics: Introduction to Distribution Systems, Load Modelling and Characteristics. Coincidence Factor, Contribution Factor Loss Factor - Relationship between the Load Factor and Loss Factor. Classification of Loads (Residential, Commercial, Agricultural, and Industrial) and Their Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of the electrical distribution systems. (L2)
- Analyze the relationship between load factor and loss factor. (L4)
- Understand the various loads and its characteristics. (L2)

UNIT – II (9 Hrs)

Classification Of Distribution Systems: Classification of Distribution Systems - Comparison of DC vs AC and Under-Ground vs Over - Head Distribution Systems- Requirements and

Design Features of Distribution Systems. Design Considerations of Distribution Feeders: Radial and Loop Types of Primary Feeders, Voltage Levels, Feeder Loading, Basic Design Practice of the Secondary Distribution System.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the classification of electrical distribution systems. (L2)
- Analyze the design considerations of the radial and loop type feeders. (L4)

UNIT – III (9 Hrs)

Substations: Location of Substations: Rating of Distribution Substation, Service Area within Primary Feeders. Benefits Derived Through Optimal Location of Substations. Classification of Substations: Air Insulated Substations - Indoor & Outdoor Substations: Substation Layout showing the Location of all the Substation Equipment. Bus Bar Arrangements in the Sub-Stations: Simple Arrangements Like Single Bus Bar Sectionalized Single Bus Bar, With Relevant Diagrams.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the layout of the substation and various equipment installed. (L2)
- Analyze the classification of the substation based on insulating medium. (L4)
- Understand various bus bar schemes in substation. (L2)

UNIT – IV (9 Hrs)

Power Factor Improvement: Three Phase Balanced Primary Lines. Causes of Low P.F - Methods of Improving P.F -Phase Advancing and Generation of Reactive KVAR Using Static Capacitors-Most Economical P.F. for Constant KW Load and Constant KVA Type Loads, Capacitive Compensation for Power-Factor Control - Effect of Shunt Capacitors (Fixed and Switched), Power Factor Correction.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

UNIT – V (9 Hrs)

Distribution Automation: Distribution Automation (DA) – Project Planning – Definitions – Communication Sensors- Supervisory Control and Data Acquisition (SCADA) – Consumer Information Service (CIS) – Geographical Information System (GIS) – Automatic Meter Reading (AMR) – Automation Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the voltage drop and power loss calculations in manual lines. (L4)
- Understand the power factor compensation methods in the lines. (L2)
- Apply various power factor correction methods using fixed and switched capacitors. (L3)

TEXTBOOKS:

1. "Electric Power Distribution Engineering", Turan Gonen, CRC Press, 3rd Edition, 2014.
2. "Electric Power Distribution", A.S. Pabla, Tata Mc Graw Hill (India) Pvt. Ltd., 6th Edition, 2011.

REFERENCE BOOKS:

1. "Electric Power Distribution Automation", Dr. M. K. Khedkar and Dr. G. M. Dhole, University Science Press, 2010
2. "Electrical Power Distribution Systems", V. Kamaraju, Jain Book Depot, 2012.

Course Code	ROBOTICS		L	T	P	C
21A030501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control
- To choose and incorporate robotic technology in engineering systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the introduction and types of robots. **(K2)**

CO2: Analyze kinematics using forward and inverse kinematics and dynamics of robots using transformation, Jacobians, Lagrange – Euler and Newton – Euler formation. **(K4)**

CO3: Understand the working principle of different types of actuators and sensors. **(K2)**

CO4: Understand the motion types and robot programming software. **(K2)**

CO5: Know importance of robotic Applications in manufacturing. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	2	3	-
CO2	1	-	3	-	-	-	-	-	-	-	-	1	1	3
CO3	3	-	2	-	2	-	-	-	-	-	-	1	3	1
CO4	3	-	2	-	3	-	-	-	-	2	-	-	3	2
CO5	3	-	2	-	2	-	-	-	-	1	-	2	3	-

UNIT – I (8 Hrs)

Introduction to Industrial Robots: Classification. Robot configurations, Functional line diagram, Degrees of Freedom. Components, common types of arms, joints, grippers.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concepts of robots. (L2)
- Differentiate types of robots and robot grippers. (L4)

UNIT – II (8 Hrs)

Manipulator Kinematics: Homogeneous transformations as applicable to rotation and translation-D-H notation, Forward and inverse kinematics.

Manipulator Dynamics: Differential transformation, Jacobians .Lagrange – Euler and Newton – Euler formations.

Learning Outcomes: At the end of this unit, students should be able to

- Acquire the knowledge about robot kinematics and dynamics. (L2)

- Analyze the forward and inverse kinematics of robot manipulators. (L4)

UNIT – III (9 Hrs)

Robot actuators and Feedback components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors, comparison. Position sensors – potentiometers, resolvers, encoders – Velocity sensors, Tactile sensors, Proximity sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the various types of robot actuators and feedback components. (L1)
- Understand the working of robot sensors. (L2)

UNIT – IV (11 Hrs)

Trajectory Planning: Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion.

Robot programming - Types – features of languages and software packages.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze motion in links and joints of a robot. (L4)
- Understand the types and software packages of robots. (L2)

UNIT – V (9 Hrs)

Robot Application in Manufacturing: Material Transfer -Material handling, loading and unloading - Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Learning Outcomes: At the end of this unit, students should be able to

- Express the various applications of robots in industries. (L2)
- Acquire the knowledge about real time applications of robots in manufacturing. (L2)

TEXTBOOKS:

1. "Industrial Robotics", M.P. Groover, TMH.
2. "Robotics, Fundamental Concepts and analysis", Ashitave Ghosal, Oxford Press
3. "Robotics and Control", Mittal R K & Nagrath I J, TMH.

REFERENCE BOOKS:

1. "Robotics", Fu K S, McGraw Hill.
2. "An Introduction to Robot Technology", P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. "Robotic Engineering", Richard D. Klafter, Prentice Hall
4. "Introduction to Robotics", John J. Craig, Pearson Edu
5. "Automation, Production systems and CIM", M.P. Groover, Pearson Edu

Course Code	BASICS OF MECHANICAL ENGINEERING		L	T	P	C
21A030502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To familiarize students with basic power plants types, turbines, pumps, IC engines, boilers, refrigeration and air conditioning process and their performance aspects.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know types of power generating plants by using conventional or Non-conventional resources. **(K2)**

CO2: Understand and implementation of turbines, explain different types of pumps and their application. **(K2)**

CO3: Describe To familiarize the developments in IC engines. **(K2)**

CO4: Uunderstand the concept of the boilers. **(K2)**

CO5: Explain the working principles of refrigeration and air conditioning systems. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	-	-	-	-	-	-	-	2	-	-
CO2	3	1	2	1	-	-	-	-	-	-	-	1	-	-
CO3	2	2	1	1	-	-	-	-	-	-	-	1	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	1	-	-	-	-	-	-	2	-	-

UNIT – I (10 Hrs)

Power Plant Engineering: Introduction – Energy Renewable and Non – Renewable Energy, Sources – Classification of Power Plants based on Sources of Energy – Thermal Power Plant or Steam Power Plant – Hydro Electric Power – Nuclear Fission, Chain Reaction, Layout of Nuclear Power Plant – Diesel Power Plant – Gas Turbine Power Plant – Open Cycle Gas Turbine, Closed Cycle Gas Turbine Power Plant, Comparison of Diesel Power Plant with Gas Turbine Power Plant.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the energy Renewable and Non – Renewable Energy Sources. (L2)
- Illustrate the working principle of Steam, Nuclear & open cycle, and closed cycle gas turbine. (L2)

UNIT – II (10 Hrs)

Hydraulic Turbine – Classification of Hydraulic Turbines, Impulse Turbine, Reaction Turbine, Difference between Impulse and Reaction Turbine.

Pumps – Classification of Pumps, Centrifugal Pump, Applications of Centrifugal Pump, Priming, Reciprocating Pumps, Single Acting Reciprocating Pump, Working of a Double acting Reciprocating Pump, Comparison of Reciprocating Pump with Centrifugal Pump.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Hydraulic Turbines, Impulse Turbine, and Reaction Turbine. (L2)
- Understand the working of Centrifugal Pump, Reciprocating Pumps and Comparison between them. (L2)

UNIT – III (10 Hrs)

I.C Engine: Heat Engine – Types of Heat Engine – External Combustion Engine, IC Engine (Internal Combustion), Classification of I.C. Engine, Two Stroke Petrol Engine, Four Stroke Engine, Valve Timing Diagram, Port Timing Diagram, Comparison of Two Stroke and Four Stroke Engines, Comparison of Petrol Engine and Diesel Engine, Fuel System of a Petrol Engine, Ignition Systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of External Combustion Engine, IC Engine. (L2)
- Illustrate the working of Two Stroke Petrol Engine, Four Stroke Engine. (L2)

UNIT – IV (7 Hrs)

Boilers: Classification of Boilers – Simple Vertical Boiler – Cochran Boiler – Babcock and Wilcox Boiler – Benson Boiler – Difference between Fire Tube and Water Tube Boilers – Boiler Mountings – Boiler Accessories – Difference between Boiler Mountings and Accessories.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of different types Fire Tube and Water Tube Boilers.(L2)

UNIT – V (8 Hrs)

Refrigeration and Air Conditioning: Introduction – Terminology of Refrigeration and Air Conditioning – Properties of Refrigerants – List of Commonly used Refrigerants – Types of Refrigerating System – Vapour Compression Refrigeration System – Vapour Absorption Refrigerator – Domestic Refrigerator – Air Conditioning – Application of Air Conditioning –Psychrometry – Window Air Conditioning.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the working of Vapour Compression Refrigeration System – Vapour Absorption Refrigeration system. (L2)
- Illustrate the working of Air Conditioning. (L2)

TEXTBOOKS:

1. "Basic Civil and Mechanical Engineering", Er. R. Vaishnavi, Prof. V. Vijayan, Prof. M. Prabhakaran, S. Chand Publication, 2nd Edition
2. "Elements of Mechanical Engineering", S Trymbaka Murthy, University Press, 4th Edition

REFERENCE BOOKS:

1. "Elements of Mechanical Engineering", S. N. Lal, Cengage Learning, 2013
2. "Elements of Mechanical Engineering", S. Trymbaka Murthy, Universities Press, 2015
3. "Mechanical Technology", Dr M. Maruthi Rao and V. Pavan Kumar, Lambert Academic Publishing, 2022

Course Code	INTRODUCTION TO CONTROL SYSTEMS		L	T	P	C
21A040501			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To introduce concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems and concept of feedback.
- To describe characteristics of the given system in terms of the transfer function.
- To provide knowledge in analyzing the system response in time-domain and frequency domain
- To introduce concepts of state variable analysis and design.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain different system representations, block diagram reductions and Mason's rule. **(K3)**
CO2: Analyse time response analysis, error constants. **(K4)**
CO3: Analyse the concept of stability in time domain. **(K4)**
CO4: Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots. **(K4)**
CO5: Analyze the states space models, controllability and observability. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

MATHEMATICAL MODELS OF PHYSICAL SYSTEMS: Definition & classification of system–terminology & structure of feedback control theory–Mathematical models – Differential equations of Translational and Rotational mechanical systems, and Electrical Systems, Block diagram reduction methods – Signal flow graph - Reduction using Mason's gain formula.

Learning Outcomes: At the end of this unit, students should be able to

- Write the differential equations for mechanical and electrical systems. (L3)
- Develop the transfer function from block diagrams and signal flow graphs. (L3)

UNIT – II (8 Hrs)

TIME RESPONSE ANALYSIS: Time response of first order and second order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems- Time domain specifications– Steady state response -Steady state errors and error

constants.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the time domain specifications. (L4)
- Calculate the steady state errors. (L3)

UNIT – III (9 Hrs)

STABILITY: The concept of stability – Routh's stability criterion –Stability and conditional stability – limitations of Routh's stability. Root locus–Rules for sketching root loci.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse the concept of stability in time domain. (L4)
- Apply the concept of Routh's stability and Root locus in time domain. (L3)

UNIT – IV (9 Hrs)

FREQUENCY RESPONSE ANALYSIS: Introduction, Frequency domain specifications-Bode Diagrams-Determination of Frequency domain specifications. Polar Plots-Nyquist Plots- Phase margin and Gain margin.

