KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Computer Science and Engineering the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total Quality Education".

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO 1:

Apply the basic engineering skills and domain knowledge for developing effective computing solutions to address various social issues.

PEO 2:

Able to have successful career in technical / managerial roles in multi-disciplinary environment.

PEO 3:

To confront the evolving technical challenges and problems in the areas of computing.

PROGRAM OUTCOMES:

After going through the four years of study, the Artificial Intelligence and Data Science will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: Professional Skills: To apply learned skills to build optimized solutions pertaining to Data Processing, Artificial Intelligence and Machine Learning.

PSO 2: Problem - Solving Skills: To analyze data using domain knowledge to get insights and develop appropriate solutions.

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SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
THEORY								
1	MA1371	Multivariate Calculus and Linear Algebra	BS	3	1	0	4	4
2	AD1371	Data Structures and Algorithms	PC	3	0	0	3	3
3	AD1372	Introduction to Artificial Intelligence	PC	3	0	0	3	3
4	CS1371	Database Management Systems	PC	3	0	0	3	3
5	CS1372	System Programming and Operating Systems	PC	3	0	0	3	3
PRACTICAL								
6	AD1381	Data Structures and Algorithms Laboratory	PC	0	0	4	4	2
7	CS1381	Database Management Systems Laboratory	PC	0	0	4	4	2
8	AD1311	Artificial Intelligence Laboratory	PC	0	0	4	4	2
9	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
TOTAL				**15**	**1**	**14**	**30**	**23**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1473	Probability and Statistics	BS	3	1	0	4	4
2	EC1372	Digital System Design and Microprocessors	ES	3	0	0	3	3
3	AD1401	Introduction to Internet of Things	PC	3	0	0	3	3
4	AD1471	Machine Learning	PC	3	0	0	3	3
5	GE1471	Professional Ethics and Human Values	HS	3	0	0	3	3
PRACTICAL								
6	AD1411	Internet of Things Laboratory	PC	0	0	4	4	2
7	AD1412	Machine Learning Laboratory	PC	0	0	4	4	2
8	EC1381	Digital System Design and Microprocessors Laboratory	ES	0	0	4	4	2
9	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**15**	**1**	**14**	**30**	**23**

MA1371 **MULTIVARIATE CALCULUS AND LINEAR ALGEBRA**

L	T	P	C
3	1	0	4

OBJECTIVES:

This course enables the students to

- Introduce the concepts of graphs of level curves, level surface and differentiability of multi variable function.
- Find extreme values of a function using derivative matrix.
- Explain the concepts of vector space, linear transformations and diagonalization.
- Make them understand the concept of orthogonalization in inner product spaces.

UNIT I MULTIVARIABLE CALCULUS 12

Functions of several variables – Domain, Range – Graphs, Level Curves and Contours of Functions of Two variables – Level Surface – Limits and Continuity in Higher Dimensions – Two – path Test for Nonexistence of a Limit – Partial Derivatives of a Function of Two Variables – Differentiability – The Chain Rule.

UNIT II APPLICATIONS OF MULTIVARIABLE CALCULUS 12

Directional Derivatives and Gradient Vectors - Gradients and Tangents to Level Curves - Tangent Planes and Normal Lines to Surfaces - Extreme Values, Saddle Points and Lagrange Multipliers by matrix method.

UNIT III VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations of vectors - Linear Span – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT V INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the concepts of partial derivatives to find the higher derivatives of multi variable functions.

CO2 Apply the techniques of multi variable calculus to compute the gradients, directional derivative and extreme values.

CO3 Test the given system of equation is linearly dependent or independent.

CO4 Apply the concept of eigen values and eigenvectors for Diagonalization of a matrix.

CO5 Apply the inner product techniques for finding the orthonormal vector and minimal solution to the system of linear equation.

TEXT BOOKS:

1. Thomas, Weir & Hass, 2018, *Calculus*, 13th ed, Pearson.
2. Friedberg, AH, Insel, AJ & Spence, L, 2004, *Linear Algebra*, Prentice Hall of India, New Delhi.

REFERENCES:

1. James Stewart, 2007, *Calculus* (Early transcendentals), Brooks cole.
2. Peter D Lax, Maria shea Terrell, 2018, *Multi variable Calculus with applications*, 6th ed, Springer.
3. Kolman, B & Hill, DR, 2009, *Introductory Linear Algebra*, Pearson Education, New Delhi, 1st Reprint.
4. Kumaresan, S, 2010, *Linear Algebra - A Geometric Approach*, Prentice Hall of India, New Delhi, Reprint.
5. Strang, G, 2005, *Linear Algebra and its applications*, Thomson (Brooks/ Cole), New Delhi.

AD1371 **DATA STRUCTURES AND ALGORITHMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the fundamentals of algorithms and the concepts of List ADT.
- Learn linear data structures – stacks and queues.
- Understand the concepts of non-linear data structures, Trees.
- Learn the concepts of non-linear data structures, Graphs.
- Understand sorting, searching and hashing algorithms.

UNIT I INTRODUCTION TO ALGORITHMS AND ADTs 9

Time and space complexity-Big O,Omega,Theta notation – List ADT – array based implementation, linked list implementation, singly linked lists, circularly linked lists, doubly linked lists, applications of lists.

UNIT II STACK AND QUEUE 9

Stack ADT – Operations, Applications, Evaluating arithmetic expressions, Conversion of Infix to postfix expression - Queue ADT – Operations, Circular Queue, Priority Queue, dequeue, applications of queues.

UNIT III TREES 9

Tree ADT - tree traversals - Binary Tree ADT - expression trees, applications of trees - binary search tree ADT – AVL Tree - B-Tree - Heap- Binary heap - Applications of heap.

UNIT IV GRAPHS 9

Definition, Representation of Graph, Types of graph, Breadth-first traversal, Depth-first traversal - Topological Sort - Bi-connectivity - Cut vertex - Euler circuits - Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching - Linear Search, Binary Search - Sorting - Bubble sort, Selection sort, Insertion sort, Shell sort, Radix sort - Hashing - Hash Functions, Separate Chaining, Open Addressing, Rehashing, Extendible Hashing

Total : 45 Periods

COURSE OUTCOMES:

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

CO1 Illustrate the basic concepts of List ADT.

CO2 Explain Stack and Queue ADTs.

CO3 Summarize the concepts of non-linear data structures, Trees.

CO4 Outline the concepts of non-linear data structure, Graph.

CO5 Apply appropriate sorting and searching techniques for problem solving.

TEXT BOOKS:

1. Weiss, MA, 1997, *Data Structures and Algorithm Analysis in C*, 2nd ed, Pearson Education India.
2. Reema Thareja, 2011, *Data Structures Using C*, 2nd ed, Oxford University Press.

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest & Clifford Stein, 2002, *Introduction to Algorithms*, 2nd ed, Mcgraw Hill.
2. Aho, Hopcroft & Ullman, 1983, *Data Structures and Algorithms*, Pearson Education.
3. Kochan, SG, 2015, Programming in C, Pearson education.
4. Ellis Horowitz, SartajSahni, Susan & Anderson-Freed, 2008, *Fundamentals of Data Structures in C*, 2nd ed, University Press.

AD1372 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in Artificial Intelligence
- Be familiar with represent knowledge in solving Artificial Intelligence problems
- Understand the agent communication and Trust and Reputation
- Know about the various applications of Artificial Intelligence.

UNIT I INTRODUCTION 9

Introduction–Definition - The Foundations of Artificial Intelligence- Characteristics of Intelligent Agents -Turing test – Agents and Environments - Good Behavior: The Concept of

Rationality, The Nature of Environments, The Structure of Agents; Problem Solving Approach to Typical AI problems

UNIT II PROBLEM SOLVING USING SEARCHING 9

Problem-Solving Agents, Formulating problems, searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, searching with Partial Information, Informed Search Strategies, Greedy best-first search, A* Search-IDA*- Heuristic Functions, Local Search Algorithms and Optimization Problems - Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning.

UNIT III LOGIC AND INFERENCES 9

Propositional Logic - First Order Logic – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories.

UNIT IV AGENT COMMUNICATION 9

Architecture for Intelligent Agents – Agent communication - Agents and Objects – Negotiation and Bargaining –Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the various characteristics of intelligent agents.

CO2 Interpret appropriate search algorithms for Artificial Intelligence problem.

CO3 Illustrate a Knowledge Representation using first order logic.

CO4 Infer different ways of the agent communication and Trust and Reputation in Multi-agent systems.

CO5 Summarize the various application of AI.

TEXTBOOK:

1. Russell, S & Norvig, P, 2020, *Artificial Intelligence: A Modern Approach*, 4th ed, Prentice Hall.

REFERENCES:

1. Elaine Rich & Kevin Knight, 2008, *Artificial Intelligence*, 3rd ed, Tata McGraw-Hill.
2. Tim Jones, M, 2008, *Artificial Intelligence: A Systems Approach (Computer Science*), 1st ed, Jones and Bartlett Publishers, Inc.
3. Nils, J, Nilsson, 2009, *The Quest for Artificial Intelligence*, Cambridge University Press.
4. Gerhard Weiss, 2013, *Multi Agent Systems*, 2nd ed, MIT Press.
5. David, L, Poole, Alan, K & Mackworth, 2010, *Artificial Intelligence: Foundations of Computational Agents,* Cambridge University Press.

CS1371 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to:

- Learn the fundamentals of data models and to represent a database system using ER diagrams.
- Study SQL and relational database design.
- Understand the internal storage structures using different file and indexing techniques which will help in physical DB design.
- Understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- Learn about file organization and query processing

UNIT I INTRODUCTION TO DATABASE & ER MODEL 9

Introduction to Databases - File System Vs Database System - Database System Architecture- Database Users and Administrator - Data Models - Entity Relationship Model - E-R Diagrams - Design Issues - Extended E-R Features - Introduction to Relational Model - ER to Relational Schema Mapping

UNIT II RELATIONAL MODEL & SQL 9

Structure of Relational Databases - Relational Query Languages - Relational Algebra – SQL: DDL, DML, DCL, TCL - Simple Queries, Complex Nested Queries, Correlated Nested Queries, Joins, Aggregate Functions, Grouping - PL/SQL : Functions, Procedures, Triggers, Views -Embedded SQL - Dynamic SQL

UNIT III NORMALIZATION 9

Pitfalls in Bad Relational database design - Functional Dependencies (Closure of Functional dependencies) - Closure of Attributes - Normal Forms : First, Second, Third, Boyce Codd Normal Form, Multivalued Dependencies : Fourth Normal Form, Join Dependencies : Fifth Normal Form –Domain Key Normal Form

UNIT IV TRANSACTION AND CONCURRENCY CONTROL 9

Transaction processing concepts - Need for concurrency control and recovery - Recoverability – Transaction Recovery – Serializability : Conflict Serializability, View Serializability, Testing for Serializability - Concurrency Control : Lock Based Protocols (Two phase locking Techniques, Strict Two Phase Locking, Deadlocks, Multiple Granularity) Timestamp Based protocol, Validation Based protocol

UNIT V FILE ORGANIZATION & QUERY PROCESSING 9

File Organization: Organization of Records in Files, Indexing and Hashing, Ordered Indices - Query Processing: Measures of Query Cost (Selection, Sorting and Join Operation), Query Tuning, Query Optimization (Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views) – No SQL – Mongo DB

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Infer the basic concepts of database system and model ER diagram for real time applications.

CO2: Use appropriate SQL commands to store and access data from Relational Database.

CO3: Construct normalized database for real world scenario using functional dependencies.

CO4 Illustrate the importance of transaction and concurrency control to maintain consistency in a database.

CO5 Interpret the mechanism incorporated in file organization and Query Processing.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F Korth, Sudharshan, S, 2017, *Database System Concepts*, 6th ed, Tata McGraw Hill.
2. Ramez Elmasri, Shamkant B Navathe, 2011, *Fundamentals of Database Systems*, 6th ed, Pearson Education.

REFERENCES:

1. Date, CJ, Kannan, A & Swamynathan, S, 2006, *An Introduction to Database Systems*, 8th ed, Pearson Education.
2. Raghu Ramakrishnan, 2015, *Database Management Systems*, 4th ed, McGraw-Hill College Publications.
3. G.K.Gupta, 2011, *Database Management Systems*, Tata McGraw Hill.

CS1372 SYSTEM PROGRAMMING AND OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the basic concepts about system software.
- Know about processes and threads.
- Familiarize with the scheduling algorithms and deadlock handling mechanisms.
- Implement various memory management schemes.
- Explain about file systems.

UNIT I SYSTEM SOFTWARE 9

System Software versus Application Software – Basic System Software: Assembler: Two pass assembler, Loader: Absolute and Bootstrap loader; Key terms: Relocation, linking, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, and Interpreter

Operating system objectives and functions - Operating System Structure - System Calls, System Programs, OS Generation and System Boot

UNIT II PROCESS MANAGEMENT 9

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues

UNIT III PROCESS SYNCHRONIZATION 9

Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

UNIT IV STORAGE MANAGEMENT 8

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory

UNIT V FILE SYSTEMS 10

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management. File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery. I/O Systems – I/O Hardware, Application I/O interface - Kernel I/O subsystem, Streams, Performance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain different types of system software and its use.

CO2 Illustrate the concepts of process, threads and CPU scheduling algorithms.

CO3 Explain the algorithms used for concurrency and deadlock handling.

CO4 Make use of various memory management schemes.

CO5 Demonstrate the concept of file systems.

TEXT BOOKS:

1. Leland L Beck, 1997, *System Software: An Introduction to Systems Programming*, 3rd ed, Pearson Education Asia.
2. Abraham Silberschatz, Peter Baer Galvin & Greg Gagne, 2018, *Operating System Concepts*, 9th ed, John Wiley and Sons Inc.

REFERENCES:

1. Andrew S Tanenbaum, 2004, *Modern Operating Systems*, 2nd ed, Pearson Education.
2. Elmasri, R, Gil Carrick, A & Levine, D, 2010, *Operating Systems – A Spiral Approach*, Tata McGraw Hill Edition.
3. Achyut S Godbole & Atul Kahate, 2016, *Operating Systems*, McGraw Hill Education.
4. Gary Nutt, 2004, *Operating Systems*, 3rd ed, Pearson Education.
5. Harvey M Deitel, 2004, *Operating Systems*, 3rd ed, Pearson Education.
6. Daniel P Bovet & Marco Cesati, 2005, *Understanding the Linux kernel*, 3rd ed, O 'Reilly.
7. Neil Smyth, 2011, *iPhone iOS 4 Development Essentials – Xcode*, 4th ed, Payload media.

AD1381 DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Implement the linear Data Structures Array, List, Stack and Queue
- Implement non-linear Data Structures – Trees for problem solving
- Implement non-linear Data Structures – Graph for problem solving
- Implement various sorting and searching algorithms
- Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EXPERIMENTS:

1. Implementation of List ADT using array and Linked list.
2. Implementation of Stack ADT using array and linked list.
3. Application of Stack - Conversion of infix expression into postfix expression.
4. Implementation of Queue ADT using array and linked list
5. Implementation of Binary Search Tree ADT
6. Implementation of Graph ADT using adjacency matrix and Graph traversal algorithms
7. Implementation of Linear search and binary search algorithms
8. Implementation of Bubble sort and Insertion Sort Algorithms
9. Implementation of collision techniques in hashing.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1 Make use of linear Data Structures Array, List, Stack and Queue to solve problems.

CO2 Apply non-linear Data Structures - Trees for problem solving.

CO3 Make use of non-linear Data Structures - Graph for problem solving

CO4 Utilize various sorting and searching algorithms to solve problems.

CO5 Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 1 GB RAM)	30
2.	Printer	1
3.	Server (Intel Core i3, 4 GB RAM) (High Speed Processor)	1
4.	Compilers: C / C++	30 users

CS1381 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Learn the commands for creating and manipulating the databases.
- Construct queries for retrieval of required data from database.
- Understand views, sequences and synonyms concepts of SQL.
- Learn the functions, procedures, triggers and exception handling in SQL.
- Develop GUI based application for storage and retrieval of data

LIST OF EXPERIMENTS:

1. **WRITE AND EXECUTE SIMPLE QUERIES USING SQL**
   a. DDL, TCL and DCL commands
   b. DML commands
   c. Aggregate Functions
2. **WRITE AND EXECUTE ADVANCED QUERIES USING SQL**
   a. Nested Queries and Sub queries
   b. SQL Join
3. **WRITE AND EXECUTE VIEWS, SYNONYMS, SEQUENCE**
4. **WRITE AND EXECUTE QUERIES USING PL/SQL**
   a. Simple programs
5. **WRITE AND EXECUTE QUERIES USING ADVANCED CONCEPTS OF PL/SQL**
   a. Cursors and Procedures
   b. Functions
   c. Triggers
   d. Exception Handling
6. **IMPLEMENT DATABASE CONNECTIVITY CONCEPTS**
   a. Design a Front End for a real time application
   b. Connect the database with the application
7. **MINI PROJECT**

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Choose appropriate DDL, DML, DCL and TCL commands for creating and manipulating the databases.