Learning Outcomes: At the end of this unit, students should be able to

- Evaluate the frequency domain specifications from Bode, Polar and Nyquist plots(L4)
- Deducing transfer functions from Bode Plots (L4)
- Understand difference between Phase and Gain margins(L2)

UNIT – V (9 Hrs)

STATE VARIABLE ANALYSIS: Concept of state–State Variable & State Model–state models for linear & continuous time systems. Solution of state & output equation–controllability & observability.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the concept of state space (L3)
- Analyze the concept of Controllability and Observability. (L4)

TEXTBOOKS:

1. "Automatic Control Systems", Benjamin C. Kuo, PHI Learning Private Ltd, 2010.
2. "Control Systems Engineering", J. Nagrath and M. Gopal, Tata Mc Graw-Hill Education Private Limited, Reprint, 2010.

REFERENCE BOOKS:

1. "Modern Control Systems", Richard C. Dorf and Robert H. Bishop, Pearson Education, Third Impression, 2009.
2. "Control System Engineering", S. Palani, Tata Mc Graw- Hill Education Private Limited, First Reprint, 2010.

Course Code	INTRODUCTION TO SIGNAL PROCESSING		L	T	P	C
21A040502			3	0	0	3
Pre-requisite	NIL	Semester	V			

COURSE OBJECTIVES:

- To understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- To represent continuous time signals (both periodic and non-periodic) in the time domain, s-domain and the frequency domain.
- To understand the properties of analog filters, and have the ability to design Butterworth filters.
- To understand and apply sampling theorem and convert a signal from continuous time to discrete time and able to represent the discrete time signal in the frequency domain.
- To understand FIR and IIR filters to meet given specifications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain continuous time and discrete time signals and systems, in time and frequency domain. **(K3)**

CO2: Apply Fourier series and Fourier Transform to analyze periodic & non-periodic signals and their spectra. **(K3)**

CO3: Design and implement the analog filter using components/suitable simulation tools. **(K4)**

CO4: Apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time. **(K3)**

CO5: Design and implement the digital filter using suitable simulation tools. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Introduction to Signals & Systems: Signal Definition, Signal Classification, System definition, System classification for both continuous time and discrete time, Basic Operations on Signals, Elementary Signals & Sequences, Definition of LTI systems, Transfer function of a LTI system, Concepts of Convolution and Correlation of signals, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand different basic types of signals and systems. (L2)
- Understand various basic operations on signals and elementary signals. (L2)

- Describe continuous time signal and discrete time signal. (L2)
- Sketch the various types of basic signals for both continuous time & discrete time. (L3)
- Understand the LTI systems, convolution & correlation of signals. (L2)

UNIT – II (10 Hrs)

Fourier Series & Transform: Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems, Fourier Transform of arbitrary signal, Properties of Fourier Transform, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the periodic signals by applying Fourier series. (L4)
- Apply Fourier transform to solve problems. (L3)
- Analyze the spectral characteristics of signals. (L4)

UNIT – III (8 Hrs)

Analog Filters: Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of analog filters. (L2)
- Design and implement the analog Butterworth filters. (L4)

UNIT – IV (8 Hrs)

Sampling Theorem & DFT: Sampling Theorem- Statement and proof, converting the analog signal to a digital signal, Practical sampling, The Discrete Fourier Transform, Properties of DFT, IDFT, Comparing the frequency response of analog and digital systems, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of sampling techniques. (L2)
- Illustrate signal sampling and its reconstruction. (L3)
- Explain the importance of discrete Fourier transform. (L3)

UNIT – V (10Hrs)

Digital Filters: Characteristics of FIR and IIR filters. Frequency response of ideal digital filters, Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, Comparison of FIR & IIR, Illustrative Problems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of IIR and FIR digital Filters. (L2)
- Analyze windowing techniques in FIR filters. (L4)
- Illustrate the digital filters of different techniques. (L3)

- Design IIR and FIR filters. (L4)

TEXTBOOKS:

1. "Signals, Systems and Communications", B. P. Lathi, BS Publications, 2008.
2. "Digital signal processing, principles, Algorithms and applications", John G. Proakis, Dimitris G. Manolakis, Pearson Education/PHI, 4th Edition, 2007.
3. "Discrete Time Signal Processing", A. V. Oppenheim and R.W. Schaffer, PHI, 2009.

REFERENCE BOOKS:

1. "Linear Systems and Signals", B. P. Lathi, Oxford University press, 2nd Edition.
2. "Digital Signal Processing – Fundamentals and Applications", Li Tan, Elsevier, 2008.
3. "Signals, Systems and Transforms", C. L. Philips, J. M. Parr and Eve A. Riskin, PE, 3rd Edition, 2004.
4. "Signals and Systems", A.V. Oppenheim, A.S. Willsky and S. H. Nawab, PHI, 2nd Edition, 2013.
5. "Signals and Systems", A. Anand Kumar, PHI Publications, 3rd Edition, 2013.

OPEN ELECTIVE – II

Course Code	ENVIRONMENTAL POLLUTION AND CONTROL		L	T	P	C
21A010502			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To impart knowledge on aspects of air pollution & control and noise pollution.
- To impart concepts of treatment of waste water from industrial source.
- To differentiate the solid and hazardous waste based on characterization.
- To introduce sanitation methods essential for protection of community health.
- To provide basic knowledge on sustainable development.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the fundamentals of solid waste management, practices adopted in his town / village and its importance in keeping the health of the city. **(K2)**

CO2: Identify the air pollutant control devices and have knowledge on the NAAQ standards and air emission standards**. (K2)**

CO3: Differentiate the treatment techniques used for sewage and industrial wastewater Treatment. **(K3)**

CO4: Integrate the methods of environmental sanitation and the management of community facilities without spread of epidemics. **(K6)**

CO5: Appraise the importance of sustainable development while planning a project or executing an activity. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

AIR POLLUTION:

Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. Noise Pollution: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO:14000.

Learning Outcomes: At the end of this unit, students should be able to

- Understand control mechanism of air pollutants. (L2)
- Design noise reduction techniques. (L6)

UNIT – II (9 Hrs)

INDUSTRIAL WASTE WATER MANAGEMENT:

Strategies for pollution control – Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants – Recirculation of industrial wastes – Effluent standards.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of treatment process of industrial effluents. (L2)
- Design treatment plants. (L6)

UNIT – III (9 Hrs)

SOLID WASTE MANAGEMENT: solid waste characteristics – basics of on-site handling and collection – separation and processing – Incineration- Composting-Solid waste disposal
methods – fundamentals of Land filling.

HAZARDOUS WASTE: Characterization – Nuclear waste – Biomedical wastes – Electronic wastes – Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.

Learning Outcomes: At the end of this unit, students should be able to

- Categorize of solid waste and separation and procession solid waste. (L4)
- Estimate Hazardous wastes. (L5)
- Develop execute solid waste and hazardous waste management. (L6)

UNIT – IV (9 Hrs)

ENVIRONMENTAL SANITATION: Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.

Learning Outcomes: At the end of this unit, students should be able to

- Understand importance of hygienic environment. (L2)
- Choose appropriate rural sanitation methods to keep surrounding clean. (L5)

UNIT – V (9 Hrs)

SUSTAINABLE DEVELOPMENT: Definition- elements of sustainable developments-Indicators of sustainable development- Sustainability Strategies- Barriers to Sustainability– Industrialization and sustainable development – Cleaner production in achieving sustainability-sustainable
development.

Learning Outcomes: At the end of this unit, students should be able to

- Express sustainable development strategies. (L6)

TEXTBOOKS:

1. "Environmental Engineering", Peavy, H. S., Rowe, D.R, Tchobanoglous, Mc-Graw Hill International Editions, New York 1985.
2. "Environmental Science and Engineering", J. G. Henry and G. W. Heinke, Pearson Education.

REFERENCE BOOKS:

1. "Waste water treatment- concepts and design approach", G. L. Karia and R.A. Christian, Prentice Hall of India
2. "Air pollution", M. N. Rao and H. V. N. Rao, Tata Mc.Graw Hill Company.
3. "Weiner and Robin Matthews Environmental Engineering", Ruth F., Elesevier, 4th Edition, 2003.
4. "Air Pollution and Control", K. V. S. G. Murali Krishna, Kousal & Co. Publications, New Delhi.

Course Code	SMART GRID		L	T	P	C
21A020503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Impart knowledge on relevance smart grids technologies, its potential challenges and applications to the real world.
- Provide deeper insight on the customer's needs and consumption pattern for better load management and forecasting.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operational and functional aspects of smart grid, architecture and technical challenges. **(K2)**

CO2: Analyze the communication signals from various measuring units and sub-networks for monitoring secured operation adhering relevant standards. **(K4)**

CO3: Assess the various energy options and apply them for the sustainability of Smart grid. **(K2)**

CO4: Develop strategies for demand side management using various communication protocols. **(K3)**

CO5: Understand the challenges and relevant standards in interoperability and cyber security of Smart grid. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction to Smart Grid: Introduction to smart grid as per National Institute Standards and Technology (NIST), smart grid architecture, functions of smart grid components, smart grid initiatives in India, technology drivers and challenges. Overview of the technologies required for smart grid and architecture of smart substation.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic concept of smart grid Technology. (L2)
- Explain Smart grid functions. (L3)
- Understand Smart grid architecture. (L2)

UNIT – II (9 Hrs)

Smart Grid Measurement Technology: Introduction, standards for information exchange, monitoring, smart meters, and measurement technologies, WAMS, PMUs, GIS and google mapping tools and multi-agent systems technology.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the measurement technologies. (L2)
- Explain the google mapping tools. (L3)
- Compare WAMS and PMU. (L3)

UNIT – III (9 Hrs)

Sustainable Energy Options for the Smart Grid: Renewable Energy Resources, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, Storage Technologies.

Learning Outcomes: At the end of the unit, the student will be able to

- Sketch the block diagram of Renewable energy source. (L3)
- Understand basic concept of Electric Vehicles. (L2)

UNIT – IV (9 Hrs)

Demand Side Management and Communication Technology: Introduction, Demand Side Management objectives and its classification. Communication technologies: IEEE 802X series. Layouts of Sub-networks: LAN, WAN, NAN, HAN and FAN and its comparison.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic concepts of management objectives. (L3)
- Compares the WAN, LAN, NAN, HAN. (L3)

UNIT – V (9 Hrs)

Interoperability, Standards and Cyber Security : Introduction, State-of-the-Art-Interoperability, Benefits and Challenges of Interoperability, Model for Interoperability in the Smart Grid Environment, Smart Grid Network Interoperability, Interoperability and Control of the Power Grid, Standards, Approach to Smart Grid Interoperability Standards, Smart Grid Cyber Security, Cyber Security State of the Art, Cyber Security Risks, cyber security concerns associated with Advanced Metering Infrastructure, Mitigation approach to cyber security risks.

Learning Outcomes: After successful completion of this unit, the students will be able to

- Understand basic Benefits and Challenges of Interoperability. (L2)
- Analyze Smart Grid Network Interoperability. (L4)

TEXTBOOKS:

1. "Smart Grid: Fundamentals of design and analysis", James Momoh, John Wiley & sons Inc, IEEE press, 2012

2. "Smart Grid: Technology and Applications", Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc., 2012.

REFERENCE BOOKS:

1. "Smart Grid: Integrating Renewable, Distributed & Efficient Energy", Fereidoon P. Shoshonis, Academic Press, 2012
2. "The smart grid: Enabling energy efficiency and demand response", Clark Grellings, Fairmont Press Inc, 2009.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108/107/108107113/
2. https://smartgrid.ieee.org/resources/webinars

Course Code	ENERGY STORAGE SYSTEMS		L	T	P	C
21A020504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need for energy storage
- Understand about the fundamentals of ESS
- Know about types, features and benefits of ESS
- Know about various management and control including market potential of ESS
- Study about various applications of ESS

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: To get exposed to latest technology of ESS. **(K3)**

CO2: Understand the principle, features, and benefits of ESS. **(K2)**

CO3: Understand the marketing and management strategies of ESS in working environment. **(K2)**

CO4: Distinguish wide variety of applications of EES for practical applications. **(K2)**

CO5: Know about latest technology applications of Battery SCADA, which is going to be vital in future applications, trend in new and renewable energy source. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Fundamentals of ESS: Definitions, Characteristics of ESS, Electricity, and roles of ESSs, Emerging needs in ESS, Classification of ESSs, Roles of Electrical storage technologies.

Learning Outcomes: At the end of this unit, students should be able to

- To know about the fundamentals of ESS. (L4)
- To know about emerging needs and roles of ESS. (L4)
- To know about various classifications of ESS. (L4)
- To understand about roles of energy storage technologies. (L2)

UNIT – II (9 Hrs)

Types and Features of ESS Technologies: Mechanical storage systems, Electromechanical

storage systems, Chemical energy storage, Electrical storage systems, Thermal storage systems, standards for EES, Comparison of ESS technology storage systems, Power and discharge duration, Energy and power density, Storage operating cost, Power quality, Reactive power capability.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about various types of ESS technologies. (L2)
- To understand about standards for ESS. (L2)
- To learn about power and discharge duration of ESS. (L2)
- To know about preliminaries of ESS operating cost. (L4)
- To understand about power quality issues and reactive power capability of ESS. (L2)

UNIT – III (9 Hrs)

Storage Benefits: Definitions, Applications, specifications, benefits, Electric energy time shift, Electric supply capacity, reserve capacity, voltage support, Electric service power quality and reliability, Incidental benefits, energy losses, access charges, Risk, dynamic operating benefits, p.f. correction, reduced air emissions, flexibility, energy benefits.

Learning Outcomes: At the end of this unit, students should be able to

- To know various storage benefits. (L4)
- To distinguish between application specific benefits and identical benefits. (L2)
- To understand about electric service power quality and reliability issues. (L2)
- To learn about energy benefits from storage systems. (L3)

UNIT – IV (9 Hrs)

EES Market and Management: Utility and Consumer use, Measurement and Control hierarchy, Internal configurations, External connections, Battery SCADA, Market potential, estimation, role of aggregators, Maximum market potential estimates, Demand change management, Time-of-use energy cost management, storage modularity.

Learning Outcomes: At the end of this unit, students should be able to

- To understand about management of ESS technologies. (L2)
- To distinguish between internal and external configuration of ESS. (L2)
- To know about battery SCADA system and storage modularity. (L4)
- To distinguish between demand change and time-of-use energy cost management. (L2)

UNIT – V (9 Hrs)

Applications of EES: Power Vs Energy, Capacity Vs energy applications, specific power and discharge durations, Electric supply applications, ancillary service applications, End user/utility customer applications, Distributed energy storage applications, Locational, Non-locational and incidental applications.

Learning Outcomes: At the end of this unit, students should be able to

- To know about various ESS. (L4)
- To distinguish between power, capacity, energy applications of ESS. (L2)
- To distinguish between electric supply and ancillary applications. (L2)
- To understand about the importance of distributed energy storage applications. (L2)

TEXTBOOKS:

1. "Energy Storage Benefits and Market Analysis", James M. Eyer, Joseph J. Iannucci and Garth P. Corey, Sandia National Laboratories, 2004
2. "The Electrical Energy Storage", IEC Market Strategy Board, White paper.

REFERENCE BOOKS:

1. "Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide", Jim Eyer, Garth Corey, Sandia National Laboratories", Feb 2010.

Course Code	AUTOMATION IN INDUSTRIES		L	T	P	C
21A030503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- Understand the need of automation
- Classify various types of automated transmission lines and components of automation.
- List and understand various material handling systems.
- Design various types of automated assembly systems
- Explain various automatic inspection systems.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand principles and basic elements of automation. **(K2)**
CO2: Understand the Detroit automation and automated flow lines. **(K2)**
CO3: Learn the material handling technology and assembly systems. **(K1)**
CO4: Learn the control systems technology and its process in automation. **(K1)**
CO5: Understand the inspection, testing and PLC's in automation. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	3	1	2	1	-	-	-	-	-
CO2	3	-	-	-	2	2	1	-	2	-	-	-	-	-
CO3	3	-	-	-	1	1	1	-	1	-	-	-	-	-
CO4	2	2	3	-	3	2	2	-	2	-	-	-	-	-
CO5	2	-	-	-	2	1	2	-	1	-	-	-	-	-

UNIT – I (9 Hrs)

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in process.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the principles of production, investment, cost concepts in automation. (L2)

UNIT – II (10 Hrs)

Detroit-Type Automation: Automated Flow lines, Methods of Work-part Transport, Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations.

Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the types of automation method concepts and machining operations. (L2)

UNIT – III (11 Hrs)

Material handling and Identification Technologies: The material handling function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.

Automated Assembly Systems: Design for Automated Assembly, Types of Automated Assembly Systems, Part Feeding Devices, Analysis of Multistation Assembly Machines, Analysis of a Single Station Assembly Machine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Apply the techniques of material handling and automated assembly systems. (L4)

UNIT – IV (7 Hrs)

Control Technologies in Automation: Industrial Control Systems, Process Industries Verses Discrete- Manufacturing Industries, Continuous Verses Discrete Control, Computer Process Control and its Forms. Computer Based Industrial Control: Introduction & Automatic Process Control, Building Blocks of Automation System: LAN, Analog & Digital I/O Modules, SCADA System & RTU.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the industrial control technologies in automation. (L2)

UNIT – V (8 Hrs)

Automated Inspection and Testing: Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods.

Programmable Logic Controllers (PLCs): Introduction, Micro PLC, Programming a PLC, Logic Functions, Input & Output Modules, PLC Processors, PLC Instructions, Documenting a PLC System, Timer & Counter Instructions, Typical PLC Programming Exercises for Industrial Applications.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain the inspection, testing methods and PLC's methods in automation. (L2)

TEXTBOOKS:

1. "Automation, Production Systems and Computer Integrated Manufacturing", M. P. Grover, Pearson Education.

REFERENCE BOOKS:

1. "Computer Based Industrial Control", Krishna Kant, EEE-PHI
2. "Principles and Applications of PLC", Webb John, Mcmillan 1992
3. "An Introduction to Automated Process Planning Systems", Tiess Chiu Chang & Richard A. Wysk
4. "Anatomy of Automation", Amber G.H & P.S. Amber, Prentice Hall.

Course Code	RAPID PROTOTYPING		L	T	P	C
21A030504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- The fundamental Theory behind RP process.
- Study the Process parameters of different machine.
- Study different types of Rapid tooling.
- Based on the industrial standards, learn how Prepare manufacturing DATA.
- The basics concept of different software used in RP system.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand Theory behind RP process. **(K2)**

CO2: Learn the Process parameters of different machine. **(K3)**

CO3: Learn different types of Rapid tooling. **(K3)**

CO4: Understand the industrial standards; learn how to prepare manufacturing Data. **(K2)**

CO5: Understand basics concept of different software used in RP system. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	2	3	1	2	-	-	1	-	-	-	-
CO2	2	2	-	3	2	2	2	-	-	1	-	-	-	-
CO3	3	2	-	3	2	1	3	-	-	1	-	-	-	-
CO4	1	2	-	3	3	1	3	-	-	1	-	-	-	-
CO5	1	2	-	3	3	1	3	-	-	1	-	-	-	-

UNIT – I (9 Hrs)

Introduction & History of Rapid Prototyping, Fundamentals of Rapid Prototyping, Advantages and Disadvantages of Rapid Prototyping, Applications of Rapid Prototyping, Classification of RP, Rapid prototyping process chain, Fundamental Automated processes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Know about the importance of rapid prototyping. (L1)
- Understand the concept of Stereo lithography. (L2)

UNIT – II (9 Hrs)

Stereo lithography (SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA, Machine details & Application of SLA.

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS.

Learning Outcomes: At the end of this unit, students should be able to

- Illustrate about the selective laser sintering process. (L4)
- Explain about the concept of fused deposition modelling and solid ground curing. (L2)

UNIT – III (7 Hrs)

Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application. Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Demonstrate about laminated object manufacturing process. (L2)
- Know about different 3D modelling printing techniques. (L1)

UNIT – IV (10 Hrs)

Rapid tooling -Indirect rapid tooling, Silicon Rubber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of rapid tolling. (L2)

UNIT – V (10 Hrs)

Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand different file format software's of 3D modelling techniques. (L2)

TEXTBOOKS:

1. "Stereo lithography and other RP & M Technologies", Paul F. Jacobs, SME, NY 1996.
2. "Rapid Manufacturing", Flham D. T & Dinjoy S.S, Verlog London 2001.
3. "Rapid automated", Lament wood, Indus press New York.

REFERENCE BOOKS:

1. "Wohler's Report 2000", Terry Wohlers, Wohler's Association, 2000.
2. "Rapid prototyping materials", Gurumurthi, IISc Bangalore

Course Code	PRINCIPLES OF COMMUNICATION SYSTEMS		L	T	P	C
21A040503			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To understand the concept of various modulation schemes and multiplexing.
- To apply the concept of various modulation schemes to solve engineering problems.
- To analyse various modulation schemes.
- To evaluate various modulation scheme in real time applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Apply the concept of amplitude modulation to solve engineering problems. **(K3)**
CO2: Analyze the Angle modulation & demodulation systems in time & frequency domains. **(K4)**
CO3: Analyze different Analog Pulse modulation & demodulation techniques. **(K4)**
CO4: Explain various digital modulation schemes. **(K3)**
CO5: Understand the concept of various communication systems. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
CO5	2	2	-	-	-	-	-	-	-	-	-	3	3	-

UNIT – I (10 Hrs)

Amplitude Modulation: An overview of Electronic Communication Systems. Need for Frequency Translation, Amplitude Modulation: DSB-FC, DSB-SC, SSB-SC and VSB. Frequency Division Multiplexing. Radio Transmitter and Receiver.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of noise, Fourier transform, career modulation and frequency division multiplexing. (L2)
- Apply the concept of amplitude modulation to solve engineering problems. (L3)

UNIT – II (9 Hrs)

Angle Modulation: Angle Modulation, Tone modulated FM Signal, Arbitrary Modulated FM Signal, FM Modulation and Demodulation. Stereophonic FM Broadcasting.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of angle modulation and its components. (L2)
- Apply the concept of frequency modulation to solve engineering problems. (L3)
- Analyse angle modulation schemes. (L4)
- Evaluate frequency modulation scheme in real time applications. (L4)

UNIT – III (8 Hrs)

Pulse Modulation: Sampling Theorem: Low pass and Band pass Signals. Pulse Amplitude Modulation and Concept of Time Division Multiplexing. Pulse Width Modulation. Digital Representation of Analog Signals.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various pulse modulation schemes and time division multiplexing. (L2)
- Explain various pulse modulation schemes. (L4)

UNIT – IV (9 Hrs)

Digital Modulation: Binary Amplitude Shift Keying, Binary Phase Shift Keying and Quadrature Phase Shift Keying, Binary Frequency Shift Keying. Regenerative Repeater.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various digital modulation schemes. (L2)
- Analyze various digital modulation schemes. (L4)

UNIT – V (9 Hrs)

Communication Systems: Satellite, RADAR, Optical, Mobile and Computer Communication (Block diagram approach only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of various communication systems. (L2)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Principles of Communication Systems", Herbert Taub, Donald L Schilling and Goutam Saha, 3rd Edition, Tata McGraw-Hill Publishing Company Ltd., 2008.