CO2: Construct appropriate nested queries, sub queries and join queries for efficient retrieval of data.

CO3: Organize database using views, sequences, and synonyms.

CO4: Implement functions, procedures, triggers and exceptions using PL/SQL.

CO5: Develop a GUI based environment for storage and retrieval of data for a real time application.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, HDD 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: XAMPP with Apache, MySQL & PHP (or) MySQL & JAVA.	Open source

AD1311 ARTIFICIAL INTELLIGENCE LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Be familiar with Artificial Intelligence, its foundation and principles.
- Examine the useful search techniques; learn their advantages, disadvantages and comparison.
- Learn programming language to program intelligent systems.
- Understand important concepts like Expert Systems, AI applications.
- Be exposed to the role of AI in different areas like NLP, Pattern Recognition, etc.
- Learn the practical applicability of intelligent systems, specifically its applications.
- Be able to develop intelligent systems.

List of Experiments:

1. Implementation of 8 puzzle using BFS & DFS
2. Implementation of Uniform Cost Search and Iterative Deepening Search
3. Implementation of Best Uninformed Search Strategy for Given Graph
4. Implementation of State Space Search for Water Jug Problem
5. Implementation of Water Jug Problem Using BFS
6. Implementation of Water Jug Problem Using DFS
7. Implementation of Travelling Salesman Problem Using Best First Search Strategy
8. Implementation of A* Search Strategy
9. Implementation of Alpha Beta Pruning for Tic Tac Toe Problem
10. Implementation of Solve Crossword Puzzle Problem using Constraint Satisfaction

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Build the various searching techniques in intelligent agents

CO2 Apply the concepts of water jug problem

CO3 Develop the solutions for the representing knowledge in solving travelling sales person problem

CO4 Construct A* search & Alpha Beta Pruning for a problem

CO5 Build the Crossword Puzzle Problem of using Constraint Satisfaction problems

LIST OF LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250GB, 2 GB RAM)	30
2.	Printer	1
3.	Interpreter: Python 3 interpreter for Windows/Linux	30 users

HS1321 INTERPERSONAL SKILLS – LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

NIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCE BOOKS:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html

3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1473 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVES:

This course enables the students to

- Introduce the basics of random variables and some standard distributions that can describe real life phenomenon.
- Establish the basic concepts of two-dimensional random variables.
- Impart the knowledge of testing of hypothesis for small and large samples.
- Describe the basic principles in the design of simple experiments for comparing pairs of treatments.
- Introduce the basic concepts of statistical quality control that plays a vital role in the field of Engineering and Technology.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – marginal and conditional distributions –covariance – correlation – Karl Pearson's correlation coefficient – Rank correlation – Spearman's rank correlation coefficient – Kendall's rank correlation coefficient - linear regression.

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions – Statistical Hypothesis – Type I and Type II errors – Tests for single mean and difference of means of large samples (z-test) and Small samples (t-test) – F-test for variance – chi-square test for goodness of fit – independence of attributes – Demo using Excel.

UNIT IV DESIGN OF EXPERIMENTS 12

Basic Principles of experimental design – Completely randomized design – Randomized block design – Latin square design – 2 level factorial design – Demo using Excel.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\overline{X}$ and R charts for continuous data) – control charts for attributes (p, c, np and u charts for discrete data) – tolerance limits – Demo using Excel.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1	Solve various problems using random variables and distributions
CO2	Compute the correlation between two variables and linear regression equation for a set of data
CO3	Apply the concepts of testing of hypothesis for small and large samples in real life problems
CO4	Interpret the data using ANOVA and basic experimental design
CO5	Apply the techniques of Statistical quality control in industrial Engineering problems

TEXT BOOKS

1 Devore, J.L., 2017. *Probability and Statistics for Engineering and the Sciences*. Boston, Cengage Learning.

2 Johnson, R.A. and Gupta, C.B., 2017. *Miller and Freund's Probability and Statistics for Engineers*. New Delhi, Pearson India Education.

REFERENCES

1 Milton, J.S. and Arnold, J.C., 2008. *Introduction to Probability and Statistics*. New Delhi, Tata McGraw Hill.

2 Ross, S.M., 2014. *Introduction to Probability and Statistics for Engineers and Scientists*. New Delhi, Elsevier.

3 Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D., 2017. *Introduction to Probability and Statistics for Engineers and Scientists*. New Delhi, Elsevier.

4 Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., 2007. *Probability and Statistics for Engineers and Scientists*. Asia, Pearson Education.

5 Gupta, S.C. and Kapoor, V.K., 2020. *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons.

EC1372 DIGITAL SYSTEM DESIGN AND MICROPROCESSORS

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the concepts of Boolean functions and minimization techniques.
- Summarize the combinational circuits used to perform basic digital operations.
- Develop a synchronous/asynchronous counters and shift registers using sequential logic
- Understand the basic concepts of 8086 microprocessors.
- Gain knowledge in interfacing of I/O devices with 8086 processor

UNIT I DIGITAL FUNDAMENTALS 9

Review of Number systems, Logic gates, Boolean algebra - Boolean postulates and laws - Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates, Design of combinational circuits : Adder, Subtractor, Parallel adder / Subtractor, Magnitude Comparator, Code Converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip-Flops - SR, JK, D & T - Master Slave Flip Flops - Shift Registers - SISO, SIPO, PISO, PIPO, Design of synchronous counters - Modulo N counters, Random Sequence counters, Johnson counter, Ring counter

UNIT IV 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

UNIT V I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display and Alarm Controller.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

CO1: Outline the Boolean functions and various minimization techniques.

CO2: Illustrate the combinational circuits used to perform basic digital operations.

CO3: Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4: Make use of 8086 processor architecture, addressing mode and instruction set to develop Assembly Language Programming.

CO5: Explain interfacing of I/O devices with 8086 processors.

TEXT BOOKS:

1. Morris Mano, M & Michael D Ciletti, 2017, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog,* 6th ed, Pearson Education. [Unit - 1, 2, 3]
2. Nagoor Kani, A, 2017, *Microprocessors and Microcontrollers*, McGraw hill, 2017 edition.
3. Charles H Roth, 2013, *Fundamentals of Logic Design*, 6th ed, Thomson Learning. [Unit 4, 5].

REFERENCES :

1. Wakerly JF, 2002, *Digital Design: Principles and Practices*, 2nd Ed, *Prentice-Hall*.
2. Givone, DD, 2003, *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
3. Thomas L Floyd, 2011, *Digital Fundamentals*, 10th ed, Pearson Education Inc.
4. Stephen Brown & Zvonko Vranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, 3rd ed, McGraw-Hill Higher Education, New Delhi, India.

AD1401 **INTRODUCTION TO INTERNET OF THINGS**

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the IoT architecture and sensor fundamentals.
- Learn the fundamentals of signal conditioning and sensor basics
- Gain knowledge about different IoT protocols.
- Build IoT Systems using Arduino and Raspberry Pi.
- Develop real time smart IoT applications.

UNIT I INTRODUCTION TO IoT 9

Evolution of Internet of Things - IoT Enabling Technologies - IoT Levels - IoT Architectures - IoT and M2M – Sensors–types, principle, requirement and advantages. Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of Sensors, Actuators, Smart Objects and Connecting Smart Objects.

UNIT II SENSORS FUNDAMENTALS 9

Amplification Basics of Measurement – Classification of errors – Error analysis – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition. Data logging – applications, Motion Sensors – Potentiometers, Resolver, Accelerometer, GPS, Bluetooth, Ultrasonic Ranging, Strain Gauge, Load Cell, Magnetic Sensors and Heading Sensors.

UNIT III PROTOCOLS 6

IoT access technologies: Physical and MAC Layers, Topology – Security of IEEE 802.15.4, 802.1ah and LoraWAN network layer – Application transport methods: supervisory control and data acquisition – Application layer protocols: CoAP and MQTT.

UNIT IV BUILDING IoT WITH ARDUINO, RASPBERRY PI & JETSON 12

Design Methodology - Embedded Computing Logic - Microcontroller, System on Chips - IoT System Building Blocks - Arduino - Board Details, IDE Programming - Logical Design using Python, Raspberry Pi - Interfaces and Raspberry Pi with Python Programming, Introduction to Jetson controller and its applications.

UNIT V CASE STUDIES – REAL WORLD APPLICATIONS 9

IoT Cloud Storage Models & Communication APIs - Cloud for IoT – Smart Agriculture Power Utility Industry - Smart Grid - Smart and Connected Cities: Smart Lighting, Smart Parking, Smart Traffic Control and Commercial building automation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Outline the IoT architecture and sensor fundamentals.

CO2 Summarize the data acquisition concepts and sensor basics.

CO3 Outline the various protocols used in IoT applications.

CO4 Build IoT Systems using Arduino and Raspberry PI.

CO5 Construct real time smart IoT Application using embedded system.

TEXT BOOKS:

1. Ernest O Doebelin, *Measurement Systems – Applications and Design*, 7th ed, Tata McGraw-Hill.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton & Jerome Henry, 2017, *IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things*, Cisco Press.

REFERENCES:

1. Rrshdeep Bahga & Vijay Madisetti, 2015, *Internet of Things - A hands-on approach*, Universities Press.
2. Olivier Hersent, David Boswarthick & Omar Elloumi, 2012 (for Unit 2), *The Internet of Things - Key Applications and Protocols*, Wiley.
3. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos Stefan Avesand & David Boyle, 2014, "*From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence*", Elsevier.
4. Dieter Uckelmann, Mark Harrison, Michahelles & Florian (Eds), 2011, *Architecting the Internet of Things*, Springer.
5. Michael Margolis & Arduino Cookbook, 2011, *Recipes to Begin, Expand, and Enhance Your Projects*, 2nd ed, O'Reilly Media.

AD1471 **MACHINE LEARNING**

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- Understand the concepts of Machine Learning and Probability Theory
- Learn supervised learning techniques and their applications.
- Learn unsupervised learning techniques like clustering and EM algorithms.
- Understand the theoretical and practical aspects of probabilistic graphical models.
- Understand advanced learning concepts like reinforcement learning, representation learning, deep learning and neural networks

UNIT I INTRODUCTION **9**

Machine Learning –Types of Machine Learning –Supervised Learning –Unsupervised Learning –Basic Concepts in Machine Learning –Machine Learning Process –Weight Space –Testing Machine Learning Algorithms –A Brief Review of Probability Theory –Turning Data into Probabilities –The Bias-Variance Trade-off.

UNIT II SUPERVISED LEARNING **9**

Linear Models for Regression –Linear Basis Function Models –The Bias-Variance Decomposition –Bayesian Linear Regression –Common Regression Algorithms –Simple Linear Regression –Multiple Linear Regression –Linear Models for Classification –Discriminant Functions –Probabilistic Generative Models –Probabilistic Discriminative Models –Laplace Approximation –Bayesian Logistic Regression –Common Classification.

UNIT III UNSUPERVISED LEARNING **9**

Mixture Models and EM–K-Means Clustering –Dirichlet Process Mixture Models –Spectral Clustering –Hierarchical Clustering –The Curse of Dimensionality –Dimensionality Reduction –Principal Component Analysis –Latent Variable Models(LVM) –Latent Dirichlet Allocation (LDA).

UNIT IV GRAPHICAL MODELS **9**

Bayesian Networks –Conditional Independence –Markov Random Fields –Learning –Naive Bayes Classifiers –Markov Model –Hidden Markov Model

UNIT V ADVANCED LEARNING 9

Reinforcement Learning –Representation Learning –Neural Networks –Active Learning –Ensemble Learning, Bootstrap Aggregation –Boosting –Gradient Boosting Machines –Deep Learning

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Interpret the type of machine learning algorithm required for a given application

CO2 Apply suitable classification or regression algorithm for an application

CO3 Apply clustering algorithms for different types of applications

CO4 Apply HMM for a sequence model type of application.

CO5 Identify suitable machine learning algorithm for different types of applications with suitable justification.

TEXT BOOK:

1. Ethem Alpaydin, 2015, *Introduction to Machine Learning*, 3rd ed, Prentice Hall of India.

REFERENCES:

1. Christopher Bishop, 2006, *Pattern Recognition and Machine Learning*, Springer.
2. Kevin P Murphy, 2012, *Machine Learning: A Probabilistic Perspective*, MIT Press.
3. Stephen Marsland, 2014, *Machine Learning –An Algorithmic Perspective*, 2nd ed, CRC Press.
4. Tom Mitchell, 2017, *Machine Learning*, McGraw-Hill.
5. Trevor Hastie, 2008, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning*, 2nd ed, Springer.
6. Fabio Nelli, 2018, Python *Data Analytics with Pandas*, *Numpy, and Matplotlib*", 2^{nd} ed, Apress.

GE1471 PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Create an awareness on Engineering Ethics and Human Values.
- Instill Moral and Social Values and
- Impart Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue –Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Stress management Techniques.

UNIT II ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg‘s theory – Gilligan‘s theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk -Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR)– Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of the course, students will be able to

CO1 Summarize the various Morals, Values, Ethics, Integrity and other Human Values

CO2 Describe the Senses of Engineering ethics, its related Theories and Models of Professional Roles

CO3 Explain the Codes of Ethics for various Engineering Experiments.

CO4 Examine the various Risk, Safety and Risk Benefit Analysis for a Product/Service in an Organization

CO5 Explain the Various Global Issues in Ethics and Review the Responsibilities and Rights of Professionals and Employees in an Organization

REFERENCES:

1. Mike W Martin & Roland Schinzinger, 2017, *Ethics in Engineering*, 4th ed, McGraw Hill.
2. Govindarajan, M, Natarajan, S, & Senthil Kumar, VS, 2004, *Engineering Ethics*, Prentice Hall of India.
3. Charles B Fleddermann, 2012, *Engineering Ethics*, 4th ed, Prentice Hall.
4. Charles E Harris, Michael S Pritchard, Raw W James, Elaine E Englehardt & Michael J Rabins, 2019, *Engineering Ethics –Concepts and Cases*, 12th ed, Cengage Learning.
5. John R Boatright & Jeffery Smith, 2016, *Ethics and the Conduct of Business*, 8th ed, Pearson Education.
6. Edmund G Seebauer & Robert L Barry, 2001, *Fundamentals of Ethics for Scientists and Engineers*, South Asia Edition, Oxford University Press.

AD1411 INTERNET OF THINGS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to o

- Demonstrate the operation of different electronic devices and sensors.
- Select the most appropriate sensors for an IoT application.
- Build a small low cost embedded system using Arduino.
- Demonstrate the usage of Raspberry PI processor in developing IoT applications.
- Apply the concept of Internet of Things in real world scenario.

List of Experiments:

1. Implement Basic Electronics and Digital Circuits
    a. Half Wave Rectifier
    b. Full Wave Rectifier
    c. Transistor Switch
    d. Digital Gate Verification
    e. Adder / Subtractor
2. Working with Basic Analog and Digital Sensors
    a. LED Display
    b. Intensity Measurements (Dawn to Dusk)
    c. Human Detection
    d. Counter Objects
3. Working with Advanced Analog and Digital Sensors
    a. Human Gesture
    b. Wet measurement
    c. Sound Control
    d. Load Monitoring
4. Implement the following experiments using Arduino like IDE
    a. Temp and Humidity measurement
    b. Signal Variance - Potentio Meters
    c. Fire alarm indication using Buzzer
5. Write Program for monitoring sensor values in real time using Arduino.
    a. IR Temperature sensor
    b. Gas leakage detection
    c. Sound Pollution Monitoring
    d. Accelerometer Sensor – Fall detection, Screen Orientation
    e. Smart Intrusion detection with SMS alert
6. Study the ESP8266 WIFI module and write program to transfer the data in the cloud.
    a. Light Control Monitoring
    b. Soil Condition Monitoring
    c. Human detection – PIR Sensor
7. Study the Ethernet shield and control the devices over internet through web Application
8. Various applications using Raspberry Pi
    a. Stepper Motor

    b. Face recognition
    c. Finger print recognition
    d. RFID
9. Experiments on Industrial IoT
    a. Smart AC Controller System
    b. health monitoring
    c. Energy Meter monitoring for theft detection.
10. Develop a JetBOT application using Jetson controller
11. Demonstrate of firefighting Robot
12. Mini projects in IoT
    a. Sensor Fabrication
    b. AI Thermometer
    c. Vehicle Density Calculation
    d. Smart AI pot hole detector
    e. Open ALPR license
    f. Fruit Classifier
    g. Autonomous mine detector
    h. Water Quality Management
    i. Defect identification stereo camera
    j. Home automation
    k. Smart health monitoring
    l. Smart agriculture
    m. Smart Pest Control using Drone
    n. Field surveillance using Drone

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Construct simple electronic circuits and sensor circuits.

CO2 Make use of various sensors to develop IoT applications.

CO3 Build IoT applications using Arduino.

CO4 Make use of Raspberry PI processor for developing IoT applications.

CO5 Develop real time smart IoT Applications.