REFERENCE BOOKS:

1. "Modern Digital and Analog Communication Systems", B. P. Lathi, Zhi Ding and Hari M. Gupta, 4th Edition, Oxford University Press, 2017.

2. "Digital and Analog Communication Systems", K. Sam Shanmugam, Wiley India Edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108104091
2. https://www.eeeguide.com/principles-of-communication-systems
3. https://ncert.nic.in/ncerts/l/leph207.pdf

Course Code	ELECTRONIC INSTRUMENTATION		L	T	P	C
21A040504			3	0	0	3
Pre-requisite	NIL	Semester	VI			

COURSE OBJECTIVES:

- To introduce various measuring instruments and their functionality.
- To teach various measurement metrics for performance analysis.
- To explain principles of operation and working of different electronic instruments.
- To familiarize the characteristics, operations, calibrations and applications of the different oscilloscopes and signal generators.
- To provide exposure to different types of transducers.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the different methods for measurement of various electrical quantities. **(K2)**
CO2: Compare the various measuring techniques for measuring voltage. **(K4)**
CO3: Measure amplitude and frequency utilizing oscilloscopes. **(K5)**
CO4: Analyze the functioning of various types of probes, derive the balanced condition for various bridges. **(K4)**
CO5: Measure various physical parameters by appropriately selecting the transducers. **(K5)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (10 Hrs)

Measurement and Error: Definitions, Accuracy, Precision, Resolution and Significant Figures, Types of Errors, Measurement error combinations. **Ammeters:** DC Ammeter, Multi-range Ammeter, The Ayrton Shunt or Universal Shunt, Requirements of Shunt, Extending of Ammeter Ranges, RF Ammeter (Thermocouple), Limitations of Thermocouple. **Voltmeters and Multi-meters:** Introduction, Basic Meter as a DC Voltmeter, DC Voltmeter, Multi range Voltmeter, Extending Voltmeter Ranges, Loading, AC Voltmeter using Rectifiers. True RMS Voltmeter, Multi-meter.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the importance of measurement system. (L2)
- Explain the characteristics of different Instruments. (L2)

- Illustrate different types of errors that may occur in instruments during measurements. (L2)

UNIT – II (9 Hrs)

Digital Voltmeters: Introduction, RAMP technique, Dual Slope Integrating Type DVM, Integrating Type DVM, Most Commonly used principles of ADC, Successive Approximations, Digit, Resolution and Sensitivity of Digital Meters, General Specifications of DVM.

Digital Instruments: Introduction, Digital Multi-meters, Digital Frequency Meter, Digital Measurement of Time, Universal Counter, Digital Tachometer, Digital pH Meter, Digital Phase Meter, Digital Capacitance Meter.

Learning Outcomes: At the end of this unit, students should be able to

- Explain working of digital measuring Instruments. (L2)
- Compare the various measuring techniques for measuring voltage. (L4)

UNIT – III (9 Hrs)

Oscilloscopes: Introduction, Basic principles, CRT features, Block diagram of Oscilloscope, Simple CRO, Vertical Amplifier, Horizontal Deflecting System, Sweep or Time Base Generator, Measurement of Frequency by Lissajous Method, Digital Storage Oscilloscope.

Signal Generators: Introduction, Fixed and Variable AF Oscillator, Standard Signal Generator, Laboratory Type Signal Generator, AF sine and Square Wave Generator, Function Generator.

Learning Outcomes: At the end of this unit, students should be able to

- Measure parameters viz. Amplitude, frequency and time period using CRO. (L5)
- Classify signal generators and describe its characteristics. (L2)

UNIT – IV (8 Hrs)

Measuring Instruments: Field Strength Meter, Stroboscope, Phase Meter, Q Meter, Megger.

Bridges: Introduction, Wheatstone‘s bridge, Kelvin‘s Bridge; AC bridges, Capacitance Comparison Bridge, Inductance Comparison Bridge, Maxwell‘s bridge, Wien‘s bridge.

Learning Outcomes: At the end of this unit, students should be able to

- Describe function of various measuring Instruments. (L2)
- Describe how unknown capacitance and inductance can be measured using bridges. (L2)
- Select appropriate bridge for measuring R, L and C parameters. (L2)
- Analyze the functioning of various types of probes derive the balanced condition for various bridges. (L4)

UNIT – V (9 Hrs)

Transducers: Introduction, Electrical transducers, Selecting a transducer, Resistive transducer, Resistive position transducer, Strain gauges, Resistance thermometer, Thermistor, Inductive

transducer, LVDT, Piezoelectric transducer, Photo cell, Photo voltaic cell, Semiconductor photo diode and transistor.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the importance of transducer. (L2)
- Measure various physical parameters by appropriately selecting the transducers. (L5)

TEXTBOOKS:

1. "Electronic Instrumentation", H. S. Kalsi, McGraw Hill, 3rd Edition, 2012, ISBN: 9780070702066.
2. "Modern Electronic Instrumentation and Measuring Techniques", A. D. Helfrick and W.D. Cooper, Pearson, 1st Edition, 2015, ISBN: 9789332556065.

REFERENCE BOOKS:

1. "Electronic Instrumentation & Measurements", David A. Bell, Oxford University Press PHI 2nd Edition, 2006 ISBN 81-203-2360-2.
2. "Electronics and Electrical Measurements", A. K. Sawhney, Dhanpat Rai &Sons. ISBN - 81-7700-016-0

ONLINE LEARNING RESOURCES:

1. http://nptel.ac.in/courses/108105064/
2. http://nptel.ac.in/courses/108105062/

OPEN ELECTIVE – III

Course Code	DISASTER MANAGEMENT AND MITIGATION		L	T	P	C
21A010503			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To obtain the basic knowledge of Environmental Hazards and disasters.
- To understand the basics of Endogenous and Exogenous hazards and gives a suitable picture on the different types of hazard and disaster mitigation methods.
- To understand the key concepts of disaster management related to development and the relationship of different disaster management activities.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze and evaluate the environmental, social, cultural, economic, legal and organizational Aspects influencing vulnerabilities and capacities to face disasters and to know about different types of environmental hazards. **(K4)**

CO2: Compute knowledge on different types of natural and man- made disasters. Work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery). **(K3)**

CO3: Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ. **(K3)**

CO4: Identify endogenous and exogenous hazards their harmful effects to the environment, Case studies of India. **(K1)**

CO5: Identify the regulatory controls used in hazard management. **(K1)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO2	3	3	3	3	-	-	2	1	-	-	2	-	2	-
CO3	3	3	3	3	-	-	2	2	-	-	2	-	2	-
CO4	3	3	2	3	-	-	2	2	-	-	2	-	2	-
CO5	3	3	2	3	-	-	2	1	-	-	2	-	3	-

UNIT – I (8 Hrs)

Environmental Hazards & Disasters: Meaning of Environmental hazards, Environmental Disasters and Environmental stress. Concept of Environmental Hazards, Environmental stress & Environmental Disasters. Different approaches & relation with human Ecology - Landscape Approach - Ecosystem Approach - Perception approach - Human ecology & its application in geographical researches.

Learning Outcomes: At the end of this unit, students should be able to

- Debate on the Knowledge of the disaster phenomenon, its different contextual aspects, impacts and public health consequences. (L5)
- Express about the natural hazards and its management. (L6)

UNIT – II (10 Hrs)

Types of Environmental hazards & Disasters: Natural hazards and Disasters - Man induced hazards & Disasters - Natural Hazards- Planetary Hazards/ Disasters - Extra Planetary Hazards/ disasters - Planetary Hazards- Endogenous Hazards - Exogenous Hazards

Learning Outcomes: At the end of this unit, students should be able to

- Explain the Capacity to manage the Public Health aspects of the disasters. (L4)
- Distinguish the different types of environmental hazards & disasters. (L5)

UNIT – III (9 Hrs)

Risk and Vulnerability: Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about the regulations of building codes and land use planning related to risk and vulnerability. (L4)
- Justify the financial management of disaster and related losses. (L6)

UNIT – IV (9 Hrs)

Exogenous hazards/ disasters - Infrequent events- Cumulative atmospheric hazards/ disasters Infrequent events: Cyclones – Lightning – Hailstorms Cyclones: Tropical cyclones & Local storms - Destruction by tropical cyclones & local storms (causes , distribution human adjustment, perception & mitigation)Cumulative atmospheric hazards/ disasters : - Floods- Droughts- Cold waves- Heat waves. Floods:- Causes of floods- Flood hazards India- Flood control measures (Human adjustment, perception & mitigation).Droughts:- Impacts of droughts- Drought hazards in India- Drought control measures.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the Mitigation and control measures of exogenous hazards. (L2)
- Analyze, and communicate information on risks, relief needs and order to formulate strategies for mitigation. (L4)

UNIT – V (9 Hrs)

Soil Erosion: - Mechanics & forms of Soil Erosion- Factors & causes of Soil Erosion- Conservation measures of Soil Erosion. Chemical hazards/ disasters:-- Release of toxic

chemicals, nuclear explosion- Sedimentation processes. Sedimentation processes:- Global Sedimentation problems- Regional Sedimentation problems- Sedimentation & Environmental problems- Corrective measures of Erosion & Sedimentation. Biological hazards/ disasters:- Population Explosion.

Learning Outcomes: At the end of this unit, students should be able to

- Relate their interconnections, particularly in the field of the Public Health aspects of the disasters. (L3)
- Understand different approaches to prevent disasters. (L2)

TEXTBOOKS:

1. "Disaster Management", Rajib Shah, Universities Press, India, 2003
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Disaster Mitigation: Experiences and Reflections", Pardeep Sahni
4. "Natural Hazards & Disasters", Donald Hyndman & David Hyndman, Cengage Learning.

REFERENCE BOOKS:

1. "The Environment as Hazards", Kates, B.I & White, G.F, Oxford Publishers, New York, 1978
2. "Disaster Management", R.B. Singh (Ed), Rawat Publication, New Delhi, 2000
3. "Disaster Management", H.K. Gupta (Ed), Universities Press, India, 2003
4. "Space Technology for Disaster Mitigation in India (INCED)", R.B. Singh, University of Tokyo, 1994.

ONLINE LEARNING RESOURCES:

1. http://ndma.gov.in
2. http://www.ndrf.gov.in

Course Code	RENEWABLE ENERGY SYSTEMS		L	T	P	C
21A020505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

COURSE OUTCOMES:

After completion of the course, the student will be able to:

CO1: Understand various alternate sources of energy for different suitable application requirements. **(K2)**

CO2: Understand the concepts of solar energy generation strategies and wind energy system. **(K2)**

CO3: Analyze Solar and Wind energy systems. **(K4)**

CO4: Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass, and fuel cells. **(K2)**

CO5: Understand the fundamentals of Solar and Wind energy systems. **(K2)**

CO-POMAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Solar Energy: Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. Flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding renewable and nonrenewable energy resources. (L2)
- Understand the various forms of conventional energy resources. (L2)
- Understanding of Solar power properties. (L2)

UNIT – II (8 Hrs)

PV Energy Systems: Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the PV cells and modules. (L2)
- Disseminate information on PV. (L3)

UNIT – III (10 Hrs)

Wind Energy: Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

Learning Outcomes: At the end of this unit, students should be able to

- Understanding of wind energy production. (L2)
- Outline division aspects and utilization of renewable energy sources for both domestics and industrial application. (L3)
- Understand the need of Wind Energy and the various components used in energy generation and know the classification. (L2)

UNIT – IV (8 Hrs)

Geothermal Energy: Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

Learning Outcomes: At the end of this unit, students should be able to

- Identify the Resources of geothermal energy.(L2)

UNIT – V (10 Hrs)

Miscellaneous Energy Technologies: Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations. Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of Biomass energy resources and their classification. (L2)
- Analyze the performance of Ocean Energy. (L4)

TEXTBOOKS:

1. "Renewable Energy Power for a Sustainable Future", Stephen Peake, Oxford International Edition, 2018.
2. "Non-Conventional Energy Sources", G. D. Rai, Khanna Publishers, 4th Edition, 2000.