LIST OF LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: Arduino IDE, Third Party Cloud API like (Azure/ Think speak), Python 3 interpreter	30 (Opensource)
Hardware list:		
1.	Sensors and Actuator	60
2.	Arduino Boards	10
3.	Node MCU	10
4.	GSM/GPRS shields	10
5.	Raspberry PI 4	10
6.	Jetson GPU Board	10
7.	Robotic and Drone Kit	3

AD1412 MACHINE LEARNING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students

- Interpret the type of machine learning algorithm required for a given application
- Develop the skills in using recent machine learning software for solving practical problems in high-performance computing environment.
- Use suitable classification or regression algorithm for an application
- Use clustering algorithms for different types of applications
- Gain knowledge in recommendation systems

LIST OF EXPERIMENTS

1. Exercises to solve the real-world problems using the following machine learning methods:
   a. Simple Linear Regression
   b. Multiple Linear Regression
   c. Logistic Regression
   d. Classification algorithms

i. Decision trees
ii. Naïve Bayes
iii. K nearest neighbours
iv. Neural Networks
v. Support Vector Machines

e. K-Means Clustering & PCA

2. Develop programs to implement Anomaly Detection & Recommendation Systems.
3. Implement GPU computing models to solving some of the problems mentioned in Problem 1.

COURSE OUTCOMES:

Upon completion of the course students will be able to:

CO 1 Implement and apply machine learning algorithms to solve problems.

CO 2 Use Supervised learning algorithms in high-performance computing environment to solve real-world problems

CO 3 Implement classification techniques

CO 4 Use unsupervised learning algorithms for solving practical problems.

CO 5 Implement recommendation systems

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 8 GB RAM)	30
2.	Printer	1
3.	Software: Python 3.9.5 or later version	30

EC1381 **DIGITAL SYSTEM DESIGN AND MICROPROCESSORS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Design and implement the various combinational circuits.
- Design and implement combinational circuits using MSI devices.
- Design and implement sequential circuits.
- Implement and simulate 8086 programs in 8086 kit and MASM Assembler.
- Implement different I/Os with 8086 microprocessor.

LIST OF EXPERIMENTS:

Digital Experiments:

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions
3. Design and implementation of Half/Full Adder and Subtractor
4. Design and implementation of Encoder, Decoder, Multiplexer and Demultiplexer using logic gates
5. Design and implementation of Shift register (SISO, SIPO, PIPO) using Flip flops
6. Design and implementation of 2 bit Synchronous counters

Microprocessor Experiments:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic operations

Peripherals and Interfacing Experiments

1. Traffic light control
2. Stepper motor control
3. Keyboard and Display Interface

Mini project

1. Flashing of LEDS using NODE MCU/Arduino
2. Monitoring Temperature using LM35 sensor in NODEMCU/Arduino

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Experiment with the basics of gates.

CO2 Build different combinational circuits.

CO3 Construct various sequential circuits.

CO4 Experiment with 8086 microprocessor based programs.

CO5 Build different I/Os with 8086 microprocessors.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Digital trainer kits	15
2.	Digital ICs	50
3.	8086 Microprocessor trainer kit with power supply	15
4.	Traffic light control interfacing card compatible with 8086	5
5.	Stepper motor control interfacing compatible with 8086	5
6.	Keyboard & Display interface board compatible with 8086 kits	5

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, Reading and Writing (Level 4) Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

1. http://learnenglishteens.britishcouncil.org/skills/reading
2. https://learnenglish.britishcouncil.org/skills/reading
3. https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
4. https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. BIOTECHNOLOGY

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Biotechnology, unique of its kind in the field of research and development activities pertaining to the field of biotechnology in this part of the world.

MISSION:

To impart highly innovative and technical knowledge in the field of biotechnology to the urban and rural student folks through "Total Quality Education".

PROGRAM EDUCAITON OBJECTIVES:

Educational objectives of the course Bachelor of Biotechnology programme can be divided into

PEO1:

Program Specific Academic Excellence: The student will be able to pursue higher education in India/Abroad in Biotechnology and its related fields by taking up competitive exams like GATE, CSIR, TANCET, GRE, TOEFL etc

PEO2:

Professional Attitude: The student will be able to come up with solutions for any scientific or technical problems related to Biotechnological industries/institutes by engaging in independent and life-long learning.

PEO3:

Core Competence: The student will be able to plan and conduct experiments in modern biotechnology and allied field laboratories using modern tools including interpreting the significance of resulting data, reporting results and writing technical reports

PEO4:

Collaboration: The students will be able to work in multidisciplinary team with confidence and will be able to venture out with entrepreneurial activities.

PROGRAM OUTCOMES:

After going through the four years of study, the Biotechnology graduates will have the ability to

	Graduate Attribute	**Programme Outcome**
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

1. **Future ready graduates:** The student will be able to identify, choose and perform to their best ability in the next career step: Higher education/Job/Entrepreneurial initiatives.
2. **Socially Aware graduates:** The student will be able to apply biotechnological know-how to address environmental, ethical, intellectual property rights and societal issues.
3. **Industry ready graduates:** The student will be able to apply the acquired knowledge to provide cost-effective and sustainable solutions in Biotechnology.

KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY
(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)
S.P.G.Chidambara Nadar - C.Nagammal Campus
S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. BIOTECHNOLOGY

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1373	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2	BT1301	Cell Biology	PC	3	0	0	3	3
3	BT1302	Microbiology	PC	3	0	0	3	3
4	BT1303	Stoichiometry	PC	3	1	0	4	4
5	BT1306	Thermodynamics for Biotechnologist	ES	3	0	0	3	3
PRACTICAL								
6	BT1311	Cell Biology Laboratory	PC	0	0	4	4	2
7	BT1312	Microbiology Laboratory	PC	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EE	0	0	2	2	1
			TOTAL	**15**	**2**	**10**	**27**	**22**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1473	Probability and Statistics	BS	3	1	0	4	4
2	BT1401	Analytical Methods and Instrumentation	PC	3	0	0	3	3
3	BT1402	Basic Industrial Biotechnology	PC	3	0	0	3	3
4	BT1403	Enzyme Technology and Biotransformations	PC	3	0	0	3	3
5	BT1404	Molecular Biology	PC	3	0	0	3	3
6	BT1406	Fluid Mechanics and Heat Transfer Operations	ES	3	0	0	3	3
PRACTICALS								
7	BT1411	Chemical Engineering Laboratory for Biotechnologist	PC	0	0	4	4	2
8	BT1412	Instrumentation and Methods of Analysis Laboratory	PC	0	0	4	4	2
9	HS1421	An Introduction to Advanced Reading and Writing	EE	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1373 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of PDE used in solving partial differential Equations.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To acquaint the students with Fourier transform and Z-transform techniques

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two- dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Form the partial differential equations and solve them using various techniques
CO2	Find the Fourier constants and frame the Fourier series of periodic functions
CO3	Classify and solve the initial and boundary value problems such as wave and heat flow equation
CO4	Compute the Fourier transforms of standard functions and learn the properties
CO5	Apply the techniques of Z- transform to get the solutions of differential equations

TEXTBOOKS:

1 Erwin kreyszig, 2015, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th Edition, New Delhi.

2 Grewal B,S, 2017*,* *Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, New Delhi.

REFERENCES:

1 Bali, N, Goyal, M, & Watkins C, 2009*, Advanced Engineering Mathematics,* Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.

2 Narayanan, S, Manicavachagom Pillay T, K & Ramanaiah, G , 1998, *Advanced Mathematics for Engineering Students*, Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai.

3 Glyn James, 2011, *Advanced Modern Engineering Mathematics*, Pearson Education, 4 th Edition, New Delhi.

4 Peter V, O'Neil, 2012, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi.

5 Ramana, 2010, B,V*,* *Higher Engineering Mathematics*, Tata McGraw Hill, 11th Reprint, New Delhi.

BT1301 **CELL BIOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Acquire the basic knowledge of the structural and functional properties of cells
- Understand the fundamental of cell signalling and membrane transport mechanism
- Understand the key analytical techniques in cell biology

UNIT I CELL ORGANELLES & CYTOSKELETON 9

Cell – Fundamental unit of life; Structural organization of prokaryotic and eukaryotic cell; Structure and functions of cell organelles: Nucleus and cytoplasm. Mitochondria and Chloroplast, Endoplasmic reticulum and its types, Golgi complex, Lysosomes, Vacuoles and peroxisomes. Organelle biomarkers; Cytoskeleton: Structure, Composition, Assembly and functions of microtubules, microfilaments and intermediate filaments, Microfilaments: mechanism of myosin-ATPase activity, contraction; Microtubules, microfilaments activity in Organelle movement.

UNIT II CELL DIVISION AND CONNECTION 9

Cell cycle – Mitosis, Meiosis ; Molecules controlling cell cycle – Cyclins, CDK, Regulation of cell cycle ; Cell cycle - Check points ; Extra cellular matrix – Basal lamina, Connective tissue ; Cell-Cell and Cell-ECM Junctions and their Adhesion Molecules - Gap junctions, Tight junctions, Desmosomes, Hemidesmosomes.

UNIT III MEMBRANE TRANSPORT 9

Basics of membrane transport: Size, solubility and electrochemical gradient of solutes across membrane. Transport proteins: Uniporters, Symporters, Antiporters, Aquaporins, ATP driven pumps and its types, Ion-channels – voltage and ligand gated. Role of ion-channels and ATP pumps in nerve conduction. Principles of Patch-Clamp experiment to study ion-channels activity.

UNIT IV CELL SIGNALLING 9

Cell signaling models: autocrine, endocrine and paracrine; Steps in signal transduction, Signal amplification, Modes of intercellular signaling ; Intracellular receptor pathways - Nitric oxide pathway; Signaling at the cell surface: GPCRs and Second messengers ; Receptors with intrinsic or associated enzymatic activity: Receptor tyrosine kinases – Ras MAP Kinase pathway, cytokine receptor – JAK/STAT pathway, receptors that are ion channels – Ca2+signaling, receptors activating pathways involving proteolysis - Wnt pathway.

UNIT V TECHNIQUES IN CELL BIOLOGY 9

Cell fractionation: Extraction, Homogenization and Centrifugation techniques. Microscopy and cell architecture; Cell isolation: Fluorescence Activated Cell Sorter (FACS) and Magnetic-activated cell sorting (MACS); Primary Cell culture – Isolation and separation of cells, viable cell count, maintenance of cell culture ; Types of cell cultures – Monolayer, Suspension, Clone culture, Mass culture-microcarrier culture ; Cell viability studies: Using tetrazolium salts, LDH release and Tryphan blue exclusion.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Demonstrate the fundamental composition, structure and characteristics of prokaryotic and eukaryotic cell membrane
CO2	Illustrate the fundamental composition, structure and characteristics of prokaryotic and eukaryotic cell organelles
CO3	summarize the action of membrane transport proteins in transport of ions and small molecules across the membrane
CO4	Analyze the basic mechanism behind membrane trafficking and intracellular protein transport
CO5	Utilize a microscope and other bioinstrumentation required in cellular or molecular biology investigations

TEXT BOOKS

1. Alberts, B., Johnson, A., Lewis, J., Morgan, D., Raff, M., Roberts, K. and Walter, P., 2015. *Analyzing cells, molecules, and systems*. *Molecular Biology of the Cell* (6th Edition). Richter LM (Ed.). Garland Science, NY and Abingdon, UK, pp.439-528.
2. Lodish, H., Berk, A., Kaiser, C.A., Kaiser, C., Krieger, M., Scott, M.P., Bretscher, A., Ploegh, H. and Matsudaira, P., 2008. *Molecular cell biology*. Macmillan.
3. Karp, G., 2009. *Cell and molecular biology: concepts and experiments*. John Wiley & Sons.

REFERENCES

1. Cooper, G.M. and Hausman, R.E., 2004. *The cell: a molecular approach*.
2. Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G.P., 2006. *The world of the cell*. San Francisco, CA: Pearson/Benjamin Cummings.

3 Simon, E.J., Dickey, J.L., Hogan, K.A. and Reece, J.B., 2016. *Essential Biology*. United States of America, Pearson Education, Inc.

BT1302 MICROBIOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Know Different types of microorganisms and Structural organization,
- Define Multiplication, growth, control and their applications.

UNIT I INTRODUCTION 9

History and Scope of microbiology; Classification and Nomenclature of microorganisms; Stains and Staining techniques- Simple staining, Differential staining (Gram & Acid fast); Special staining-(Capsular, Flagellar & Endospore).

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION 9

Structural organization and multiplication of bacteria, viruses, Bacteriophages; General characteristics and reproduction of Fungi (Mould& Yeast), Algae, Actinomycetes and Mycoplasma.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 9

Nutritional classification of microorganisms based on carbon, Energy and electron sources; Definition of growth, Different media used for bacterial culture; Cultural characteristics; Growth curve and Different methods to quantify bacterial growth; Aerobic and naerobic bioenergetics.

UNIT IV CONTROL OF MICROORGANISMS 9

Physical and chemical control of microorganisms; Antibiotics - anti-bacterial, antifungal and anti-viral agents; Mode of action and Resistance to antibiotics; Host-microbe interactions; clinically important microorganisms.

UNIT V APPLICATIONS OF MICROBIOLOGY 9

Primary metabolites; secondary metabolites and their applications; Production of biogas; Bioremediation; Biofertilizers and Biopesticides; Food preservation; Microbial leaching; Biosensors.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Define the categories of microorganisms, their classification, diversity and microscopy
CO2	Demonstrate structural differences among diversified microbes
CO3	Explain method to cultivate microorganisms and microbial metabolic pathways
CO4	Demonstrate methods and parameters to control microbes and evaluation of microbial control.
CO5	Apply various microbial systems in biotechnological industries for commercial products

TEXT BOOKS

1 Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., 2001. *Microbiology*. Tata McGraw Hill Edition, New Delhi, India

2 Brock, T.D., Madigan, M.T., Martinko, J.M. and Parker, J., 2014. *Brock biology of microorganisms*. Upper Saddle River (NJ): Prentice-Hall.

3 Gerard J. Tortora, Berdell R. Funke & Christine L. Case. 2018 *Microbiology: An Introduction*. Pearson, 13th Ed.

REFERENCE BOOKS

1 Willey, J.M., Sherwood, L. and Woolverton, C.J., 2011. *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.

2 Louise Hawley, Don Dunn, "*Microbiology and Immunology*" 2002 Kaplan, Inc.

3 Cruger.Wulf and Anneliese Crueger, 2017 "*Biotechnology: A Textbook of. Industrial. Microbiology"*, 3rd Edition, Panima Publishers.

BT1303 **STOICHIOMETRY**

L	T	P	C
3	1	0	4

OBJECTIVES:

This course enables the students to

- Learn about the various units and dimensions of physical quantities.
- Develop skills of the students in the area of Chemical Engineering with emphasis in material and energy balance calculations without chemical reactions.

- Develop skills of the students in the area of Chemical Engineering with emphasis in material and energy balance calculations with chemical reactions.

UNIT I BASIC CHEMICAL CALCULATIONS (9 + 3)

Dimension – Systems of units esp. engineering FPS, Engineering MKS & SI systems – Conversion from one system to the other; Composition of mixtures and solutions – mass fraction, mass %, mole fraction, mole %, mass ratios, molarity, molality, normality, ppm, composition by density; Chemical Reaction - limiting reactant, excess reactant, fractional conversion, percent conversion, yield, selectivity, extent of reaction.

UNIT II IDEAL AND ACTUAL GAS EQUATIONS (9 + 3)

Ideal and actual gas equations – Vander Walls, compressibility factor equations; Application to pure gas & gas mixtures – partial pressures, partial volumes; Air-water vapour systems – Humidity, Molar Humidity, Relative Humidity, % Saturation, humid Volume, Humidity chart, Wet and Dry bulb temperatures, Dew point; pH of solutions; Vapour pressure.

UNIT III MATERIAL BALANCE (9 + 3)

Material balance concept – overall & component; material balance applications – Evaporator, Gas absorber, Distillation (Binary system), Liquid extraction, Solid-liquid extraction, Drying, Crystallization, Humidification, Mixing, Recycle and Bypass illustration.

UNIT IV ENERGY BALANCE (9 + 3)

Thermo physics - general energy balance equation for open systems, closed systems; sensible heat calculation; heat required for phase change; Thermo chemistry – heat of formation, heat of reaction, heat of combustion; Application of steam tables - saturated and superheated steam.

UNIT V CHEMICAL REACTION (9 + 3)

Combustion reactions – solid, liquid and gaseous fuels; applications - oxidation of sulphur compounds and related processes, carbon dioxide from limestone, phosphorous compounds, nitrogen, ammonia, nitric acid, metallurgical applications; processes in biological systems – yield and yield coefficient, elemental balance, respiratory quotient, degree of reduction, oxygen requirement.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Solve the various unit conversion problems and problems related to basic chemical calculations in chemical engineering and biotechnology practice.
CO2	Solve the problems related to ideal, actual gas, air-water vapour system and humidity.
CO3	Apply the concept of material balance without chemical reaction and analysis of data for steady and unsteady state operations in chemical and biochemical engineering.
CO4	Apply the concept of energy balance for open and closed systems and the concept of thermochemistry in chemical engineering and biotechnology application.
CO5	Apply the concepts of material and energy balance with chemical reactions.