REFERENCE BOOKS:

1. "Solar Energy", S. P. Sukhatme, Tata Mc Graw Hill Education Pvt. Ltd, 3rd Edition, 2008.
2. "Non-Conventional Energy Resources", B H Khan, Tata Mc Graw Hill Education Pvt Ltd, 2nd Edition, 2011.
3. "Non-Conventional Energy Resources", S. Hasan Saeed and D. K. Sharma, S. K. Kataria & Sons, 3rd Edition, 2012
4. "Renewable Energy Resource: Basic Principles and Applications", G. N. Tiwari and M. K. Ghosal, Narosa Publishing House, 2004

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/103103206
2. https://nptel.ac.in/courses/108108078

Course Code	CONCEPTS OF ELECTRICAL DRIVES AND APPLICATIONS		L	T	P	C
21A020506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- The operation of electric motor drives controlled by power electronic converters.
- The stable steady-state operation and transient dynamics of a motor-load system.
- The operation of the chopper fed DC drive.
- The distinguishing features of synchronous motor drives and induction motor drives.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Identify the choice of the electric drive system based on their applications. **(K2)**

CO2: Explain the operation of single and multi-quadrant electric drive. **(K3)**

CO3: Analyze single phase and 3-phase rectifiers fed DC motors and chopper fed DC motors. **(K4)**

CO4: Explain the speed control methods for AC-AC & DC-AC converters fed to Induction motors with closed loop, and open loop operations. **(K3)**

CO5: Explain the speed control methods for AC-AC & DC-AC converters fed to Synchronous motors with closed loop, and open loop operations. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	2	2	3	1	-	-	-	1	3	2
CO2	3	2	1	-	2	2	2	-	-	-	-	1	3	2
CO3	3	2	1	-	2	2	1	-	-	-	-	-	3	2
CO4	3	2	1	-	2	2	-	-	-	-	-	1	3	2
CO5	3	2	1	-	2	2	2	-	-	-	-	1	3	2

UNIT – I (9 Hrs)

Converter Fed DC Motors: Classification of Electric Drives, Basic elements of Electric Drive, Dynamic Control of a Drive system, Stability analysis, Introduction to Thyristor Controlled Drives, Single Phase semi and fully controlled converters connected to D.C Separately Excited and D.C Series Motors – Continuous Current Operation – Output Voltage and Current Waveforms – Speed and Torque Expressions – Speed – Torque Characteristics.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basic electrical drive elements and its function. (L2)
- Analyze the single-phase dc drives and its speed-torque characteristics. (L4)
- Analyze the three phase dc drives and its speed-torque characteristics (L4)

UNIT – II (9 Hrs)

Four Quadrant Operation of DC Drives: Introduction to Four Quadrant Operation – Motoring Operations, Electric Braking – Plugging, Dynamic and Regenerative Braking Operations. Four Quadrant Operation of D.C Motors by Dual Converters – Closed Loop Operation of DC Motor (Block Diagram Only).

Learning Outcomes: At the end of this unit, students should be able to

- Understand the four-quadrant operation of the dc drives. (L2)
- Analyze the various motoring and braking operations of the dc motors. (L4)
- Understand the closed loop operation of the dc drives. (L2)

UNIT – III (9 Hrs)

Chopper fed DC Motors: Single Quadrant, Two Quadrant and Four Quadrant Chopper Fed DC Separately Excited and Series Excited Motors – Continuous Current Operation – Output Voltage and Current Wave Forms – Speed Torque Expressions – Speed Torque Characteristics– Problems on Chopper Fed D.C Motors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the basics concepts of choppers and its operation. (L2)
- Analyze the classification of various choppers feeding the dc drives. (L4)

UNIT – IV (9 Hrs)

Control of Induction Motor: Induction Motor Stator Voltage Control and Characteristics. AC Voltage Controllers–Waveforms – Speed Torque Characteristics - Stator Frequency Control and characteristics. Voltage Source and Current Source Inverter – Comparison of VSI and CSI Operations – Speed Torque Characteristics – Static Rotor Resistance Control

Learning Outcomes: At the end of this unit, students should be able to

- Understand the various speed control methods of induction motor used in drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods to induction motor on rotor side. (L3)

UNIT – V (9 Hrs)

Control of Synchronous Motors: Separate Control & Self Control of Synchronous Motors – Operation of Self-Controlled Synchronous Motors by VSI and CSI. Load Commutated CSI Fed Synchronous Motor – Operation – Waveforms – Speed Torque Characteristics – Applications – Advantages.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the self and separate control methods of synchronous motor drives. (L2)
- Analyze the voltage source and current source inverters used in AC drives. (L4)
- Apply the various speed control methods of synchronous motors. (L4)

TEXTBOOKS:

1. "Power semiconductor-controlled drives", G K Dubey, Prentice Hall, 1995.
2. "Modern Power Electronics and AC Drives", B. K. Bose, PHI, 2002.

REFERENCE BOOKS:

1. "Power Electronics", MD Singh and K B Khanchandani, Tata McGraw-Hill Publishing company, 2008.
2. "Power Electronic Circuits, Devices and applications", M. H. Rashid, PHI, 2005.
3. "Electric drives Concepts and Applications", Vedam Subramanyam, Tata McGraw Hill Publications, 2nd Edition, 2011.

Course Code	OPTIMIZATION TECHNIQUES		L	T	P	C
21A030505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce the basic fundamentals of optimization methods that can be used during a design process.
- To expose the students to different modern optimization techniques.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand basic theoretical principles of optimization models and its solution. **(K2)**
CO2: Formulate the given practical problem and solving by graphical /simplex method. **(K3)**
CO3: Analyse the cost for transportation and assigning the jobs to machines. **(K3)**
CO4: Analyse the cost and duration of the project, also preparation of job scheduling. **(K3)**
CO5: Use latest methods for optimization. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	-	2	-	-	1	2	2	1	-	-
CO2	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO3	3	3	3	3	-	2	-	-	1	-	2	1	-	-
CO4	3	3	3	3	-	2	-	1	1	-	2	1	-	-
CO5	3	3	3	3	2	2	-	-	2	-	2	1	-	-

UNIT – I (10 Hrs)

Introduction to Optimization: Classification of Optimization, Design vector and constraints, Constraint surface, Objective function, Classification of Optimization Problems.

Classical Optimization Techniques: Single variable optimization, Multi-variable: Direct substitution method, Lagrange's method of multipliers, Karush-Kuhn-Tucker conditions

***Learning Outcomes*:** At the end of this unit, students should be able to

- Explain how to formulate statement of optimization problem with or without constraints. (L3)
- Explain about classification of single and multivariable optimization problems. (L3)
- Know about necessary and sufficient conditions in defining the optimization problems. (L1)
- Understand how to formulate Kuhn-Tucker conditions and to solve numerical problems. (L3)

UNIT – II (8 Hrs)

Linear Programming: Statement of an LP problem, Graphical Solution of an LP problem, Simplex method, Two phase method, Dual simplex method.

Learning Outcomes: At the end of this unit, students should be able to

- Formulation of problem as LPP. (L4)
- Solve numerical problems with graphical method, Simplex method, two phase method and dual simplex method. (L4)

UNIT – III (9 Hrs)

Transportation Problems: Introduction, Optimal Solution for BFS, Unbalanced Transportation Problem, Transshipment, Assignment Problems, Hungarian Method.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Model linear programming problems like the transportation. (L6)
- Solve the problems of transportation from origins to destinations with minimum time and cost. (L3)
- Solve assignment problems. (L4)

UNIT – IV (10 Hrs)

Project Management: Introduction, Critical Path Method, Critical Path Determination, Optimal Scheduling by CPM, Project Evaluation and Review Technique.

Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

Learning Outcomes: At the end of this unit, students should be able to

- Represent any project in the form of a network and estimate the parameters like Project Completion Time, Project Costs, and Optimum Duration of the Project. (L4)
- Probabilities of completing Projects as per schedule etc by applying either CPM or PERT technique as per the suitability. (L4)
- Solve problems of production scheduling. (L3)

UNIT – V (8 Hrs)

Modern Methods of Optimization: An overview of evolutionary algorithms, Genetic algorithms, simulated annealing, fuzzy optimization, neural-network based methods, Particle swarm optimization.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Solve the numerical problems using modern optimization techniques. (L4)

TEXTBOOKS:

1. "Engineering Optimization- Methods and Applications", A. Ravindran, K. M. Ragsdell, G.V. Reklaitis, Wiley India Edition, 2nd Edition.
2. "Operations Research: An Introduction", H.A. Taha, PHI Pvt. Ltd., 6th Edition

REFERENCE BOOKS:

1. "Introduction to Optimum Design", J S Arora, Mc-Graw Hill.
2. "Optimization Methods for Engineering Design", Fox, R. L., Addison Wesley, 2001.
3. "Multi-objective optimization using evolutionary algorithms", K Deb John Wiley Publications.
4. "Operations Research", Dr. J. K. Sharma, Mc Millan.
5. "Engineering Optimization: Theory and Practice", Singiresu S. Rao, John Wiley & Sons

Course Code	GLOBAL WARMING AND CLIMATE CHANGES		L	T	P	C
21A030506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To know the basics, importance of global warming.
- To know the concepts of mitigation measures against global warming
- To know the impacts of climate changes

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Know the impact of Ozone layer on green house effect and global warming. **(K1)**
CO2: Understand the structure of atmosphere and effects of inversion on pollution dispersion. **(K2)**
CO3: Know the effect of global warming and climatic changes on environment. **(K1)**
CO4: Understand Global change in temperature and climate and measures to reduce the effect. **(K2)**
CO5: Understand the clean technology, use of renewable energy, mitigation technologies and their practices **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO5	1	2	-	2	-	-	-	-	2	-	-	2	-	-

UNIT – I (7 Hrs)

EARTH'S CLIMATE SYSTEM:

Introduction to environment, Ozone, ozone layer and its functions, Ozone depletion and ozone hole, Vienna convention and Montreal protocol, Green house gases and green house effect, Hydrological cycle and Carbon cycle, Global warming and its impacts

Learning Outcomes: At the end of this unit, students should be able to

- Identity the importance of Ozone and effect of green house gases. (L1)
- Know the effect of global warming. (L1)

UNIT – II (9 Hrs)

ATMOSPHERE & ITS COMPONENTS: Atmosphere and its layers-Characteristics of Atmosphere - Structure of Atmosphere - Composition of Atmosphere - Atmospheric stability -

Temperature profile of the atmosphere - Temperature inversion and effects of inversion on pollution dispersion.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the layers of atmosphere and their characteristics. (L1)

UNIT – III (8 Hrs)

IMPACTS OF CLIMATE CHANGE: Causes of Climate change - Change of Temperature in the environment - Melting of ice and sea level rise - Impacts of Climate Change on various sectors - Projected impacts for different regions, uncertainties in the projected impacts and risk of irreversible changes.