TEXT BOOKS:

1. Bhatt, B.I. and Thakore, S.B., 2010. *Stoichiometry*. Tata McGraw-Hill Education.
2. Narayanan, K.V. and Lakshmikutty, B., 2016. *Stoichiometry and process calculations*. PHI Learning Pvt. Ltd.
3. Himmelblau, D.M. and Riggs, J.B., 2012. *Basic principles and calculations in chemical engineering*. FT press.

REFERENCE BOOKS:

1. McCabe, W.L., Smith, J.C. and Harriott, P., 1993. *Unit operations of chemical engineering*. New York: McGraw-hill.
2. Sikdar, D.C., 2013. *Chemical Process Calculations*. PHI Learning Pvt. Ltd.
3. Hicks, T.G. and Chopey, N.P., 2012. *Handbook of chemical engineering calculations*. McGraw-Hill Education.

BT1306 THERMODYNAMICS FOR BIOTECHNOLOGISTS

L	T	P	C
3	0	0	3

OBJECTIVES

This course will enable the students to

- Understand the basic principles of work and energy and thermodynamics laws.
- Learn the principles of entropy and entropy driven processes in biochemical systems along with free energy and phase equilibria.
- Have a comprehensive understanding of PVT behavior of fluids and chemical reaction equilibria.

- To have a complete knowledge on principles of chemical reaction equilibria as applied to biological systems

UNIT I THERMODYNAMIC LAWS AND PROPERTIES OF FLUIDS 9

Concept of heat, work and energy; Forms – work and energy; First Law of thermodynamics- a generalized balance equation and conserved quantities; internal energy and enthalpy changes; Second law of thermodynamics - volumetric properties of fluids exhibiting non-ideal behaviour; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property changes; Maxwell's relations and applications.

UNIT II SOLUTION THERMODYNAMICS 9

Partial molar properties; concept of chemical potential and fugacity; ideal and non-ideal solutions; concept and application of excess properties of mixtures; activity coefficient; composition models; Gibbs-Duhem equation; Thermodynamic properties of ions in solutions; Entropy – Calculations of entropy changes, Clausius inequality, Irreversibility.

UNIT III PHASE EQUILIBRIA 9

Criteria for phase equilibria; Phase equilibrium in single and multi-component system; Phase rule for non-reacting systems; Duhem's theorem; Vapour-Liquid Equilibria (VLE) calculations for binary and multi-component systems; Azeotropes; Consistency Test for VLE Data; Liquid-Liquid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA 9

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; other factors affecting the equilibrium conversion; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION 9

Thermodynamics of microbial growth stoichiometry; thermodynamics of maintenance; calculation of the operational stoichiometry - at different growth rates, Herbert-Pirt relation for electron donor; thermodynamics and stoichiometry of product formation.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Outline the concepts of equilibrium conditions, internal energy, enthalpy, free energy, chemical potential and thermodynamic laws.
CO2	Summarize the basic concepts in solution thermodynamics and relative energies of different liquid and solid solution
CO3	Illustrate the basic concepts of different phases (multiple) and its equilibria
CO4	Identify and apply appropriate thermodynamic relations in chemical reaction system
CO5	Analyze the biochemical reaction to the knowledge of basic thermodynamics of chemical reactions in biological systems

TEXT BOOKS

1. Smith, J.M., Van Ness, H.C. and Abbott, M.M., 2009. *Introduction to Chemical Engineering Thermodynamics,* ‘, Mc Grawhill Book Company. International Edition.
2. Narayanan, K.V., 2004. *A textbook of chemical engineering thermodynamics*. PHI Learning Pvt. Ltd..
3. Smolke, C. ed., 2009. *The metabolic pathway engineering handbook: fundamentals (Vol. 1).* CRC press.
4. Von Stockar, U., 2013. *Biothermodynamics: The role of thermodynamics in biochemical engineering*. PPUR Presses polytechniques.

REFERENCE BOOKS

1. Sandler, S.I., 2017. *Chemical, biochemical, and engineering thermodynamics.* John Wiley & Sons..
2. Atkins, P.W. and De Paula, J., 2013. *Physical chemistry*. John Wiley & Sons.
3. Haynie, D.T., 2013. *Biological thermodynamics*. Cambridge University Press.
4. Peter Atkins, P. and De Paula, J., 2014. *Atkins’ Physical Chemistry*. OUP Oxford.

BT1311 CELL BIOLOGY LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Learn about the principles of microscopy and sterilisation techniques
- Get trained with different cell staining and viability methods

LIST OF EXPERIMENTS

1. Identification of plant cells – root, stem and leaf.
2. Identification of animal cells – blood cells, squamous epithelial cells.
3. Plant -sub-cellular staining
4. Hemocytometer – enumeration of Red Blood Cells and White Blood Cells.
5. Bacterial cell viability studies - Tryphan blue dye exclusion, Tetrazolium salts
6. Cell/tissue lysis - Homogenization
7. Cell fractionation - Differential fractionation
8. Cell division - mitosis in onion root
9. Cell division - meiosis (pre-stained slides)
10. Histopathology - Hematoxylin and Eosin staining (pre-prepared paraffin sections fixed on slide)
11. Membrane transport – Osmosis, Dialysis, Diffusion
12. Tonicity -(hyper, hypo and iso) osmolality condition

TOTAL: 60 PERIODS

EQUIPMENT REQUIRED (FOR 30 STUDENTS)

1. Refrigerated centrifuge – 2 Nos.
2. Temperature controlled Incubator shaker – 2 Nos.
3. Temperature controlled water bath – 2 Nos.
4. Ice flake machine – 1 Nos.
5. Tissue homogenizer – 2 Nos
6. Microplate reader – 1 No.
7. Laminar air flow – 3 nos.

Glass wares/Plastic wares/Chemicals/Media as required

COURSE OUTCOMES

After successful completion of the course, Students will be able to

CO1	Demonstrate the working principles of Microscopy.
CO2	Develop the ability to examine the sub cellular structures.
CO3	Carry out differential staining in order to understand the internal components / complexities of a cell.
CO4	Evaluate the integrity and lysis of cells in culture for downstream experiments

CO5 Identify the viability of cells

REFERENCES

1. Rickwood, D. and J.R. Harris 1996, *Cell Biology : Essential Techniques*, John Wiley,
2. Davis, J.M. 1994, *Basic Cell Culture : A Practical Approach*, IRL,.

BT1312 MICROBIOLOGY LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Know Laboratory biosafety, sterilization techniques.
- Learn Media preparation, isolation of microorganisms and staining techniques.
- Familiarize the growth of microbes, environmental factors effect on growth and Control of microbes.

LIST OF EXPERIMENTS

1. Laboratory Safety, Use of Equipment; Sterilization Techniques
2. Culture Media- Preparation of Nutrient medium (Broth and agar – Slant, Deep)
3. Pure Culture Techniques, Streak plate, Pour plates, Spread plate, Slants, Stabs
4. Microscopy – Working and principles, Microscopic identification of Yeast/Mould
5. Staining

    Simple staining

    Differential - Gram's Staining

    Endospore staining

    Capsular staining

    Lacto-phenol Cotton blue staining – Fungi
6. Motility test – Hanging drop method
7. Enumeration of Microbes: Sampling and Serial Dilution; Bacterial count in Soil – TVC
8. Growth Curve in Bacteria
9. Effect of pH, Temperature, UV radiation on Growth Bacteria
10. Biochemical analysis: Indole, Methyl red, Vogus proskaur test, Citrate utilization, TSI – type study – *E.coli*
11. Antibiotic Sensitivity Assay

12. Effect of Disinfectants- Phenol Coefficient

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Prepare different types of media and demonstrate culture techniques
CO2	Demonstrate the different types of staining for microbe identification.
CO3	Perform different methods of enumeration of microorganisms in different samples and microbial growth.
CO4	Evaluate the effect of various physical factors on growth and microbial biochemical efficacy.
CO5	Carry out antibiotic sensitivity and effect of disinfectant on growth of microorganisms.

TEXT BOOK

1. Cappuccino, J.G. and N. Sherman 2013 —*Microbiology: A Laboratory Manual*‖, 10th Edition, Addison-Wesley.

REFERENCES

1. Brown, A. and Smith, H., 2014. *Benson's Microbiological Applications, Laboratory Manual in General Microbiology*

HS1321	INTERPERSONAL SKILLS - LISTENING AND SPEAKING	L	T	P	C
OBJECTIVES:		**0**	**0**	**2**	**1**

The course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation –– taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work**.**

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.

   Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCE BOOKS:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf

2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html

3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/

4.https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1473 **PROBABILITY AND STATISTICS**

L	T	P	C
3	1	0	4

OBJECTIVES:

The Course will enable students to

- Understand the basics of random variables and some standard distributions that can describe real life phenomenon.
- Establish the basic concepts of two-dimensional random variables.
- Impart the knowledge of testing of hypothesis for small and large samples.
- Describe the basic principles in the design of simple experiments for comparing pairs of treatments.
- Introduce the basic concepts of statistical quality control that plays a vital role in the field of Engineering and Technology.

UNIT I RANDOM VARIABLES 12

Basics of Probability - Discrete and continuous random variables – moments – moment generating functions – binomial, Poisson, geometric, uniform, exponential, gamma and normal distributions – functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions — marginal and conditional distributions — covariance — correlation – Karl Pearson's correlation coefficient – Rank correlation – Spearman's rank correlation coefficient – Kendall's rank correlation coefficient - linear regression.

UNIT III TESTS OF SIGNIFICANCE 12

Type I and Type II errors — tests for single mean, difference of means (large and small samples) — tests for single variance and equality of variances — chi-square test for goodness of fit — independence of attributes.

UNIT IV DESIGN OF EXPERIMENTS 12

Basic Principles of experimental design - Completely randomized design – randomized block design – Latin square design –2 level factorial design.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\overline{X}$ and R charts for continuous data) — control charts for attributes (p, c, np and u charts for discrete data) - tolerance limits.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After completing this course, students will be able to:

CO1	Solve various problems using random variables and distributions
CO2	Compute the correlation between two variables and linear regression equation for a set of data
CO3	Apply the concept of testing of hypothesis for small and large samples in real life problems
CO4	Interpret the data using ANOVA and basic experimental design
CO5	Apply the techniques of Statistical quality control in industrial Engineering problems

TEXT BOOKS:

1. Devore, J L 2017, *Probability and Statistics for Engineering and the Sciences*, Cengage Learning, 9th Edition, Boston.
2. Johnson, R A, & Gupta, C B 2017, *Miller and Freund's Probability and Statistics for Engineers*, Pearson India Education, Asia, 9th Edition, New Delhi.

REFERENCES:

1. Milton, J S & Arnold, J C 2008, *Introduction to Probability and Statistics*, Tata McGraw Hill, 4th Edition, New Delhi.
2. Ross, S M 2014, *Introduction to Probability and Statistics for Engineers and Scientists*, Elsevier, 5th Edition, New Delhi.
3. Spiegel, M R, Schiller, J, Srinivasan, R A & Goswami, D 2017, *Schaum's Outline of Theory and Problems for Probability and Statistics*, McGraw Hill Education, 3rd Edition, New Delhi.

BT1401 ANALYTICAL METHODS OF INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- learn the fundamentals about the light spectrum, Absoprtion, Emission, Fluorescence, NMR and Mass spectroscopy
- understand instrumentation and working principle of optical instruments
- acquire knowledge on the different chromotographic methods for separation of biological products.

UNIT I INTRODUCTION TO ELECTROMAGNETIC SPECTRUM 9

Properties of electromagnetic radiation- wave properties; components of optical instruments – Sources of radiation, wavelength selectors, sample containers, radiation transducers, signal process and read outs; signal to noise ratio - sources of noise , Enhancement of signal to noise; types of optical instruments ; Principle of Fourier Transform optical Measurements.

UNIT II SPECTROSCOPY AND ITS APPLICATIONS 9

Theory, instrumentation, types and applications of Molecular absorption spectrometry, Emission spectroscopy (Fluorescence and Phosphorescence, Infrared absorption spectrometry Raman spectroscopy. Theory, instrumentation and applications of XRD; Other techniques- Turbidometry, nephelometry

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

Theory of NMR; environmental effects on NMR spectra – chemical shift; NMR-spectrometers; applications of 1H and 13C NMR; Molecular mass spectra – ion sources – Mass spectrometer. Applications of molecular mass; Electron paramagnetic resonance- g values; instrumentation.

UNIT IV SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance; Liquid chromatography ; Partition chromatography ; Adsorption chromatography, expanded bed adsorption chromatography ; Ion exchange chromatography ; size exclusion chromatography; Affinity chromatography; HPLC; principles of GC, super critical fluid chromatography, displacement chromatography-horizontal and vertical electrophoresis;

Capillary electrophoresis – Applications.

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

Electrochemical cells; Electrode potential cell potentials – potentiometry, reference electrode , ion selective and molecular selective electrodes ; Instrument for potentiometric studies; Voltametry – Cyclic and pulse voltametry, Applications of voltametry ; Study of surfaces – Scanning probe microscopes – AFM and STM

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

CO1	Illustrate the instrumentation and working principle of optical instruments
CO2	Restate the principle, illustrate the instrumentation of spectroscopic methods and utilize them for applications in biotechnology.
CO3	Restate the principles, illustrate the instrumentation of NMR and Mass spectroscopy and utilize them for applications in biotechnology
CO4	Restate the principles, illustrate the instrumentation of various separation methods and utilize them for applications in biotechnology.
CO5	Restate the principles, illustrate the instrumentation of electrochemical analysis and advanced surface microscopic techniques and utilize them for applications in biotechnology

TEXT BOOKS:

1. Skoog, D.A., Holler, F.J. and Crouch, S.R., 2017. *Principles of Instrumental Analysis*. Cengage learning.
2. Willard, H.H., Merritt Jr, L.L., Dean, J.A. and Settle Jr, F.A., 1988. *Instrumental methods of analysis*.7thEdition, CBS.
3. Braun, R.D., 1987. *Introduction to instrumental analysis*. Mcgraw-Hill College. Pharma Book Syndicate, 1987.

REFERENCES:

1. Ewing,G.W. 1985 *Instrumental Methods of Chemical* Analysis, 5th Edition, McGraw-Hill.
2. Sharma, B.K., 1981. *Instrumental methods of chemical analysis*. Krishna Prakashan Media.
3. Haven, M.C., Tetrault, G.A. and Schenken, J.R. eds., 1994. *Laboratory instrumentation*. John Wiley & Sons.

BT1402 BASIC INDUSTRIAL BIOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- Develop an understanding on overall industrial bioprocess
- Help them to manipulate the process to the requirement of the industrial needs.
- Understand various strategies for the bulk production of commercially important modern bio products, industrial enzymes, products of plant and animal cell cultures.

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 9

Biochemistry of fermentation; Concepts of upstream and downstream processing in Bioprocess, Process flow sheet – block diagrams, pictorial representation. Fermentation - Bacterial, Fungal and Yeast; Strategies for strain improvement; Bioprocess strategies in Plant Cell and Animal Cell culture; monitoring and control of contamination.

UNIT II PRODUCTION OF PRIMARY METABOLITES 9

Biosynthetic pathways and production of commercially important primary metabolites: Organic Acids – Citric acid, Lactic acid, Acetic acid, Gluconic acid; Amino Acids – L-Glutamic acid, L-Lysine, L-Tryptophan; Alcohols – Ethanol, Butanol; Enzymes.

UNIT III PRODUCTION OF SECONDARY METABOLITES 9

Biosynthetic pathways and production processes for various classes of secondary metabolites: Antibiotics – Penicillin, Cephalosporin, Tetracycline; Vitamins – Vitamin B12, Riboflavin, β-Carotene; Steroid Precursors - sapogenins.

UNIT IV PRODUCTION OF BIOFUELS, AGRI AND FOOD PRODUCTS 9

Production of Biodiesel, Biogas, Biopesticides, Biofertilizers, Biopolymers, Cheese, Beer, Single Cell Proteins – Bacterial, Yeast, Algal & Mushroom culture.

UNIT V PRODUCTION OF RECOMBINANT BIOPRODUCTS 9

Production of recombinant proteins having therapeutic and diagnostic applications, Monoclonal antibodies, Vaccines, Human Growth Factor, Insulin, Tumor Suppressor Proteins, Future Aspects.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Illustrate the steps involved in industrial bioprocess
CO2	Explain the basic biotechnological principles, methods and models in the production of primary metabolites.
CO3	Outline the various metabolic engineering approaches in the production of secondary metabolites.
CO4	Apply various bioprocess principles in the production of industrial bioproducts
CO5	The students will be able to restate the principles, illustrate the instrumentation of electrochemical analysis and advanced surface microscopic techniques and utilize them for applications in biotechnology

TEXT BOOKS:

1. Casida, L.E., 1968. *Industrial microbiology.*
2. Crueger, W., Crueger, A., Brock, T.D. and Brock, T.D., 1990. *Biotechnology: a textbook of industrial microbiology*.
3. Stanbury, P.F., Whitaker, A. and Hall, S.J., 2013. *Principles of fermentation technology*. Elsevier.
4. Watson, J.D., Myers, R.M., Caudy, A.A. and Witkowski, J.A., 2007. *Recombinant DNA: genes and genomes: a short course*. Macmillan.

REFERENCES:

1. Prescott, S.C. and Dunn, C.G., 1949. *Industrial microbiology.*
2. Moo-Young, M., 2019. *Comprehensive biotechnology*. Elsevier.
3. El-Mansi, M., Bryce, C.F.A., Demain, A.L. and Allman, A.R*., Fermentation microbiology and biotechnology*. 2007.

BT1403 ENZYME TECHNOLOGY AND BIOTRANSFORMATION

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Familiarize the basic concepts of mechanism of enzyme action.
- Apply the kinetics aspects of reaction with single substrate, multi substrate, inhibitor and immobilized enzyme in various biotechnological applications
- Explore skills in production, purification of enzyme and its applications in biotransformation reactions.

UNIT I INTRODUCTION TO ENZYMES 9

Classification of enzymes; Mechanisms of enzyme action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme action; Principles of catalysis - collision theory, transition state theory; role of entropy in catalysis.

UNIT II KINETICS OF ENZYME ACTION 9

Kinetics of single substrate reactions; Estimation of Michaelis-Menten parameters; Types of inhibition & models; Multi substrate enzyme kinetics; Allosteric regulation of enzymes; Monod-Changeux-Wyman models; Effect of pH and temperature on enzyme action.

UNIT III ENZYME IMMOBILIZATION 9

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding - examples, advantages and disadvantages; Kinetics of immobilized enzyme - Factors affecting the kinetics of bound enzymes, Effect of internal and external diffusional limitations, Diffusional effects and determination of kinetic parameters.

UNIT IV ENZYME PRODUCTION AND PURIFICATION 9

Production and purification of crude enzyme from microbial, plant and animal sources; Development of enzymatic assays; methods of characterization of enzymes – structural and functional properties.

UNIT V APPLICATIONS OF ENZYMES 9

Hydrolytic reactions - Ester, Amide, Epoxides, Nitriles; Reduction reactions - aldehydes, Ketones; Oxidation reactions - Alkanes, Aromatic, Baeyer-Villiger; Enzymes in organic synthesis - esters, amide, peptide; Modified and Artificial Enzymes; Catalytic antibodies; Introduction to Biosensors - design of enzyme electrodes and their application as biosensors in industry, healthcare and environment; Immobilized enzymes in biofuel research.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Explain the complexities of enzyme action for biotechnological applications

CO2 Outline the kinetics of enzyme action.

CO3 Apply the knowledge of immobilized enzyme and its kinetics

CO4 Design strategies for the production and purification of enzymes.

CO5 Comprehend the uses of enzymes catalyst in various biotransformation reactions

TEXT BOOKS:

1. Trevor Palmer and Philip Bonner., 2008. *ENZYMES: Biochemistry, Biotechnology, Clinical Chemistry*. 2nd Edn, East West Publishers.
2. Harvey W. Blanch, Douglas S. Clark., 2007. *Biochemical Engineering*, Taylor & Francis.
3. Harvey W. Blanch and Douglas S. Clark., 2021. *Applied Biocatalysis*. 1st Edn. CRC Press.

REFERENCES:

1. Nelson DL, Cox MM., 2021. *Lehninger Principles of Biochemistry*. 8th Edn. W.H.Freeman & Co Ltd.
2. Alka Dwevedi, 2018. *Enzyme Immobilization: Advances in Industry, Agriculture, Medicine, and the Environment*. Springer.
3. Ajit Sadana, Neeti Sadana., 2010. *Handbook of Biosensors and Biosensor Kinetics*. 1st Edn. Elsevier Science.

BT1404 **MOLECULAR BIOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Familiarize the basic principles of molecular biology and explore skills in molecular biology to aware the complexity and harmony of the cells.

UNIT I INTRODUCTION TO NUCLEIC ACIDS 9

Structure and physicochemical properties of elements in DNA and RNA; Primary and secondary structure of DNA - Chargaff's rule, Watson & Crick model; Conformational variants of double helical DNA - Hoogsteen base pairing, Triple helix, Quadruple helix; Tertiary structure of DNA – DNA supercoiling, Forces stabilizes DNA structure, Reversible denaturation and hyperchromic effect, Organization of prokaryotic chromosomes – lampbrush chromosome, Polytene chromosomes; Organization of eukaryotic chromosomes – Histone proteins.

UNIT II DNA REPLICATION & REPAIR 9

Central dogma, Meselson & Stahl experiment; DNA replication - bi–directional DNA replication, Okazaki fragments, D-loop, rolling circle and theta mode of replication, Differences in prokaryotic and eukaryotic DNA replication, Proteins involved in DNA replication, Fidelity of DNA replication – DNA mutations and repair mechanisms; Inhibitors of DNA replication; Telomere replication in eukaryotes.

UNIT III TRANSCRIPTION 9

Structure and function of mRNA, rRNA and tRNA; Characteristics of promoter and enhancer sequences; RNA synthesis - Initiation, elongation and termination of RNA synthesis, Proteins involved in RNA synthesis, Fidelity of RNA synthesis; Inhibitors of transcription; Differences in prokaryotic and eukaryotic transcription; Post transcriptional modification - RNA processing, 5'-Capping, Poly 'A' tail addition and base modification, Splicing, Alternative splicing.

UNIT IV TRANSLATION 9

Introduction to Genetic code - Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and Eukaryotic ribosomes; Translation - Initiation, Elongation and termination of protein synthesis; Differences in prokaryotic and eukaryotic translation mechanism; Inhibitors of protein synthesis; Post-translational modifications.

UNIT V REGULATION OF GENE EXPRESSION 9

Hierarchical levels of gene regulation; Introduction to operon concept; Prokaryotic gene regulation –lac and trp operon; Regulation of gene expression with reference to λ phage life cycle; Eukaryotic gene regulation – at replication, transcriptional and translational levels; Recombination and crossing over as mechanism of gene regulation – Holliday model, Jumping genes.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1	Familiarize the concepts of physical and chemical characteristics of nucleic acid
CO2	Comprehend the DNA replication mechanism in prokaryotic and eukaryotic cells.
CO3	Demonstrate the transcription and post transcriptional events to find out the check points in drug discovery
CO4	Demonstrate the translation and post translation modification events to find out the check points in drug discovery
CO5	Articulate the concepts of gene regulation in molecular biotechnology applications

TEXT BOOKS:

1. Malacinski G.M., 2015, *Freifelder's Essentials Of Molecular Biology*, 4th Edn, Narosa Publication.
2. Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P., 2016. *Molecular Biology of the cell*, 8th Edn. Garland Science Publishers.
3. Krebs JE, Goldstein ES, Kilpatrick ST., 2017. *Lewin's Essential GENES XII*, 12th Edn. Jones and Bartlett Publishers.

REFERENCES:

1. Cooper GM, Hausman RE., 2015. *The Cell: A Molecular approach*. 7th Edn. Sinauer Associates Inc.,U.S.
2. Nelson DL, Cox MM., 2021. *Lehninger Principles of Biochemistry*. 8th Edn. W.H.Freeman & Co Ltd.
3. Tropp, Burton E.,2012. *Molecular Biology : Genes to Proteins*. 4th Edn. Laxmi Publications.

BT1406 FLUID MECHANICS AND HEAT TRANSFER OPERATIONS

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Learn about the fluid statics, fluid dynamics, fluid moving machinery.
- Understand the fundamental laws that governs heat transfer process.
- Expose the applications of conduction, convection and radiation heat transfer.

UNIT I FLUID PROPERTIES & FLUID MECHANICS 9

Fluid definition; compressible, incompressible fluids; coefficient of isothermal compressibility; Fluid properties - Density Specific gravity, Specific weight, Surface tension, Vapour pressure, Viscosity; Newtonian and Non-Newtonian fluids; Fluid statics – Barometric equation – application for incompressible and compressible fluids; Pressure changes in atmospheric air – Gauge and absolute pressure – pressure measurement with Bourdon gauge & manometers. Centre of pressure concept. Fluid Dynamics – equation of continuity – Bernoulli's equation – press loss in straight pipes – in fittings – expansion and contraction losses (applied to Newtonian Fluids only); Fluid flow measurement - Orifice, Venturi & Rotameter for Newtonian fluids.

UNIT II FLOW OF FLUID THROUGH PACKINGS 9

Fluidization, Fluid transport Industrial application of fluid flow through packing- characteristics of packed bed-Bed surface area-void fraction-Laminar flow through packed bed and turbulent flow pressure drop experienced by the fluid-equations and application problems. Fluidization phenomena-Industrial application - minimum fluidization velocities. Fluid moving machinery-pumps centrifugal, Reciprocating-gear, Peristaltic pumps, Introduction togas moving machinery-Fans, blowers, compressors.

UNIT III CONDUCTION HEAT TRANSFER 9

Heat transfer phenomena-thermodynamics & heat transfer. Heat conduction – Fourier's equation – steady-state conduction in plexor and radial systems – Resistance concept – series and resistance in conduction –and parallel resistance in conduction – unsteady state conduction – lumped capacity model – extended surfaces (Fins) –combined conduction & convection – two dimensional conduction.

UNIT IV CONVECTION HEAT TRANSFER 9

Forced and natural convection – Dimensional analysis, Dimensional numbers, Convection heat transfer coefficient, Correlations for flow over plate, through tubes, over spheres and cylinders, Agitated systems, Packed columns, condensation phenomena, Film and dropwise condensation over tubes. Boiling and Condensation phenomena.

UNIT V RADIATION HEAT TRANSFER AND HEAT TRANSFER EQUIPMENT 9

Electromagnetic waves, energy of radiation, Planck's equation-Blackbody, Radiation exchange. Kirchhoff's law, Stefen Boltzmann equation of radiant energy – Wien's law, Radiation exchange between surfaces – black, grey bodies, view factors-sample problems. Concept of overall heat transfer coefficient, Heat exchangers, types, boilers, Kettles, Heat exchanger Design concept. NTU concept.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Solve the problems related to fluid statics and dynamics in momentum transfer.
CO2	Outline the concepts of fluid moving machinery, flow through packed column as well as fluidized column.
CO3	Differentiate among different modes of heat transfer, various laws and terms used for design purpose.
CO4	Solve problems related to convection, boiling and condensation phenomena,
CO5	Illustrate the principles of radiation mode of heat transfer and their applications

TEXTBOOK

1. Geankoplis, C.J. 2015, *Transport Processes and Unit Operations,* IV edition, Prentice Hall of India.
2. Nag, P.K. 2003, *Heat & Mass Transfer*, 3rd edition, Tata McGraw Hill.
3. McCabe, W.L, Sonith, J. C and Harriot, P, 2001, *Unit operations of chemical Engineering,* 6th edition, McGraw Hill.

REFERENCE BOOKS

1. Frank Kreith, Raj, M. Manglik and Mark S. Bohn, 2011, *Principles of Heat Transfer,* 7th

edition, Cenage Learning Inc.
2. Coulson, J.M., 1999, *Coulson and Richardson's Chemical Engineering Volume 1-Fluid Flow, Heat Transfer and Mass Transfer,* 6th Edition, Elsevier.

BT1411 CHEMICAL ENGINEERING LABORATORY FOR BIOTECHNOLOGISTS

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Understand the basics of fluid flow characteristics.
- Apply the principles of mechanical separations in chemical and biotechnology field.
- Understand the basics of principles of heat and mass transfer.

LIST OF EXPERIMENTS

1. Flow measurement – Variable Head Meters (Venturimeter and Orificemeter)
2. Flow measurement – Variable Area Meter (Rotameter)
3. Pressure drop in flow through pipes
4. Pressure drop in flow through packed column
5. Pressure drop in flow through fluidized bed
6. Characteristics of centrifugal pump
7. Characteristics of reciprocating pump
8. Solid-Liquid Separation - Filtration
9. Settling and Sedimentation
10. Heat transfer characteristics in heat exchanger
11. Simple distillation
12. Liquid-Liquid extraction
13. Drying characteristics in a pan dryer
14. Adsorption

TOTAL: 60 Periods

Equipment Needed for 30 students

Colorimeter	2
Filter leaf	1
Orifice meter	1
Venturimeter	1

Rotameter	1
Hot air oven	1
Fluidized Bed	1
Packed Bed	1
Plate and Frame Filter Press	1
Heat Exchanger	1

Glassware, Chemicals, Media as required

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Calibrate the flow measuring devices and measure the flow rate.
CO2	Investigate the pressure drop in various conduits.
CO3	Analyse the operating characteristics of pumps.
CO4	Separate solid-liquid slurries using filtration equipment.
CO5	Find the heat and mass transfer terminologies using heat exchanger, distillation, extraction, adsorption and drying equipment.

REFERENCES

1. McCabe, W.L., Smith, J.C. and Harriott, P., 2001. *Unit operations of chemical engineering* 6th edition, New York: McGraw-Hill.
2. Kreith, F. and Bohn, M.S., 1997. *Principles of heat transfer* 7th edition. Cenage Learning Inc.
3. Geankoplis, C.J., 2006. *Transport processes and separation process principles* 4th edition. Prentice Hall Professional Technical Reference.

BT1412 INSTRUMENTATION AND METHODS OF ANALYSIS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Have a practical hands on experience on Absorption Spectroscopic methods
- Understand and perform nephlometric and fluorimertic experiments
- Acquire experience in the purification by performing chromatography

LIST OF EXPERIMENTS

1. Precision and validity checking of instrument using KMnO4 solution
2. Verification of Beer Lambert's law using standard sugar solution and protein solution
3. UV spectra of nucleic acids and proteins
4. Limits of detection using aluminium alizarin complex
5. Finding the molar absorbtivity and stoichiometry of the Fe (1,10phenanthroline)3 using absorption spectrometry.
6. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
7. Chemical actinometry using potassium ferrioxolate.
8. Estimation of SO^{4-} by nephelometry.
9. Estimation of Al^{3+} by Flourimetry.
10. Estimation of thiamine by Fluorimetry
11. Chromatography analysis of amino acids using TLC
12. Chromatography analysis of plant pigments using column chromatography.

TOTAL: 60 PERIODS

EQUIPMENT NEEDED FOR 30 STUDENTS

- UV visible spectrophotometer 2
- Spectrofluorometer
- Nephlometer / turbidometer
- Actinometer
- TLC plates 12
- Adsorbent column 12
- Glassware, Chemicals- as required

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Determine the precision and validity of experiments

CO2 Identify biomolecules by spectrum analysis

CO3 Perform experiments using nephlometry and fluorimetry

CO4 Perform experiments using absorption spectroscopy

CO5 Perform experiments using thin layer and column chromatography techniques

REFERENCES

1. Skoog, D.A., Holler, F.J. and Crouch, S.R., 2017. *Principles of Instrumental Analysis*. Cengage learning.
2. Willard, H.H., Merritt Jr, L.L., Dean, J.A. and Settle Jr, F.A., 1988. *Instrumental methods of analysis*. 7th Edition, CBS.
3. Braun, R.D., 1987. *Introduction to instrumental analysis*. Mcgraw-Hill College. Pharma Book Syndicate, 1987.
4. Ewing,G.W. 1985 *Instrumental Methods of Chemical Analysis*, 5th Edition, McGraw-Hill,

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING **6**

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING **6**

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING **6**

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1.Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.

2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.

5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

http://learnenglishteens.britishcouncil.org/skills/reading
https://learnenglish.britishcouncil.org/skills/reading
https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. CIVIL ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION

To make the Department of Civil Engineering, unique of its kind to promote education and research in the various fields of construction industry.

MISSION

To impart highly innovative and technical knowledge in the field of Civil Engineering to the urban and rural student folks through "Total Quality Education".

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1:

Graduates of the program will be creative, able to apply scientific knowledge and computer aided design tools for technical problems in the field of Civil Engineering.

PEO 2:

Graduates of the program will be a professional Civil Engineer and/or will pursue higher education in various domains of Civil Engineering by taking competitive examinations.

PEO 3:

Graduates of the program will passionately perform as a competent team member, team leader and/or entrepreneur in the development of a sustainable environment.

PROGRAM OUTCOMES:

After going through the four years of study, the Civil Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Graduating students will be able to deal complex problems in the field of Civil Engineering to achieve design solutions with modern technological approach and application software.

PSO2:

Graduating students will be able to understand the professional Civil Engineering practice and apply contextual knowledge with the appropriate consideration of the society and environment.