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and its effects on various sectors. (L1)

UNIT – IV (10 Hrs)

OBSERVED CHANGES AND ITS CAUSES: Climate change and Carbon credits-Clean Development Mechanism (CDM), CDM in India - Kyoto Protocol - Intergovernmental Panel on Climate Change (IPCC) - Climate Sensitivity - Montreal Protocol - United Nations Framework Convention on Climate Change (UNFCCC) - Global change in temperature and climate and changes within India

Learning Outcomes: At the end of this unit, students should be able to

- Know about the causes of climate change and carbon credits, effect of change in temperature and climate on India. (L1)

UNIT – V (11 Hrs)

CLIMATE CHANGE AND MITIGATION MEASURES: CDM and Carbon Trading - Clean Technology, biodiesel, compost, biodegradable plastics - Renewable energy usage as an alternative - Mitigation Technologies and Practices within India and around the world - Non-renewable energy supply to all sectors - Carbon sequestration - International and regional cooperation for waste disposal biomedical wastes, hazardous wastes, e-wastes, industrial wastes, etc.,

Learning Outcomes: At the end of this unit, students should be able to

- Know about the clean technology, use of renewable energy, mitigation technologies and their practices. (L1)

TEXTBOOKS:

1. "Climate Change – An Indian Perspective", Dash Sushil Kumar, Cambridge University Press India Private limited 2007.

REFERENCE BOOKS:

1. "Adaptation and mitigation of climate change-Scientific Technical Analysis", Cambridge University Press, Cambridge, 2006.
2. "Atmospheric Science", J.M. Wallace and P.V. Hobbs, Elsevier / Academic Press 2006.
3. "Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Jan C. van Dam, Cambridge university press, 2003.
4. "Global Warming: Understanding the Forecast"", David Archer, Wiley, 2nd Edition, 2011
5. "Global Warming: The Complete Briefing", John Houghton, Cambridge University Press, 5th Edition, 2015

Course Code	ELECTRONIC SENSORS		L	T	P	C
21A040505			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To learn the characterization of sensors.
- To know the working of Electromechanical, Thermal, Magnetic and radiation sensors
- To understand the concepts of Electro analytic and smart sensors
- To be able to use sensors in different applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain the Principles of different sensors, Characterization and working of Electro mechanical Sensors. **(K3)**

CO2: Analyze the working of Thermal sensors. **(K4)**

CO3: Compare the working of magnetic resistor and hall effect sensors. **(K4)**

CO4: Explain the working of radiation and Electro analytic Sensors. **(K3)**

CO5: Develop a system with smart sensors. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	-	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	-	-	-	-	-	-	-	-	-	3	3	2

UNIT – I (9 Hrs)

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization.

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of sensors/Transducers principles. (L2)
- Understand the concepts of Electro mechanical sensors. (L2)
- Identify the operation of Inductive and capacitive sensors. (L3)

UNIT – II (9 Hrs)

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor, Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer, Nuclear Thermometer, Magnetic Thermometer, Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of Thermal sensors. (L2)
- Understand the working of Thermal radiation sensors. (L2)
- Identify the types of semiconductor sensors. (L3)
- Analyse the operation of heat flux sensors. (L4)

UNIT – III (9 Hrs)

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the principles of Magnetic sensors. (L2)
- Summarize the concepts of Angular transducers. (L2)
- Compare the working of magnetic resistor and Hall effect sensors. (L4)

UNIT – IV (9 Hrs)

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors, Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of radiation sensors. (L2)
- Summarize the types of photo detectors. (L2)
- Explain different electrodes and sensors. (L3)

UNIT – V (9 Hrs)

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications, Introduction- On-board Automobile

Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts of smart sensors. (L2)
- Summarize the applications of automation sensor. (L2)
- Develop different sensors used in the industries and manufacturing. (L3)

TEXTBOOKS:

1. "Sensors and Transducers", D. Patranabis, PHI Learning Private Limited., 2003.
2. "Introduction to sensors", John veteline, Aravind Raghu, CRC press, 2011

REFERENCE BOOKS:

1. "Sensors and Actuators", D. Patranabis, PHI, 2nd Edition, 2013.
2. "Make sensors", Tero Karvinen, Kimmo Karvinen and Ville Valtokari, Maker media, 1st Edition, 2014.
3. "Sensors handbook", Sabrie Soloman, TMH, 2nd Edition, 2009

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108147
2. http://www.nitttrc.edu.in/nptel/courses/video/101104066/101104066.html

Course Code	INTRODUCTION TO IMAGE PROCESSING		L	T	P	C
21A040506			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce fundamentals of Image Processing.
- To expose various intensity transformations in spatial and frequency domains.
- To impart concepts of wavelets and various coding techniques for image compression.
- To dissimilate various segmentation techniques for images.
- To teach various color models and to introduce the concepts of color image segmentation.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Analyze various types of images mathematically. **(K4)**
CO2: Compare image enhancement methods in spatial and frequency domains. **(K3)**
CO3: Apply various segmentation algorithms for processing an image. **(K3)**
CO4: Categorize various compression techniques and color models. **(K4)**
CO5: Apply various techniques for color image smoothing, sharpening and segmentation. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	3	-	-	-	-	-	-	3	3	-
CO5	3	3	2	-	3	-	-	-	-	-	-	3	3	-

UNIT – I (9 Hrs)

Digital Image Fundamentals: Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels: neighbourhood, adjacency, connectivity, distance measures. Mathematical tools/ operations applied on images.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the basic building blocks of image processing. (L2)
- Define image processing parameters such as adjacency and distance measures. (L1)
- Analyze various types of images mathematically. (L4)

UNIT – II (9 Hrs)

Image Enhancements and Filtering: Gray level transformations, histogram equalization and specifications, pixel-domain smoothing filters – linear and order-statistics, pixel-domain

sharpening filters – first and second derivative, two-dimensional DFT and its inverse, frequency domain filters – low-pass and high-pass.

Learning Outcomes: At the end of this unit, students should be able to

- Apply spatial domain and frequency Domain filtering techniques for image enhancement (L3)
- Compare image enhancement methods in spatial and frequency domains. (L3)

UNIT – III (9 Hrs)

Image Segmentation: Detection of discontinuities, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various Image segmentation techniques. (L2)
- Illustrate detection of discontinuities in an image. (L2)
- Apply various segmentation algorithms for processing an image. (L3)

UNIT – IV (9 Hrs)

Image Compression: Redundancy, inter-pixel and psycho-visual; Loss less compression-predictive, entropy; Lossy compression- predictive and transform coding; Discrete Cosine Transform; Still image compression standards – JPEG and JPEG-2000.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various transform techniques for lossy compression. (L2)
- Apply various coding techniques for lossless compression. (L3)

UNIT – V (9 Hrs)

Color Image Processing: Color models–RGB, YUV, HSI; Color transformations– formulation, color complements, color slicing, tone and color corrections; Color image smoothing and sharpening; Color Segmentation.

Learning Outcomes: At the end of this unit, students should be able to

- Describe various color models for color image processing. (L2)
- Apply various techniques for color image smoothing, sharpening and segmentation. (L3)

TEXTBOOKS:

1. "Digital Image Processing", R.C. Gonzalez and R.E. Woods, Pearson Education, 2nd Edition, 2008.
2. "Fundamentals of Digital Image Processing", Anil Kumar Jain, Prentice Hall of India, 2nd Edition 2004.

REFERENCE BOOKS:

1. "Digital Image processing using MATLAB", Rafael C. Gonzalez, Richard E woods and Steven L. Eddins, Tata McGraw Hill, 2010.
2. "Image Processing, Analysis, and Machine Vision", Milan Sonka, Vaclav Hlavac, Roger Boule, Cengage Learning, 3rd Edition, 2016.
3. "Digital Image processing", S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
4. "Digital Image Processing", William K. Pratt, John Wiley, 3rd Edition, 2004.

ONLINE LEARNING RESOURCES:

1. https://www.udemy.com/course/learn-image-analysis/
2. https://alison.com/tag/image-processing
3. https://nptel.ac.in/courses/117/105/117105135/

OPEN ELECTIVE – IV

Course Code	COST EFFECTIVE HOUSING TECHNIQUES		L	T	P	C
21A010504			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To train the students to have a comprehensive knowledge of planning, design, evaluation, construction
- To train the students to financing of housing projects
- To Provide Knowledge on cost effective construction materials and methods.
- To teach the principles of sustainable housing policies and programmes.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand about planning, design, evaluation, construction and financing of housing projects with cost effective housing techniques. **(K2)**

CO2: Choose the basic housing programmes and services and slum improvement and relocation. **(K3)**

CO3: The student can be in a position to adopt the suitable techniques in construction of low cost constructions. **(K6)**

CO4: Understand about alternate building materials for low cost housing techniques and sanitation services in rural areas. **(K2)**

CO5: The student can be in a position to analyze the suitable techniques in rural and disaster prone areas by using locally available materials. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO2	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO2	2	2	2	-	-	2	2	-	-	-	-	-	2	2
CO4	2	2	2	2	-	2	-	-	-	-	-	-	2	2
CO5	2	2	2	2	-	2	2	-	-	-	-	-	2	2

UNIT – I (9 Hrs)

INTRODUCTION TO HOUSING: Definition of Basic Terms – House, Home, Household, Apartments, Multi storied Buildings, Special Buildings, Objectives and Strategies of National Housing Policies including Slum Housing Policy, Principle of Sustainable Housing – Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for Housing at National, State and Local levels.

Learning Outcomes: At the end of this unit, students should be able to

- Explain the about basics about housing norms. (L4)

- Understand the objectives and strategies of housing policies. (L2)

UNIT – II (9 Hrs)

HOUSING PROGRAMMES: Basic Concepts, Contents and Standards for Housing Programmes - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative Housing, Slum Housing Programmes – Slum improvement – Slum redevelopment and Relocation – Use of GIS and MIS in Slum Housing Projects,, Role of Public housing agencies, and Private sector in supply, quality, infrastructure and pricing – Role of Non-Government Organizations in slum housing.

Learning Outcomes: At the end of this unit, students should be able to

- Differentiate the usage of GIS and MIS in housing projects. (L4)
- Explain about development of plots and gated communities. (L4)

UNIT – III (9 Hrs)

DEVELOPMENT AND ADOPTION OF LOW COST HOUSING TECHNOLOGY: Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements - Adopting of total prefabrication of mass housing in India- General remarks on pre cast rooting/flooring systems -Economical wall system - Single Brick thick loading bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall - Fly ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and join system for roof/floor in the building

Learning Outcomes: At the end of this unit, students should be able to

- Write about the adoption of Economical Wall System. (L6)
- Write about Adoption of precast R.C. plank and join system for roof/floor in the building. (L6)

UNIT – IV (9 Hrs)

ALTERNATIVE BUILDING MATERIALS FOR LOW COST HOUSING AND INFRASTRUCTURE SERVICES IN RURAL HOUSES: Introduction - Substitute for scarce materials – Ferrocement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - Low cost Infrastructure services: Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy. Rural Housing**:** Introduction traditional practice of rural housing continuous - Mud Housing technology-Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs.

Learning Outcomes: At the end of this unit, students should be able to

- Determine about alternate building materials for low cost housing construction. (L3)

- Justify about low cost sanitation from traditional methods. (L6)

UNIT – V (9 Hrs)

HOUSING IN DISASTER PRONE AREAS: Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirements of structural safety of thin pre-cost roofing units against Earthquake forces -Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety.

Learning Outcomes: At the end of this unit, students should be able to

- Explain about Type of Damages and Railways of non-engineered buildings. (L4)
- Express about Repair and restore action of earthquake Damaged structures and for future constructions. (L6)

TEXTBOOKS:

1. "Hand book of Low Cost Housing", A. K. Lal, New Age International publishers.
2. "Low Cost Housing", G.C. Mathur, IBH Publishers.
3. "Housing in India", Francis Cherunilam and Odeyar D Heggade, Himalaya Publishing House, Bombay, 1997.