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B.E. CIVIL ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III TO IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MA1373	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2.	CE1301	Construction Materials	PC	3	0	0	3	3
3.	CE1302	Engineering Geology	PC	3	0	0	3	3
4.	CE1303	Fluid Mechanics	PC	3	0	0	3	3
5.	CE1304	Strength of Materials I	PC	3	0	0	3	3
6.	CE1305	Surveying	PC	3	0	0	3	3
PRACTICAL								
7.	CE1311	Computer Aided Building Drawing Laboratory	PC	0	0	4	4	2
8.	CE1312	Surveying Laboratory	PC	0	0	4	4	2
9.	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK L	T	P	TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	MA1471	Numerical Methods	BS	3	1	0	4	4
2.	CE1401	Applied Hydraulic Engineering	PC	3	0	0	3	3
3.	CE1402	Concrete Technology	PC	3	0	0	3	3
4.	CE1403	Construction techniques, Equipment and Practice	PC	3	0	0	3	3
5.	CE1404	Soil Mechanics (Theory cum Lab)	PC	3	0	2	5	4
6.	CE1405	Strength of Materials II	PC	3	0	0	3	3
PRACTICAL								
7.	CE1411	Strength of Materials Laboratory	PC	0	0	4	4	2
8.	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**8**	**27**	**23**

SEMESTER III

MA1373 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of PDE used in solving partial differential Equations.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To acquaint the students with Fourier transform and Z-transform techniques

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange"s Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet"s conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval"s identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two- dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair- Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval"s identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z transform.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Form the partial differential equations and solve them using various techniques
CO2	Find the Fourier constants and frame the Fourier series of periodic functions
CO3	Classify and solve the initial and boundary value problems such as wave and heat flow equation
CO4	Compute the Fourier transforms of standard functions and learn the properties
CO5	Apply the techniques of Z- transform to get the solutions of differential equations

TEXTBOOKS:

1 Erwin kreyszig, 2015, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th Edition, New Delhi.

2 Grewal B,S, 2017*, Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, New Delhi.

REFERENCES:

1 Bali, N, Goyal, M, & Watkins C, 2009*, Advanced Engineering Mathematics,* Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.

2 Narayanan, S, Manicavachagom Pillay T, K & Ramanaiah, G , 1998, *Advanced Mathematics for Engineering Students*, Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai.

3 Glyn James, 2011, *Advanced Modern Engineering Mathematics*, Pearson Education, 4 th Edition, New Delhi.

4 Peter V, O‟Neil, 2012, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi.

5 Ramana, 2010, B,V*, Higher Engineering Mathematics*, Tata McGraw Hill, 11th Reprint, New Delhi.

CE1301 **CONSTRUCTION MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students to various materials commonly used in civil engineering construction and their properties

UNIT I STONES – BRICKS – CONCRETE BLOCKS **9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks – Flyash Bricks.

UNIT II LIME – CEMENT – AGGREGATES – MORTAR **9**

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades - Properties of cement and Cement mortar - Hydration - Compressive strength - Tensile strength - Fineness- Soundness and consistency - Setting time - fine aggregates - river sand – crushed stone sand – properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading-Bulking of fine aggregate – M-Sand.

UNIT III CONCRETE **9**

Concrete - Ingredients - Manufacturing Process - Batching plants -mixing – transporting – placing – compaction of concrete –curing and finishing – Ready mix Concrete – Mix specification – Special Concrete.

UNIT IV TIMBER AND OTHER MATERIALS **9**

Timber - Market forms - Industrial timber- Plywood - Veneer - Thermocol - Panels of laminates - Steel - Aluminum and Other Metallic Materials - Composition - Aluminum composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumen.

UNIT V MODERN MATERIALS **9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products –

Refractories - Composite materials - Types - Applications of laminar composites - Fibre textiles- Geomembranes and Geotextiles for earth reinforcement.- Green material, Sustainable material, Nano materials, Construction chemicals, Pavement Tiles – Interlocking concept.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 Compare the properties of most common and advanced building materials

CO2 summarize the typical and potential applications of lime, cement and aggregates.

CO3 outline the production of concrete and also the method of placing and making of concrete elements.

CO4 Illustrate the applications of timbers and other materials.

CO5 Illustrate the importance of modern material for construction

TEXT BOOKS:

1. Varghese.P.C, 2015, *Building Materials*, PHI Learning Pvt. Ltd, New Delhi.
2. Rajput. R.K., 2008, *Engineering Materials*, S. Chand and Company Ltd.
3. Gambhir.M.L., 2004, *Concrete Technology*, 3rd Edition, Tata McGraw Hill Education
4. Duggal.S.K., 2008, *Building Materials*, 4th Edition, New Age International.

REFERENCES:

1. Jagadish.K.S,2007, *Alternative Building Materials Technology*, New Age International.
2. Gambhir. M.L., &NehaJamwal 2012,*Building Materials, products, properties and systems*, Tata McGraw Hill Educations Pvt. Ltd, New Delhi,.
3. *IS456 - 2000*: *Indian Standard specification for plain and reinforced concrete*, 2011.
4. *IS4926 - 2003*: *Indian Standard specification for ready–mixed concrete*, 2012.
5. *IS383 - 1970*: *Indian Standard specification for coarse and fine aggregate from natural Sources for concrete*, 2011.
6. *IS1542-1992*: *Indian standard specification for sand for plaster*, 2009.
7. *IS 10262-2009*: *Indian Standard Concrete Mix Proportioning –Guidelines*, 2009.

CE1302 ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- At the end of this course the students will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.

UNIT I PHYSICAL GEOLOGY 9

Geology in civil engineering - branches of geology - structure of earth and its composition weathering of rocks - scale of weathering - soils landforms and processes associated with river, wind, groundwater and sea - relevance to civil engineering. Plate tectonics - Earth quakes – Seismic zones in India.

UNIT II MINEROLOGY 9

Physical properties of minerals - Quartz group, Feldspar group, Pyroxene hypersthene and augite, Amphibole - hornblende, Mica - muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9

Classification of rocks, distinction between Igneous Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT IV STRUCTURAL GEOLOGY ANDGEOPHYSICAL METHODS 9

Geological maps - attitude of beds, study of structures - folds, faults and joints - relevance to civil engineering. Geophysical methods - Seismic and electrical methods for subsurface investigations Applications for sub-surface investigation and groundwater exploration.

UNIT V APPLICATION OF GEOLOGICAL INVESTIGATIONS 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings – Hydro-geological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.-Case Studies in India

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 Develop an understanding about the various physical processes that lead to the formation of geological features and plate tectonics.

CO2 Identify and categorize minerals based on their appearance and chemical composition

CO3 Compare the traits that delineate the various types of rocks and their suitability for various engineering applications

CO4 Relate the structural form of rocks and its implications on its mechanical properties

CO5 Make use of various field investigation techniques like remote sensing for collecting data on geological conditions on site.

TEXT BOOKS:

1. Varghese, P.C.,2012, *Engineering Geology for Civil Engineering*, Prentice Hall of India Learning Private Limited, New Delhi.
2. Venkat Reddy. D, 2010, *Engineering Geology*, Vikas Publishing House Pvt. Ltd.
3. Gokhale KVGK,2011, *Principles of Engineering Geology*, B.S. Publications, Hyderabad.
4. ChennaKesavulu N.,2009, *Textbook of Engineering Geology*, Macmillan India Ltd.
5. Parbin Singh. A ,2009,Text*book of Engineering and General Geology*, Katson publishing house, Ludhiana.

REFERENCES:

1. Blyth F.G.H. & De Freitas M.H., 2010, *Geology for Engineers*, Edward Arnold, London.
2. Bell .F.G., 2011, *Fundamentals of Engineering Geology*, B.S. Publications. Hyderabad.
3. Dobrin, M.B, 1988 ,*An introduction to geophysical prospecting*, McGraw Hill, New Delhi,.

CE1303 **FLUID MECHANICS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.

UNIT I FLUID PROPERTIES AND FLUID STATICS **9**

Fluid – definition, distinction between solid and fluid - Units and dimensions Properties of fluids - density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

UNIT II FLUID KINEMATICS AND DYNAMICS **9**

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net. Fluid dynamics - equations of motion---Euler's equation along streamline - Bernoulli‟s equation - applications Venturimeter, orifice meter and Pitot tube- linear momentum equation and its application to pipe bend.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES **9**

Fundamental dimensions - dimensional homogeneity - Rayleigh‟s method and Buckingham Pi-theorem - dimensionless parameters - similitude and model studies distorted models.

UNIT IV FLOW THROUGH PIPES **9**

Reynold‟s experiment - laminar flow through circular pipe (Hagen poiseulle's) -- hydraulic and energy gradient – flow through pipes - Darcy - Weisbach's equation - pipe roughness - friction factor- Moody's diagram- major and minor losses of flow in pipes pipes in series and in parallel – Equivalent pipe.

UNIT V BOUNDARY LAYER **9**

Boundary layer – definition- boundary layer on a flat plate – laminar and turbulent boundary layer- displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

CO1 Get a basic knowledge of fluids in static, kinematic and dynamic equilibrium.

CO2 Understand and solve the problems related to equation of motion.

CO3 Gain knowledge about dimensional and model analysis.

CO4 Learn types of flow and losses of flow in pipes.

CO5 Understand and solve the boundary layer problems.

TEXT BOOKS:

1. Modi P.N and Seth., 2009, *Hydraulics and Fluid Mechanics including Hydraulic Machines*, Standard Book House New Delhi.
2. Jain.A.K..,2016,*Fluid Mechanics" (Including Hydraulic Machines)*, Khanna Publishers, Twelfth Edition.
3. Subramanya.K., 2010,*Fluid Mechanics and Hydraulic Machines*, Tata McGraw Hill Education Private Limited, New Delhi.
4. Rajput.R.K., 2008,*Fluid Mechanics*, S.Chand and Co, New Delhi.

REFERENCES:

1. Streeter, V.L., and Wylie, E.B., 2010,*Fluid Mechanics*, McGraw Hill.
2. Fox W.R. and McDonald A.T., 2013,*Introduction to Fluid Mechanics,* John-Wiley and Sons, Singapore.
3. White, F.M., 2017,*Fluid Mechanics*, Tata McGraw Hill, 5th Edition, New Delhi.
4. Mohd. Kaleem Khan., 2015, *Fluid Mechanics and Machinery*, Oxford University Press, New Delhi.
5. Bansal.R.K., 2013,*Fluid Mechanics and Hydraulic Machines*, Laxmi Publications Pvt. Ltd., New Delhi.

CE1304 **STRENGTH OF MATERIALS I**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn the fundamental concepts of Stress, Strain and deformation of solids.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To understand the effect of torsion on shafts and springs.
- To analyze plane and space trusses

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS **9**

Simple Stresses and strains – Elastic constants--Relationship between elastic constants – Stress Strain Diagram – Ultimate Stress – Yield Stress – Deformation of axially loaded member - Composite Bars Thermal Stresses - State of Stress in two dimensions - Stresses on inclined planes – Principal Stresses and Principal Planes – Maximum shear stress--Mohr's circle method.

UNIT II TRANSFER OF LOADS AND STRESSES IN BEAMS **9**

Types of loads, supports, beams – concept of shearing force and bending moment – Relationship between intensity of load, Shear Force and Bending moment Shear Force and Bending Moment Diagrams for Cantilever, simply supported and overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force Flitched Beams – Leaf Springs.

UNIT III DEFLECTION OF BEAMS **9**

Elastic curve – Governing differential equation - Double integration method Macaulay's method - Area moment method--conjugate beam method for computation of slope and deflection of determinant beams.

UNIT IV TORSION **9**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs - springs in series and parallel - Design of buffer springs.

UNIT V ANALYSIS OF TRUSSES 9

Determinate and indeterminate trusses Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient - Analysis of Space trusses by tension coefficient method.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the fundamental concepts of stress, strain of solids and the stresses in two dimensions

CO2 Construct shear force and bending moment diagram for determinate beams and understand the concept of simple bending

CO3 Apply the analytical techniques for computing deflection of members subjected to bending.

CO4 Solve analytical problems on shafts subjected to torsion and helical springs

CO5 Solve analytical problems on plane and space trusses

TEXTBOOKS:

1. Rajput.R.K., 2015,*Strength of Materials,*S.Chand and Co, New Delhi.
2. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain.,2015 *SMTS –I Strength of materials*, Laxmi publications. New Delhi,
3. Rattan. S. S.,2012, *Strength of Materials,* Tata McGraw Hill Education Private Limited, New Delhi,
4. Bansal. R.K.,2010, *Strength of Materials,*Laxmi Publications Pvt. Ltd., New Delhi.

REFERENCES :

1. Timoshenko.S.B. and Gere.J.M.,1999, *Mechanics of Materials,* Van NosReinbhold, New Delhi.
2. Vazirani.V.N and Ratwani.M.M,,1995, *Analysis of Structures,* Vol IKhanna Publishers, New Delhi,.
3. Junnarkar.S.B. and Shah.H.J.,2016, *Mechanics of Structures,*Vol I, Charotar Publishing House,New Delhi.
4. Singh. D.K.,2016, *Strength of Materials,*Ane Books Pvt. Ltd., New Delhi,

5. Basavarajaiah, B.S. and Mahadevappa, P., 2010,*Strength of Materials*, Universities Press, Hyderabad,.
6. Gambhir. M.L., 2009, *Fundamentals of Solid Mechanics,* PHI Learning Private Limited., New Delhi.

CE1305 **SURVEYING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of plane and geodetic surveying principles
- To illustrate the various methods of surveying to solve the field problems
- To .categorize the errors and correction in surveying
- To outline the basics of Astronomical Surveying.

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9

Classifications and basic principles of surveying-- Equipment and accessories for ranging and chaining - Methods of ranging - Compass - Types of Compass Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing Levelling- Principles and theory of Levelling – Datum --Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling- Booking – Reduction - Sources of errors in Levelling Curvature and refraction.

UNIT II THEODOLITE AND TACHEOMETRIC SURVEYING 9

Horizontal and vertical angle measurements - Temporary and permanent adjustments Heights and distances - Tacheometer - Stadia Constants - Analytic Lens-- Tangential and Stadia Tacheometry surveying – Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring Contour gradient – Uses of contour plan and map

UNIT III CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control- Methods – Triangulation - Traversing – Trigonometric Levelling - Gale„s table - Trilateration -Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – adjustment of simple triangulation networks.

UNIT IV MODERN SURVEYING 9

Total Station: Digital Theodolite, EDM, Electronic field book-- Advantages – Parts and accessories - working principle – Observables – Errors COGO functions – Field procedure and applications. GPS: Advantages System components – Signal structure – Selective availability and antispoofing – receiver components and antenna – Planning and data acquisition – Data processing Errors in GPS – Field procedure and applications.

UNIT V ADVANCED TOPICS IN SURVEYING 9

Route Surveying - Reconnaissance - Route surveys for highways, railways and waterways - Simple curves – Compound and reverse curves – Transition curves - Setting out different methods of simple curve - Vertical curves - Hydrographic surveying – Tides - MSL Sounding methods - - Astronomical terms and definitions Celestial coordinate systems – different time systems Field observations and determination of azimuth by altitude and hour angle method.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Understand the rudiments of various surveying and its principles.

CO2 Infer the concepts of Theodolite and Tacheometric Surveying.

CO3 Narrate the procedure for establishing horizontal and vertical control and its adjustment procedure.

CO4 Describe the basics of Modern Surveying

CO5 Outline the knowledge in Route surveying, Hydrographic surveying and Field Astronomical surveying

TEXTBOOKS:

1. Venkatramaiah, 2014, "*Text book of Surveying*", University press, New Delhi,
2. Dr.B.C.Punmia, Ashok K.Jain and Arun K Jain, 2005, "*Surveying Vol.I& II*", Lakshmi Publications Pvt Ltd, New Delhi.

REFERENCES:

1. R. Subramanian, 2012, "*Surveying and Levelling*", Oxford University Press, Second Edition.
2. Bannister and S. Raymond, 2004, "*Surveying*", Seventh Edition, Longman
3. S.K. Roy, 2004, "*Fundamentals of Surveying*", Second Edition, Prentice„ Hall of India
4. K.R. Arora, 2013, "*Surveying Vol I & II*", Standard Book house , Twelfth Edition.

CE1311 COMPUTER AIDED BUILDING DRAWING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To introduce the students to draft the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

LIST OF EXPERIMENTS

1. Principles of planning, orientation and complete joinery details (Paneled and Glazed Doors and Windows).
2. Buildings with load bearing walls.
3. Buildings with sloping roof.
4. R.C.C. framed structures.
5. Industrial buildings – North light roof structures.

TOTAL:60 PERIODS

COURSE OUTCOMES:

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

CO 1 Draft Paneled and Glazed Doors and Windows.

CO 2 Sketch front, top & side views of Buildings with load bearing walls.

CO 3 Sketch Buildings with sloping roof.

CO 4 Sketch R.C.C. framed structures.

CO 5 Draft Industrial buildings – North light roof structures.

TEXTBOOKS:

1. SikkaV.B.,*A Course in Civil Engineering Drawing*, 4^{th} Edition, S.K.Katariaand Sons, 2015.

2. George Omura, *Mastering in Autocad 2005 and Autocad* LT 2005- BPB Publications,2008

REFERENCES:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, *BIM Handbook:A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors*, John Wiley and Sons.Inc.,2011.
2. MarimuthuV.M.,Murugesan R. and Padmini S., *Civil Engineering Drawing-I,* Pratheeba Publishers,2008.
3. Shah.M.G., Kale. C.M. and Patki.S.Y.,*Building Drawing with an Integrated Approach to Built Environment,* Tata McGraw Hill Publishers Limited,2007.
4. Verma.B.P.,*Civil Engineering Drawing and House Planning,* Khanna Publishers,2010.

CE1312 **SURVEYING LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVE:

- At the end of the course the student will possess knowledge about Survey field techniques

LIST OF EXPERIMENTS:

Chain Survey

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Compass Survey and Plan table Survey

3. Compass Traversing – Measuring Bearings & arriving included angles
4. Plan table Surveying – Measuring areas & Distance between inaccessible points

Levelling - Study of levels and levelling staff

5. Fly levelling using Dumpy level &Tilting level

6. Check levelling

Theodolite - Study of Theodolite

7. Measurements of horizontal angles by reiteration and repetition and vertical angles
8. Determination of elevation of an object using single plane method when base is accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

9. Determination of Tacheometric Constants
10. Heights and distances by stadia Tacheometry
11. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

12. Traverse using Total station and Area of Traverse
13. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 60 PERIODS

COURSE OUTCOMES:

CO1 Make use of chain for measuring distance in field

CO2 Examine the area of traverse and detect local attraction using compass surveying & Plane table Surveying.

CO3 Examine the elevation of various points and carryout longitudinal and cross sectioning using level

CO4 Examine the heights and distances using Theodolite and systems of tacheometry.

CO5 Make use of total station for measuring distance in field

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S.No	Description of Equipment	Quantity
1.	Total Station	3 Nos
2.	Theodolites	At least 1 for every 5 students
3.	Dumpy level / Filling level	At least 1 for every 5 students
4.	Pocket stereoscope	1
5.	Ranging rods	1 for a set of 5 students
6.	Levelling staff	

7.	Cross staff	
8.	Chains	
9.	Tapes	
10.	Arrows	
11.	Prismatic Compass	10 nos
12.	Surveyor Compass	2 nos
13.	Survey grade or Hand held GPS	3 nos

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification Improving pronunciation- pronunciation basics — stressing syllables and speaking clearly - intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs.

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.

2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1471 NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To impart the knowledge of various techniques of differentiation and integration.
- To compute the solution of differential equation with initial and boundary conditions.
- To understand the knowledge of finding the solution for the boundary value problems in Partial differential equations using finite difference methods.

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 12

Solution of algebraic and transcendental equations: Fixed point iteration method – Newton Raphson method - Solution of linear system of equations: Gauss elimination method – Pivoting – Gauss Jordan method – Inverse of a matrix by Jordan Method – Iterative methods of Gauss Jacobi and Gauss Seidel – Dominant Eigen value of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals: Lagrange's interpolation – Newton‟s divided difference interpolation – Cubic Splines – Difference operators and relations – Interpolation with equal intervals: Newton‟s forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials – Numerical integration: Trapezoidal rule – Simpson‟s 1/3 rule – Simpson‟s 3/8 rule – Romberg‟s Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson‟s 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor‟s series method – Euler‟s method – Modified Euler‟s method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne‟s and Adam‟s predictor and corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace‟s and Poisson‟s equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

CO1 Compute numerical solutions to system of linear equations, algebraic, transcendental equations and Eigen value problems.

CO2 Construct approximate polynomial to represent the data and find the intermediate values of unknown function using interpolation

CO3 Apply numerical methods to find the values of differentiation and integration.

CO4 Solve the partial and ordinary differential equations with initial and boundary conditions by using numerical techniques.. ·

CO5 Solve using finite difference techniques for the solution of two dimensional Laplace‟s and Poisson‟s equations on rectangular domain and one dimensional heat and wave equation.

TEXTBOOKS:

1. Burden, R L and Faires, J D 2016, *Numerical Analysis*, 9th Edition, Cengage Learning.
2. Grewal, B S., and Grewal, J S. 2015, *Numerical Methods in Engineering and Science*, Khanna Publishers, 10th Edition, New Delhi.

REFERENCES:

1. Brian Bradie, 2007, *A Friendly Introduction to Numerical Analysis*, Pearson Education, Asia, New Delhi.
2. Gerald. C F. and Wheatley P O, 2006, *Applied Numerical Analysis*, Pearson Education, Asia, 6th Edition, New Delhi.
3. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.
4. Mathews, J H, 1992, *Numerical Methods for Mathematics, Science and Engineering*, 2nd Edition, Prentice Hall.
5. Sankara Rao. K. 2007, Numerical *Methods for Scientists and Engineers*, Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi.
6. Sastry, S S, 2015, *Introductory Methods of Numerical Analysis*, PHI Learning Pvt. Ltd, 5th Edition, New Delhi

CE1401 APPLIED HYDRAULIC ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like open channel· flows and hydraulic machines.
- At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

UNIT I UNIFORM FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow Properties of open channel - Velocity distribution in open channel Steady uniform flow: Chezy‟s equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow.

UNIT II GRADUALLY VARIED FLOW 9

Dynamic equations of gradually varied flows – Types of flow profiles---Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

UNIT III RAPIDLY VARIED FLOW 9

Application of the momentum equation for RVF - Hydraulic jumps - Types Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

UNIT IV TURBINES 9

Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine Specific speed – Characteristic Curves of Turbines Draft tube and cavitation.

UNIT V PUMPS 9

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip - Indicator diagrams and its variations – Air vessels Savings in work done.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

CO1 Apply their knowledge of fluid mechanics in addressing problems in open channels.

CO2 Identify an effective section for flow in different cross sections ·

CO3 Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.

CO4 Understand the principles, working and application of turbines ··

CO5 Understand the principles, working and application of pumps ··

TEXTBOOKS:

1. Subramanya.K .2000,*Flow in open channels*, Tata McGraw Hill, New Delhi.
2. Modi P.N and Seth.S.M .,2009,*Hydraulics and Fluid Mechanics including Hydraulic Machines*, Standard Book House New Delhi.
3. Chandramouli P.N. 2017,*Applied Hydraulic Engineering*, Yes Dee Publishing Pvt. Ltd.

REFERENCES:

1. VenTe Chow, 2009, *Open Channel Hydraulics*, McGraw Hill, New York.
2. HanifChaudhry.M., 2007, *Open Channel Flow*, Second Edition, Springer.
3. Rajesh Srivastava,2008, *Flow through open channels*, Oxford University Press, New Delhi.
4. Jain.A.K.,2016 , *Fluid Mechanics (Including Hydraulic Machines)*, Khanna Publishers, Twelfth Edition.
5. Subramanya.K.,2010, *Fluid Mechanics and Hydraulic Machines*, Tata McGraw Hill Education Private Limited, New Delhi.

CE1402 CONCRETE TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge to the students on the properties of materials for concrete by suitable tests, mix design for concrete and special concretes.

UNIT I CONSTITUENT MATERIALS 9

Cement - Different types - Chemical composition and Properties - Hydration of cement Tests on cement - IS Specifications - Aggregates - Classification Mechanical properties and tests as per BIS - Grading requirements – Water Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators – Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -

Effects on concrete properties. Case study on Effects of chemical and mineral admixtures on mortar/concrete

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning - Properties of concrete related to Mix Design---Physical properties of materials required for Mix Design - Design Mix and Nominal Mix--BIS Method of Mix Design Mix Design Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability - Tests for workability of concrete - Segregation and Bleeding Determination of strength Properties of Hardened concrete - Compressive strength – split tensile strength - Flexural strength - Stress-strain curve for concrete Modulus of elasticity - durability of concrete – water absorption – permeability – corrosion test – acid resistance.

UNIT V SPECIAL CONCRETES 9

Light weight concretes - foam concrete- self compacting concrete – vacuum concrete High strength concrete - Fibre reinforced concrete – Ferrocement - Ready mix concrete – SIFCON Shotcrete – Polymer concrete - High performance concrete - Geopolymer Concrete Bacterial ductal concrete.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 Summarize the various requirements of cement, aggregates and water for making concrete

CO2 Outline the effect of admixtures on properties of concrete

CO3 Experiment with concept and procedure of mix design as per IS method

CO4 Relate the properties of fresh and hardened concrete

CO5 Illustrate the importance and application of special concretes

TEXTBOOKS:

1. Gupta.B.L., Amit Gupta, 2010, "*Concrete Technology*", Jain Book AgencyShetty,M.S, "*Concrete Technology*", 2003,SChand and Company Ltd, New Delhi,

2. Bhavikatti.S.S, 2015 "*Concrete Technology*", I.K.International Publishing House Pvt. Ltd., New Delhi.
3. Santhakumar. A.R.,2006, "*Concrete Technology*", Oxford University Press India.

REFERENCES:

1. Neville, A.M;1995, "*Properties of Concrete*", Pitman Publishing Limited, London.
2. Gambhir, M.L;2007, "*Concrete Technology*", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi.
3. IS10262-2009, 1998, Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
4. Job Thomas,2015, "*Concrete Technology*", Cengage Learning India Pvt. Ltd., Delhi.
5. Kumar P Mehta., Paulo J M Monterio., "Concrete - Microstructure, Properties and Materials", 2016, McGraw Hill Education (India) Private Limited, New Delhi.

CE1403 CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICES

L	T	P	C
3	0	0	3

OBJECTIVES:

- The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities.

UNIT I CONSTRUCTION TECHNIQUES 9

Structural systems - Load Bearing Structure - Framed Structure -Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology -- Seismic effect 3D Printing-Hybrid Concrete Construction- Environmental impact of materials - responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones-Case studies of residential, office buildings and other buildings in each zones

UNIT II CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site

Clearance - Marking - Earthwork - masonry - stone masonry - Bond in masonry - concrete hollow block masonry - flooring - damp proof courses - construction joints - movement and expansion joints - pre cast pavements - Building foundations - basements - temporary shed - centering and shuttering - slip forms - scaffoldings - de-shuttering forms - Fabrication and erection of steel trusses - frames - braced domes - laying brick — weather and water proof - roof finishes - acoustic and fire protection.

UNIT III SUB STRUCTURE CONSTRUCTION 9

Techniques of Box jacking - Pipe Jacking under water construction of diaphragm walls and basement-Tunneling techniques - Piling techniques - well and caisson - sinking cofferdam cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting well points Dewatering and stand by Plant equipment for underground open excavation.

UNIT IV SUPER STRUCTURE CONSTRUCTION 9

Launching girders, bridge decks, off shore platforms - special forms for shells techniques for heavy decks - in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks.

UNITV CONSTRUCTION EQUIPMENT 9

Selection of equipment for earth work - earth moving operations types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers - Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting Equipment for material handling and erection of structures - types of cranes - Equipment for dredging, trenching, tunneling.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 Understand various construction techniques

CO2 illustrate of the construction practices followed in various construction works

CO3 Know about various construction techniques used in underground level construction works

CO4 Outline about various construction practices used in elevated level construction works.

CO5 Aware of the various construction equipment and its applications

TEXTBOOKS :

1. Peurifoy, R.L., Ledbetter, W.B.&Schexnayder, C.,1995, *Construction Planning, Equipment and Methods*, 5th Edition, McGraw Hill, Singapore.

2. Arora S.P. &Bindra S.P., 1997, *Building Construction, Planning Techniques and Method of Construction*, DhanpatRai and Sons,.

3. Varghese, P.C.,2007,*Building construction*, Prentice Hall of India Pvt. Ltd, New Delhi,.

REFERENCES:

1.Jha J and Sinha S.K., 1999, *Construction and Foundation Engineering*, Khanna Publishers,.

2.Sharma S.C.,2002,*Construction Equipment and Management*, Khanna Publishers New Delhi,.

3.Deodhar, S.V.,2012 ,*Construction Equipment and Job Planning*, Khanna Publishers, New Delhi,.

4. Mahesh Varma,1983, *Construction Equipmentand its Planning and Application*, Metropolitan Book Company, New Delhi,.

CE1404 **SOIL MECHANICS (**Theory cum Lab)

L	T	P	C
3	0	2	4

OBJECTIVES:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9 + 6

History – formation and types of soil – composition - Index properties –Classification – BIS – AASHTO – Unified classification system – phase relationship – Compaction theory – laboratory and field technology – field Compaction method – factors influencing compaction.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9 + 6

Soil - water - Static pressure in water - Effective stress concepts in soils - Capillary phenomena-Permeability - Darcy‟s law - Determination of Permeability – Factors influencing permeability of soils -Unconfined and Confined aquifer- Seepage - Two dimensional flow - Laplace‟s equation - Introduction to flow nets

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9 + 6

Stress distribution in homogeneous and isotropic medium - Boussinesq theory - (Point load, Line load and udl) Use of Newmarks influence chart -Components of settlement - Immediate and consolidation settlement - Factors influencing settlement - Terzaghi‟s one dimensional consolidation theory - Computation of rate of settlement. - √t and log t methods. e-log p relationship - determination of pre consolidation pressure consolidation settlement N-C clays - O.C clays - Computation.

UNIT IV SHEAR STRENGTH 9 + 6

Shear strength of cohesive and cohesion less soils - Mohr-Coulomb failure theory - shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests - Pore pressure parameters - Factors influencing shear strength of soil.

UNIT V SLOPE STABILITY 9 + 6

Infinite slopes and finite slopes – Friction circle method - Use of stability number -Guidelines for location of critical slope surface in cohesive and c - soil - Slope protection measures.

TOTAL: 75 PERIODS

Exercises to learn the principles and procedures of testing of Soil

OBJECTIVE:

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

EXERCISES:

DETERMINATION OF INDEX PROPERTIES

Specific gravity of soil solids

Grain size distribution – Sieve analysis

Grain size distribution - Hydrometer analysis

Liquid limit and Plastic limit tests

Shrinkage limit and Differential free swell tests

DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS

Field density Test (Sand replacement method and core cutter method)

Determination of moisture – density relationship using standard Proctor compaction test.

Determination of relative density (Demonstration only)

DETERMINATION OF ENGINEERING PROPERTIES

Permeability determination (constant head and falling head methods)

One dimensional consolidation test (Determination of Co-efficient of consolidation only)

Direct shear test in cohesionless soil

Unconfined compression test in cohesive soil

Laboratory vane shear test in cohesive soil

Tri-axial compression test in cohesionless soil (Demonstration only)

California Bearing Ratio Test

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

CO1	Summarize the classification of soil and soil properties
CO2	Describe the effective stress concepts and permeability of soil
CO3	Outline stress distribution of soil
CO4	Explain about shear strength of soil
CO5	Narrate the slope stability in soil and slope protection measures

TEXTBOOKS:

1. Murthy, V.N.S., 2014 "*Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd*., New Delhi.
2. Arora, K.R., 7th Edition, 2017(Reprint). "*Soil Mechanics and Foundation Engineering*", Standard Publishers and Distributors, New Delhi,

3. GopalRanjan, A S R Rao, 2016. "*Basic and Applied Soil Mechanics*" New Age International Publication, 3rd Edition,
4. Punmia, B.C., 2017 "*Soil Mechanics and Foundations*", Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition.

REFERENCES:

1. McCarthy, D.F., 2006. "*Essentials of Soil Mechanics and Foundations: Basic Geotechnics*". Prentice-Hall.
2. Coduto, D.P., 2010 "*Geotechnical Engineering – Principles and Practices*", Prentice Hall of India Pvt. Ltd. New Delhi.
3. Braja M Das, 2014 "*Principles of Geotechnical Engineering*", Cengage Learning India Private Limited, 8th Edition.
4. Palanikumar.M., 2013 "*Soil Mechanics*", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi,.
5. Craig.R.F., 2012. "*Soil Mechanics*", E & FN Spon, London and New York,
6. Purushothama Raj. P., 2013 "*Soil Mechanics and Foundations Engineering*",2nd Edition, Pearson Education,.
7. Venkatramaiah.C., 2017 "*Geotechnical Engineering*", New Age International Pvt. Ltd., New Delhi,
8. "*Soil Engineering Laboratory Instruction Manual*" ,2010 published by Engineering College Cooperative Society, Anna University, Chennai.
9. Lambe T.W., 2008 "*Soil Testing for Engineers*", John Wiley and Sons, New York, 1951. Digitized.
10. Saibaba Reddy, E.Ramasastri, K. 2002 "*Measurement of Engineering Properties of Soils*" New age International (P) Limited Publishers, New Delhi,.
11. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Sieves	2 sets

2.	Hydrometer	2 sets
3.	Liquid and Plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor Compaction apparatus	2 sets
6.	UTM of minimum of 20kN capacity	1
7.	Direct Shear apparatus	1
8.	Thermometer	2
9.	Sand replacement method accessories and core cutter method accessories	
10.	Tri-axial Shear apparatus	1
11.	Three Gang Consolidation test device	1
12.	Relative Density apparatus	1
13.	Van Shear apparatus	1
14.	Weighing machine - 20kg capacity	1 No
	Weighing machine - 1kg capacity	3 No

CE1405 **STRENGTH OF MATERIALS II**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam
- To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

UNIT I ENERGY PRINCIPLES **9**

Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact loadings) , shear, flexure and torsion - Castigliano‟s theorems - Maxwell‟s reciprocal theorem - Principle of virtual work – unit load method Application of energy theorems for computing deflections in determinate beams , plane frames and plane trusses – lack of fit and temperature effects Williot Mohr's Diagram.