REFERENCE BOOKS:

1. "Disaster Management", Rajib Shaw, Universities Press, India.
2. "Disaster Science and Management", Tushar Bhattacharya, TMH Publications.
3. "Building Materials For Low–Income Houses", International Council For Building Research Studies And Documentation.
4. "Modern Trends In Housing In Developing Countries", A.G. Madhava Rao, D.S. Rama Chandra Murthy & G. Annamalai.
5. "Properties of Concrete"', Neville A.M. Pitman Publishing Limited, London.
6. "Light Weight Concrete", Academic Kiado, Rudhai.G, Publishing home of Hungarian Academy of Sciences, 1963.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/124107001
2. https://nptel.ac.in/courses/105103206
3. https://onlinecourses.nptel.ac.in/noc20_ar14/preview4

Course Code	ENERGY CONSERVATION AND MANAGEMENT		L	T	P	C
21A020507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Familiarize present energy scenario, and energy auditing methods.
- Explain components of electrical systems, lighting systems and improvements in performance. Demonstrate different thermal systems, efficiency analysis, and energy conservation methods.
- Train on energy conservation in major utilities.
- Instruct principles of energy management and energy pricing.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Explain Energy Utilization and Energy Auditing Methods. **(K3)**

CO2: Analyse Electrical Systems Performance of Electric Motors and Lighting Systems. **(K4)**

CO3: Examine Energy Conservation Methods in Thermal Systems. **(K3)**

CO4: Estimate Efficiency of Major Utilities Such as Fans, Pumps, Compressed Air Systems, Havoc and D.G. Sets. **(K2)**

CO5: Elaborate Principles of Energy Management, Programs, Energy Demand and Energy Pricing. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	2	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	3	-	-	-	-	-	-	-	2	1	-
CO5	-	3	2	2	-	-	-	-	-	-	-	1	1	-

UNIT – I (9 Hrs)

Introduction: Energy – Power – Past & Present Scenario of World; National Energy Consumption Data – Environmental Aspects Associated with Energy Utilization –Energy Auditing: Need, Types, Methodology And Barriers. Role of Energy Managers, Instruments for energy auditing.

Learning Outcomes: At the end of this unit, students should be able to

- Infer energy consumption patterns and environmental aspects of energy utilization. (L4)
- Outline energy auditing requirements, tools, and methods. (L3)
- Identify the function of energy manager. (L2)

UNIT – II (9 Hrs)

Electrical Systems: Components of EB Billing – HT And LT Supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors – Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of Lighting, Efficacy, LED Lighting And Scope Of Economy In Illumination.

Learning Outcomes: At the end of this unit, students should be able to

- Outline components of electricity billing, transmission, and distribution. (L3)
- Analyse performance characteristics of transformers, capacitors, and electric motors. (L4)
- Examine power factor improvements, and electric motor efficiency. (L3)
- Evaluate lighting systems. (L4)

UNIT – III (9 Hrs)

Thermal Systems: Stoichiometry, Boilers, Furnaces, and Thermic Fluid Heaters – Efficiency Computation and Encon Measures. Steam: Distribution & Usage: Steam Traps, Condensate Recovery, Flash Steam Utilization, and Insulators & Refractory's.

Learning Outcomes: At the end of this unit, students should be able to

- Determine efficiency of boilers, furnaces, and other thermal systems. (L3)
- Recommend energy conservation measures in thermal systems. (L2)
- Justify steam systems in energy conservation. (L3)

UNIT – IV (9 Hrs)

Energy Conservation in Major Utilities: Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. Sets.

Learning Outcomes: At the end of this unit, students should be able to

- Explain energy conservation measures in major utilities. (L3)
- Apply performance test criteria for fans, pumps, compressors, havoc systems. (L3)
- Assess energy conservation in cooling towers and D.G. sets. (L3)

UNIT – V (9 Hrs)

Energy Management: Principles of Energy Management, Energy demand estimation, Organizing and Managing Energy Management Programs, Energy pricing.

Learning Outcomes: At the end of this unit, students should be able to

- Describe principles of energy management. (L2)
- Assess energy demand and forecast, organize energy management programs. (L3)
- Design elements of energy pricing. (L5)

TEXTBOOKS:

1. "Energy Manager Training Manual", A Website Administered by Bureau of Energy Efficiency (BEE), A Statutory Body Under Ministry Of Power, Government of India, 2004, 4 Volumes Available at ww.energymanagertraining.com

REFERENCE BOOKS:

1. "Industrial Energy Management and Utilisation", Witte. L.C., P.S. Schmidt, D.R. Brown, Hemisphere Publication, Washington, 1988.
2. "Design and Management for Energy Conservation", Callaghn, P.W., Pergamon Press, Oxford, 1981
3. "The Efficient Use of Energy", Dryden. I.G.C., Butter worths, London, 1982
4. "Energy Management", Murphy. W. R. and G. Mc Kay, Butter worths, London 1987

Course Code	BASICS OF POWER ELECTRONICS		L	T	P	C
21A020508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- Understand the differences between signal level and power level devices.
- Analyze controlled rectifier circuits.
- Analyze the operation of DC-DC choppers.
- Analyze the operation of voltage source inverters

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the operation, characteristics, and usage of power semiconductor devices. **(K2)**
CO2: Understand different types of Rectifier circuits with different operating conditions. **(K2)**
CO3: Understand DC-DC converters operation and analysis of their characteristics. **(K2)**
CO4: Understand the construction and operation of voltage source inverters. **(K2)**
CO5: Apply all the above concepts to solve various numerical problem solving. **(K3)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	1	-	-	-	-	-	-	-	-	1	-
CO3	3	3	1	1	-	-	-	-	-	-	-	-	1	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO5	2	3	1	1	-	-	-	-	-	-	-	-	1	-

UNIT – I (9 Hrs)

Power Switching Devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET, IGBT and GTO.

Learning Outcomes: At the end of this unit, students should be able to

- Know the V-I characteristics of different semi-conductor devices. (L4)
- Importance of drive circuit for MOSFET, IGBT and GTO. (L3)

UNIT – II (9 Hrs)

Rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape, power factor and effect of source inductance.

Learning Outcomes: At the end of this unit, students should be able to

- Derivation of expressions of different configurations of rectifiers. (L3)
- Calculate the Average, R.M.S values of Voltages and Currents. (L4)

UNIT – III (8 Hrs)

DC-DC converters: Elementary chopper with an active switch and diode, concepts of duty ratio, control strategies and average output voltage: Power circuit, analysis and waveforms at steady state, duty ratio control and average output voltage of Buck, Boost and Buck- Boost Converters.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of duty cycle. (L2)
- Analysis of waveforms at steady state of power circuit. (L4)
- Derivation of average output voltage of DC-DC converter. (L3)

UNIT – IV (9 Hrs)

Inverter: Single phase Voltage Source inverters– operating principle - steady state analysis, Simple forced commutation circuits for bridge inverters –Voltage control techniques for inverters and Pulse width modulation techniques, single phase current source inverter with ideal switches, basic series inverter, single phase parallel inverter – basic principle operationally.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of pulse width modulation. (L2)
- Analysis of waveforms of single phase and three phase bridge inverters. (L4)

UNIT – V (10 Hrs)

AC voltage controllers & Cyclo converters: voltage controllers – Principle of phase control – Principle of integral cycle control - Single phase two SCRs in anti-parallel – With R and RL loads – modes of operation of TRIAC – TRIAC with R and RL loads– RMS load voltage, current and power actor-waveforms. Cyclo converters - Midpoint and Bridge connections - Single phase to single phase step-up and step-down Cyclo converters with Resistive load, Principle of operation, Waveforms, output voltage.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of the phase control and integral cycle control. (L2)
- Know the principal operation of voltage and frequency converter. (L4)
- Analysis waveforms of ac voltage converter and Cyclo converter. (L4)

TEXTBOOKS:

1. "Power Electronics: Circuits, Devices and Applications", M. H. Rashid, Prentice Hall of India, 2nd Edition, 1998

2. "Power Electronics", P. S. Bimbhra, Khanna Publishers, 4th Edition, 2010.
3. "Power Electronics", M. D. Singh & K. B. Khanchandani, Tata Mc Graw Hill Publishing Company, 1998.

REFERENCE BOOKS:

1. "Power Electronics", Ned Mohan, Wiley, 2011
2. "Fundamentals of Power Electronics", Robert W. Erickson and Dragan Maksimovic, Kluwer Academic Publishers, 2nd Edition, 2004
3. "Power Electronics", Vedam Subramanyam, New Age International (P) Limited, 1996.
4. "Power Electronics", V. R. Murthy, Oxford University Press, 1st Edition, 2005.
5. "Power Electronics", P. C. Sen, Tata Mc Graw-Hill Education, 1987
6. "Power Electronic Control of Alternating Current Motors", J. M. D. Murphy.

Course Code	BASICS OF AUTOMOTIVE ENGINEERING		L	T	P	C
21A030507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To introduce various components of an automobile and engine sub systems.
- To impart knowledge on various safety systems of an automobile and emission norms.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Describe the various components of an automobile and Working of fuel supply system. **(K2)**
CO2: Know the working of various lubrication and cooling systems. **(K1)**
CO3: Familiarize with the various systems such as ignition system and transmission system. **(K2)**
CO4: Explain the suspension, braking systems of an automobile and their differences. **(K2)**
CO5: Know about the emissions from engine and safety norms for the operation of an automobile. **(K2)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	-	-	-	-	-	-	-	-	-
CO2	2	2	3	2	3	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	-	-	-
CO4	3	3	2	3	2	-	-	-	-	-	-	-	-	-
CO5	3	3	2	2	3	-	-	-	-	-	-	-	-	-

UNIT – I (9 Hrs)

Introduction: classification of automobiles, Components of four wheeler automobile- chassis, body, power unit, power transmission- front wheel drive, rear wheel drive, four-wheel drive

Fuel supply systems: simple fuel supply system in petrol and diesel engines. Working of simple Carburetor, direct fuel injection system in diesel engine.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the parts of automobile engines. (L2)
- Understand the concept of fuel supply systems. (L2)

UNIT – II (7 Hrs)

Lubricating System: Functions & properties of lubricants, methods of lubrication splash, pressure, dry sump and wet sump lubrication.

Cooling System: Necessity, methods of cooling - air cooling & water cooling, components of water cooling, radiator, thermostat.

Learning Outcomes: At the end of this unit, students should be able to

- Analyze the function of Lubricating system. (L3)

UNIT – III (10 Hrs)

Ignition System: Functions, requirements, types of an ignition system, battery ignition system - components, Magneto ignition system, Electronic ignition system.

Transmission system: Types and functions of the clutches- single plate clutch, multi plate clutch, centrifugal and semi centrifugal clutch, Types of gear boxes- Sliding mesh, Constant mesh, Synchromesh, propeller shaft, universal joint and differential.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the concept of Ignition system and its types. (L2)
- Understand the concept of Transmission system. (L2)

UNIT – IV (10 Hrs)

Suspension System: Objectives of suspension system, front suspension system rigid axle suspension system, independent suspension system, rear axle suspension, torsion bar, shock absorber.

Braking System: Mechanical brakes, hydraulic brakes-master cylinder, wheel cylinder, tandem master cylinder, brake fluid, air brakes and vacuum brakes.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand the working of suspension system and its types. (L2)
- Analyze the different types of braking systems. (L3)

UNIT – V (9 Hrs)

Emissions from Automobile: Emission norms - Bharat stage and Euro norms. Engine emissions - exhaust and non-exhaust.

Safety Systems: seat belt, air bags, bumper, antilock brake system (ABS), wind shield, suspension sensor, traction control, central locking, electric windows, speed control.

***Learning Outcomes*:** At the end of this unit, students should be able to

- Understand emission concept in automobiles engines. (L2)
- Understand the concept of safety system. (L2)

TEXTBOOKS:

1. "Automobile Engineering Vol-1 & vol-2", Kirpal Singh, Standard Publishers Distributors, 11th Edition.
2. "Automotive Mechanics", William H Crouse & Donald LAnglin, Tata Mc Graw Hill Publications, 10th Edition.
3. "Automobile Engineering", Rajput, Laxmi Publications.

REFERENCE BOOKS:

1. "Automobile Engineering", R.B Gupta, Satya Prakashan Publications, 6th Edition.
2. "The Motor vehicle", Newton steeds & Garrett, Society of Automotive Engineers, 13th Edition.
3. "Automotive Engineering", G.B.S. Narang, Khanna Publishers, 5th Edition.
4. "Automotive Mechanics", Joseph Heitner, IPC Transport Press Ltd, 2nd Edition.
5. "The Automobile", Harbans Singh Reyat, S. Chand & company Pvt. Ltd., 6th Edition.

Course Code	BASICS OF TOTAL QUALITY MANAGEMENT		L	T	P	C
21A030508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concept of quality, cost of quality, international quality standards.
- To learn the principles of Total quality management, techniques for problem solving.
- To learn about various tools of quality management used in various industrial applications.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts of Quality and Quality Control Techniques. **(K2)**
CO2: Understand TQM concepts and History and able to use quality tools for problem solving. **(K2)**
CO3: Use TQM techniques and to formulate quality circles to find solutions with team work. **(K2)**
CO4: Apply various TQM Methods to solve problems in industry. **(K3)**
CO5: Analyze various quality problems and contribute towards continuous improvement in the system. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	1	1	-	-	-	-	2	-	-	-	-
CO2	1	2	-	-	-	-	2	-	-	-	-	-	-	-
CO3	1	3	-	2	-	-	-	-	2	-	-	-	-	-
CO4	1	2	-	2	2	2	-	2	-	-	-	2	-	-
CO5	1	-	-	-	-	2	-	-	-	-	-	2	-	-

UNIT – I (9 Hrs)

Inspection & Quality Control

Statistical Quality Control (SQC) – Techniques - variables and attributes Control charts : $\bar{X}$ - R Charts, P-Chart, C-Chart. Acceptance Sampling – Single and Double sampling Plan - OC Curves. BIS and ISO Standards – Importance.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various Control charts: $\bar{X}$ - R Charts, P-Chart, C-Chart, single and double sampling plans and BIS&ISO standards. (L1)

UNIT – II (8 Hrs)

TQM – concepts, History-Quality management philosophies-Juran, Deming, Crosby, Feigenbaum, Ishikawa– Stages of Evolution– continuous improvement – internal and external customers - TQM tools & techniques- 7 QC tools- 7 New QC tools.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various quality management philosophies, Evaluation of TQM, TQM tools and technologies. (L1)

UNIT – III (10 Hrs)

Problem solving process – corrective action – order of precedence – System failure analysis approach – flow chart – fault tree analysis – failure mode assessment and assignment matrix – organizing failure mode analysis – pedigree analysis, Quality circles – organization – team approach.

Learning Outcomes: At the end of this unit, students should be able to

- Analyse Problem solving process, system failure analysis, fault tree analysis, pedigree analysis and concept Quality circles. (L4)

UNIT – IV (10 Hrs)

Quality Function Development (QFD) – elements of QFD –benchmarking-Types- Advantages & limitations of benchmarking – Taguchi Analysis – loss function - Taguchi design of experiments. Poka-yoke, Kaizen, Deming cycle.

Learning Outcomes: At the end of this unit, students should be able to

- Know the procedure for quality function development, bench marking, taguchi analysis. (L1)

UNIT – V (8 Hrs)

Value improvement elements – value improvement assault – supplier teaming. Business process reengineering & elements of Supply chain management, Six sigma approach – application of six sigma approach to various industrial situations.

Learning Outcomes: At the end of this unit, students should be able to

- Know the value improvement, supplier teaming and the concept of business process re-engineering, supply chain management and six sigma. (L1)

TEXTBOOKS:

1. "Total Quality Management", D.R.Kiran, BS Publications, 2016
2. "Total Quality Management", Bester field, Pearson.

REFERENCE BOOKS:

1. "Quality management", Howard Giltow, TMH
2. "Quality management", Evans.
3. "Quality management", Bedi
4. "Total Quality Management", Joseph & Susan Berg

5. “Total Quality Management-Toward the Emerging Paradigm”, Bounds, Yorks, Adams, Ranney, McGraHill, 1994

Course Code	PRINCIPLES OF CELLULAR AND MOBILE COMMUNICATIONS		L	T	P	C
21A040507			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the concepts and operation of cellular systems.
- To apply the concepts of cellular systems to solve engineering problems.
- To analyze cellular systems for meaningful conclusions.
- To evaluate suitability of a cellular system in real time applications.
- To design cellular patterns based on frequency reuse factor.

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Understand the concepts and operation of cellular systems. **(K2)**

CO2: Apply the concepts of co-channel interference & Cell splitting to solve engineering problems. **(K3)**

CO3: Compare different Handoffs. **(K4)**

CO4: Compare various types of multiple access techniques. **(K4)**

CO5: Evaluate suitability of a cellular system in real time applications. **(K4)**

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	2	2	-	-	-	-	-	-	-	-	3	3	-
CO3	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO4	3	3	2	-	-	-	-	-	-	-	-	3	3	2
CO5	3	3	2	-	-	-	-	-	-	-	-	3	3	3

UNIT – I (10 Hrs)

Introduction to Cellular Mobile Systems: Why cellular mobile communication systems? A basic cellular system, Evolution of mobile radio communications, Performance criteria, Characteristics of mobile radio environment, Operation of cellular systems. Examples for analog and digital cellular systems.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concepts and operation of cellular systems. (L2)
- Explain the characteristics of mobile radio environment. (L2)

UNIT – II (8 Hrs)

Cellular Radio System Design: General description of the problem, Concept of frequency reuse channels, Co-channel interference reduction, Desired C/I ratio, Cell splitting and sectoring, Microcell zone concept.

Learning Outcomes: At the end of this unit, students should be able to

- Understand the concept of frequency reuse and co-channel interference in cellular systems. (L2)
- Apply the concept of cellular systems to solve engineering problems. (L3)
- Explain the design problems of cellular systems. (L3)

UNIT – III (10 Hrs)

Handoffs and Dropped Calls: Why handoffs and types of handoffs, Initiation of handoff, Delaying a handoff, Forced handoffs, Queuing of handoffs, Power-difference handoffs, Mobile assisted handoff and soft handoff, Cell-site handoff, Inter system handoff. Introduction to dropped call rate.

Learning Outcomes: At the end of this unit, students should be able to

- Understand why handoff is required. (L2)
- Apply handoff techniques to solve engineering problems. (L3)
- Compare various types of handoffs. (L4)

UNIT – IV (8 Hrs)

Multiple Access Techniques for Wireless Communications: Introduction, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access and Space Division Multiple Access.

Learning Outcomes: At the end of this unit, students should be able to

- Understand various types of multiple access techniques. (L2)
- Apply the concept of multiple access to solve engineering problems. (L3)
- Compare various types of multiple access techniques. (L4)

UNIT – V (9 Hrs)

Digital Cellular Systems: Global System for Mobile Systems, Time Division Multiple Access Systems, Code Division Multiple Access Systems. Examples for 2G, 3G and 4G systems. Introduction to 5G system.

Learning Outcomes: At the end of this unit, students should be able to

- Understand operation of various types of digital cellular systems. (L2)
- Compare various types of digital cellular systems. (L2)
- Evaluate suitability of a cellular system in real time applications. (L4)

Note: The main emphasis is on qualitative treatment. Complex mathematical treatment may be avoided.

TEXTBOOKS:

1. "Mobile Cellular Tele communications", William C.Y.Lee, McGraw – Hill International, 2 nd Edition, 1995.
2. "Wireless Communications–Principles and Practice", Theodore S. Rappaport, PHI, 2nd Edition, 2004.

REFERENCE BOOKS:

1. "Principles of Modern Wireless Communications Systems –Theory and Practice", Aditya K. Jagannatham, McGraw – Hill International, 2015.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/117102062
2. https://www.electronicshub.org/wireless-communication-introduction-types-applications/

Course Code	EMBEDDED SYSTEMS		L	T	P	C
21A040508			3	0	0	3
Pre-requisite	NIL	Semester	VII			

COURSE OBJECTIVES:

- To understand the basics of an embedded system
- To introduce the typical components of an embedded system
- To explain various communication interfaces used in embedded system
- To provide knowledge on the design process of embedded system applications

COURSE OUTCOMES:

After completion of the course, the student will be able to

CO1: Discuss the basic concepts of an embedded system. (K3)

CO2: Explainthe role of system core, memory, sensors, actuators, I/O and other sub system components in an embedded system. (K3)

CO3: Explain the different communication interfaces of an embedded system. (K3)

CO4: Illustrate about the interrupt service mechanism and device drivers. (K3)

CO5: Write aboutvarious steps involved in design and development of embedded firmware. (K3)

CO-PO MAPPING:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO3	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO4	3	2	-	-	-	-	-	-	-	-	-	3	-	3
CO5	3	2	-	-	-	-	-	-	-	-	-	3	-	3

UNIT – I (9 Hrs)

Introduction to Embedded Systems: Definition, Embedded systems Vs General computing systems, History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

Learning Outcomes: At the end of this unit, students should be able to

- Classify embedded systems based on generation, complexity and performance. (L2)
- Discuss the characteristics of an embedded system. (L2)
- Explain the design process in embedded system. (L3)

UNIT – II (9 Hrs)

Typical Embedded System: Core of the embedded system, Memory-ROM, RAM, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer, PCB and passive components

Learning Outcomes: At the end of this unit, students should be able to

- Discuss about the core of the embedded system. (L2)
- Summarize different factors to be considered in the selection of memory for an embedded system. (L2)
- Explain the role of sensors, actuators, I/O components and other subsystem components used in embedded system. (L3)

UNIT – III (9 Hrs)

Communication Interface: Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232, USB, infrared, Bluetooth, Wi-Fi, ZigBee, GPRS, GSM

Learning Outcomes: At the end of this unit, students should be able to

- Explain the various types of on-board communication interfaces. (L3)
- Describe the external communication interfaces used in embedded system. (L2)
- Discuss the different types of wireless communication interfaces used in embedded system. (L2)

UNIT – IV (9 Hrs)

Device drivers and Interrupt Service Mechanism: Programmed I/O busy-wait approach without interrupt service mechanism, Interrupt-driven I/O, interrupt service routine concept, interrupt sources, hardware interrupts, software interrupts, interrupt-servicing mechanism, multiple interrupts, interrupt service threads as second-level interrupt handlers, context and the periods for context switching, interrupt latency, interrupt-service deadline, interrupt service mechanism form context-saving angle, Device driver programming.

Learning Outcomes: At the end of this unit, students should be able to

- Summarize pros and cons of interrupt driven data transfer. (L2)
- Illustrate hardware and software interrupts with examples. (L3)
- Know how interrupts can be used to minimize latency. (L3)
- Describe uses of hardware and software assigned priorities in an interrupt service mechanism. (L2)
- Differentiate ISRs & device driver functions. (L2)

UNIT – V (8 Hrs)

Embedded Firmware Design and Development: Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

Learning Outcomes: At the end of this unit, students should be able to

- Discuss the different approaches for embedded firmware design. (L2)
- Discuss the different embedded firmware development languages. (L2)
- Explain the process of Assembly language to machine language conversion and High-level language to machine language conversion. (L3)
- Write about various steps involved in design and development of embedded firmware. (L3)

TEXTBOOKS:

1. "Introduction to Embedded Systems", Shibu. K.V., McGraw Hill Education, 2nd Edition, 2017.
2. "Embedded Systems: Architecture, Programming and Design", Raj Kamal, McGraw Hill Education, 3rd Edition, 2017

REFERENCE BOOKS:

1. "Computers as Components", Wayne Wolf, Morgan Kaufmann, Elsevier, 2nd Edition
2. "Embedded Systems- An integrated approach", Lyla B Das, Pearson education, 2012
3. "Embedded Microcomputer Systems Real Time Interfacing", Jonathan W.Valvano, Cengage Learning, 3rd Edition, 2012.