UNIT II INDETERMINATE BEAMS **9**

Concept of Analysis - Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports - Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT III COLUMNS AND CYLINDERS 9

Euler‟s column theory – critical load for prismatic columns with different end conditions – Effective length – limitations - Rankine-Gordon formula Eccentrically loaded columns – middle third rule core of a section – Thin cylindrical and spherical shells – stresses and change in dimensions Thick cylinders – Compound cylinders – shrinking on stresses.

UNIT IV STATE OF STRESS IN THREE DIMENSIONS 9

Stress tensor at a point – Stress invariants Determination of principal stresses and principal planes Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal strain theory – Maximum shear stress theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

UNIT V ADVANCED TOPICS 9

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre curved beams – Winkler Bach formula – stresses in hooks.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of course the students will be able to

CO1	Compute the deflection of beams and trusses using strain energy principles
CO2	Analyze indeterminate structures using theorem of three moments
CO3	Compare column behavior based on loading and geometry and infer its importance in economic design.
CO4	Identify the state of stress in a 3D system and access its factor of safety against failure
CO5	Solve beams with curved geometry and unsymmetrical bending

TEXT BOOKS:

1. Rajput R.K., 2015, *Strength of Materials (Mechanics of Solids),*S.Chand& company Ltd., New Delhi,.

2. Rattan.S.S*., Strength of Materials,* Tata McGraw Hill Education Pvt. Ltd., New Delhi,
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain*.,* 2017, *Theory of Structures* (SMTS) Vol - II, Laxmi Publishing Pvt Ltd, New Delhi.
4. Basavarajiah and Mahadevapa,, 2016, *Strength of Materials,* University press, Hyderabad.

REFERENCES:

1. Kazimi S.M.A*,,* 2003, *Solid Mechanics,* Tata McGraw-Hill Publishing Co., New Delhi,
2. William A .Nash., 2007, *Theory and Problems of Strength of Materials,*Schaum‟s Outline Series, Tata McGraw Hill Publishing company,.
3. Singh. D.K., 2016, *Strength of Materials,*Ane Books Pvt. Ltd., New Delhi,
   Egor P Popov*.,* 2012, *Engineering Mechanics of Solids,* 2nd edition, PHI Learning Pvt. Ltd., New Delhi,

CE1411 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally

LIST OF EXPERIMENTS:

1. Tension test on steel rod
2. Compression test on wood
3. Double shear test on metal
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Deflection test on carriage spring

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine for steel rods	1
3.	Izod impact testing machine	1
4.	Hardness testing machine (any 2) i. Rockwell ii. Brinnel iii. Vicker‟s	1 each
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauges	few
9.	Le Chatelier‟s apparatus	2
10.	Vicat‟s apparatus	2
11.	Mortar cube moulds	10

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 practice in universal testing machine to determine the maximum strength of the materials.

CO2 Practice in torsion testing machine to determine the Stiffness for member subjected to Torsion.

CO3 Infer the type of springs and their load carrying capacity.

CO4 Appraise the characteristics of ductile materials by using hardness, Impact test..

CO5 Appraise the properties of cement and brick by conducting various tests..

REFERENCES:

1. *Strength of Materials Laboratory Manual*, Anna University, Chennai-600 025.

2. IS 432(Part I) -1992 – *Specification for mild steel and medium tensile steel bars and hard drawn steel wire for concrete reinforcement*

3. Rajput.R.K. *Strength of Materials*, S.Chand& Company Ltd., New Delhi 2014

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading- Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading- Genre and Organization of Ideas- Reading- Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing- Elements of a good essay-- Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing- Email writing- visumes – Job application- Report Writing Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1	Understand how the text positions the reader
CO2	Develop critical thinking while reading a text
CO3	Develop a descriptive paragraph
CO4	Make use of sentence structures effectively when creating an essay.
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.
3.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

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S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. COMPUTER SCIENCE AND ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Computer Science and Engineering the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge to the urban and unreachable rural student folks in Computer Science and Engineering through "Total Quality Education".

PROGRAM EDUCATIONAL OBJECTIVES:

PEO 1:

Apply the necessary mathematical tools and fundamental knowledge of computer science & engineering to solve variety of engineering problems.

PEO 2:

Develop software based solutions for real life problems and be leaders in their profession with social and ethical responsibilities.

PEO 3:

Pursue life-long learning and research in selected fields of computer science & engineering and contribute to the growth of those fields and society at large.

PROGRAM OUTCOMES:

After going through the four years of study, the Computer Science and Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Professional Skills: The ability to understand, analyze and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.

PSO2:

Problem - Solving Skills: The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. COMPUTER SCIENCE AND ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1371	Multivariate Calculus and Linear Algebra	BS	3	1	0	4	4
2	CS1301	Data Structures using Python	PC	3	0	0	3	3
3	CS1371	Database Management Systems	PC	3	0	0	3	3
4	CS1372	System Programming and Operating Systems	PC	3	0	0	3	3
5	EC1372	Digital System Design and Microprocessors	ES	3	0	0	3	3
PRACTICAL								
6	CS1311	Data Structures Laboratory using Python	PC	0	0	4	4	2
7	CS1381	Database Management Systems Laboratory	PC	0	0	4	4	2
8	EC1381	Digital System Design and Microprocessors Laboratory	ES	0	0	4	4	2
9	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**1**	**14**	**30**	**23**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1473	Probability and Statistics	BS	3	1	0	4	4
2	CS1401	Analysis of Algorithms	PC	3	0	2	5	4
3	CS1402	Software Engineering with UML Design	PC	3	0	0	3	3
4	IT1371	Computer Organization and Architecture	PC	3	0	0	3	3
5	AD1372	Introduction to Artificial Intelligence	PC	3	0	0	3	3
6	GE1471	Professional Ethics and Human Values	HS	3	0	0	3	3
PRACTICAL								
7	CS1411	CASE Tools Laboratory	PC	0	0	4	4	2
8	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**8**	**27**	**23**

MA1371 MULTIVARIATE CALCULUS AND LINEAR ALGEBRA

L	T	P	C
3	1	0	4

OBJECTIVES:

To enable the students to

- Introduce the concepts of graphs of level curves, level surface and differentiability of multi variable function.
- Find extreme values of a function using derivative matrix.
- Explain the concepts of vector space, linear transformations and diagonalization.
- Make them understand the concept of orthogonalization in inner product spaces.

UNIT I MULTI VARIABLE CALCULUS 12

Functions of several variables – Domain, Range – Graphs, Level Curves and Contours of Functions of Two variables – Level Surface – Limits and Continuity in Higher Dimensions – Two – path Test for Nonexistence of a Limit – Partial Derivatives of a Function of Two Variables – Differentiability – The Chain Rule.

UNIT II APPLICATIONS OF MULTIVARIABLE CALCULUS 12

Directional Derivatives and Gradient Vectors - Gradients and Tangents to Level Curves - Tangent Planes and Normal Lines to Surfaces - Extreme Values, Saddle Points and Lagrange Multipliers by matrix method.

UNIT III VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations of vectors - Linear Span – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT V INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Apply the concepts of partial derivatives to find the higher derivatives of multi variable functions.
CO2	Apply the techniques of multi variable calculus to compute the gradients, directional derivative and extreme values
CO3	Test the given system of equation is linearly dependent or independent.
CO4	Apply the concept of eigen values and eigenvectors for Diagonalization of a matrix
CO5	Apply the inner product techniques for finding the orthonormal vector and minimal solution to the system of linear equation

TEXT BOOKS:

1. Thomas', Weir & Hass, 2018, *Calculus*, 13th ed, Pearson.
2. Friedberg, AH, Insel, AJ & Spence, L, 2004, *Linear Algebra*, Prentice Hall of India, New Delhi.

REFERENCES:

1. James Stewart, 2007, *Calculus* (Early transcendentals), Brooks cole.
2. Peter D Lax & Maria shea Terrell, 2018, *Multi variable Calculus with applications*, 6th ed, Springer.
3. Kolman, B & Hill, DR, 2009, *Introductory Linear Algebra*, 1st Reprint, Pearson Education, New Delhi.
4. Kumaresan, S, 2010, *Linear Algebra - A Geometric Approach*, Prentice Hall of India, New Delhi, Reprint.
5. Strang, G, 2005, *Linear Algebra and its applications*, Thomson (Brooks/Cole), New Delhi.

CS1301 DATA STRUCTURES USING PYTHON

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts of linear data structures.
- Gain knowledge about non-linear data structures like stack, queue and its applications.
- Be familiar with binary tree concepts and its applications.
- Gain knowledge about graph traversal methods and application of graphs.
- Be familiar with different searching, sorting and hashing techniques.

UNIT I LINEAR DATA STRUCTURES 9

Basic concepts: Introduction to data structures - classification of data structures - operations on data structures - Introduction to Linear and Non Linear data structures - Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation - singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation – All operations (Insertion, Deletion, Merge, Traversal).

UNIT II LINEAR DATA STRUCTURES – STACKS AND QUEUES 9

Stack ADT – Operations - Applications - Evaluating arithmetic expressions- Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES - TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT –Threaded Binary Trees- AVL Trees – B-Tree - B+ Tree - Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Graphs: Basic concept - Graph Representations: Adjacency matrix, Adjacency lists -Types of graph – Graph traversals: Breadth-first traversal, Depth-first - traversal - Application of graphs - Topological Sort – Bi-connectivity – Cut vertex – Euler circuits -Minimum spanning trees – Prims and Kruskal algorithms.

UNIT V SEARCHING, SORTING & HASHING TECHNIQUES 9

Searching - Linear Search - Binary Search. Sorting - Bubble sort - Selection sort - Insertion sort - Shell sort – Radix sort - Quick sort - Heap Sort - Merge Sort -comparison of sorting algorithms - Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1	Explain about the basic concepts of linear data structures.
CO2	Outline the usage of linear data structures like stacks and queues in program design
CO3	Infer knowledge about tree data structure and its applications.
CO4	Summarize about different graph traversal methods and applications of graphs.
CO5	Make use of appropriate searching, sorting and hashing techniques for solving a problem

TEXT BOOKS:

1. Rance D Necaise, *Data Structures and Algorithms using Python*, Wiley Student Edition.
2. Benjamin Baka, David Julian, 2017, *Python Data Structures and Algorithms*, Packt Publishers.

REFERENCES:

1. Lipschutz, S, 2008, *Data Structures*, 1st ed, Tata McGraw Hill Education.
2. Samanta, D, 2004, *Classic Data Structures*, 2nd ed, PHI Learning.

CS1371 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Learn the fundamentals of data models and to represent a database system using ER diagrams.
- Study SQL and relational database design.
- Understand the internal storage structures using different file and indexing techniques which will help in physical DB design.

- Understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures.
- Learn about file organization and query processing

UNIT I INTRODUCTION TO DATABASE & ER MODEL 9

Introduction to Databases - File System Vs Database System - Database System Architecture- Database Users and Administrator - Data Models - Entity Relationship Model - E-R Diagrams - Design Issues - Extended E-R Features - Introduction to Relational Model - ER to Relational Schema Mapping

UNIT II RELATIONAL MODEL & SQL 9

Structure of Relational Databases - Relational Query Languages - Relational Algebra – SQL: DDL, DML, DCL, TCL - Simple Queries, Complex Nested Queries, Correlated Nested Queries, Joins, Aggregate Functions, Grouping - PL/SQL : Functions, Procedures, Triggers, Views - Embedded SQL - Dynamic SQL

UNIT III NORMALIZATION 9

Pitfalls in Bad Relational database design - Functional Dependencies (Closure of Functional dependencies) - Closure of Attributes - Normal Forms : First, Second, Third, Boyce Codd Normal Form, Multivalued Dependencies : Fourth Normal Form, Join Dependencies : Fifth Normal Form –Domain Key Normal Form

UNIT IV TRANSACTION AND CONCURRENCY CONTROL 9

Transaction processing concepts - Need for concurrency control and recovery - Recoverability – Transaction Recovery – Serializability : Conflict Serializability, View Serializability, Testing for Serializability - Concurrency Control : Lock Based Protocols (Two phase locking Techniques, Strict Two Phase Locking, Deadlocks, Multiple Granularity) Timestamp Based protocol, Validation Based protocol

UNIT V FILE ORGANIZATION & QUERY PROCESSING 9

File Organization: Organization of Records in Files, Indexing and Hashing, Ordered Indices - Query Processing: Measures of Query Cost (Selection, Sorting and Join Operation), Query Tuning, Query Optimization (Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views) – No SQL – Mongo DB

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Infer the basic concepts of database system and model ER diagram for real time applications
CO2	Use appropriate SQL commands to store and access data from Relational Database
CO3	Construct normalized database for real world scenario using functional dependencies.
CO4	Illustrate the importance of transaction and concurrency control to maintain consistency in a database.
CO5	Interpret the mechanism incorporated in file organization and Query Processing.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F Korth, Sudharshan, S, 2017, *Database System Concepts*, 6th ed, Tata McGraw Hill.
2. Ramez Elmasri, Shamkant B Navathe, 2011, *Fundamentals of Database Systems*, 6th ed, Pearson Education.

REFERENCES:

1. Date, CJ, Kannan, A & Swamynathan, S, 2006, *An Introduction to Database Systems*, 8th ed, Pearson Education.
2. Raghu Ramakrishnan, 2015, *Database Management Systems*, 4th ed, McGraw-Hill College Publications.
3. G.K.Gupta, 2011, *Database Management Systems*, Tata McGraw Hill.

CS1372 SYSTEM PROGRAMMING AND OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic concepts about system software.
- Know about processes and threads.
- Familiarize with the scheduling algorithms and deadlock handling mechanisms.
- Implement various memory management schemes.
- Explain about file systems.

UNIT I SYSTEM SOFTWARE 9

System Software versus Application Software – Basic System Software: Assembler: Two pass assembler, Loader: Absolute and Bootstrap loader; Key terms: Relocation, linking, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, and Interpreter.

Operating system objectives and functions - Operating System Structure - System Calls, System Programs, OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 9

Processes - Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; CPU Scheduling - Scheduling criteria, Scheduling algorithms, Multiple-processor scheduling, Real time scheduling; Threads- Overview, Multithreading models, Threading issues

UNIT III PROCESS SYNCHRONIZATION 9

Process Synchronization - The critical-section problem, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Critical regions, Monitors; Deadlock - System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock

UNIT IV STORAGE MANAGEMENT 8

Main Memory – Background, Swapping, Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, 32 and 64 bit architecture Examples; Virtual Memory – Background, Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory

UNIT V FILE SYSTEMS 10

Mass Storage system – Overview of Mass Storage Structure, Disk Structure, Disk Scheduling and Management, swap space management. File-System Interface - File concept, Access methods, Directory Structure, Directory organization, File system mounting, File Sharing and Protection; File System Implementation- File System Structure, Directory implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery. I/O Systems – I/O Hardware, Application I/O interface - Kernel I/O subsystem, Streams, Performance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain different types of system software and its use

CO2 Illustrate the concepts of process, threads and CPU scheduling algorithms

CO3 Explain the algorithms used for concurrency and deadlock handling.

CO4 Make use of various memory management schemes

CO5 Demonstrate the concept of file systems.

TEXT BOOKS:

1. Leland L Beck, 1997, *System Software: An Introduction to Systems Programming*, 3rd ed, Pearson Education Asia.
2. Abraham Silberschatz, Peter Baer Galvin & Greg Gagne, 2018, O*perating System Concepts*, 9th ed, John Wiley and Sons Inc.

REFERENCES:

1. Andrew S Tanenbaum, 2004, *Modern Operating Systems*, 2nd ed, Pearson Education.
2. Elmasri, R, Carrick, A & Levine, D, 2010, *Operating Systems – A Spiral Approach*, Tata McGraw Hill Edition.
3. Achyut S Godbole & Atul Kahate, 2016, *Operating Systems*, McGraw Hill Education.
4. Gary Nutt, 2004, *Operating Systems*, 3rd ed, Pearson Education.
5. Harvey M Deitel, 2004, *Operating Systems*, 3rd ed, Pearson Education.
6. Daniel P Bovet & Marco Cesati, 2005, *Understanding the Linux kernel*, 3rd ed, O'Reilly.
7. Neil Smyth, 2011, *iPhone iOS 4 Development Essentials – Xcode*, 4th ed, Payload media.

EC1372 DIGITAL SYSTEM DESIGN AND MICROPROCESSORS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the concepts of Boolean functions and minimization techniques.
- Summarize the combinational circuits used to perform basic digital operations.

- Develop a synchronous/asynchronous counters and shift registers using sequential logic
- Understand the basic concepts of 8086 microprocessors.
- Gain knowledge in interfacing of I/O devices with 8086 processor

UNIT I DIGITAL FUNDAMENTALS 9

Review of Number systems, Logic gates, Boolean algebra - Boolean postulates and laws - Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Magnitude Comparator, Code Converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip-Flops - SR, JK, D & T - Master Slave Flip Flops - Shift Registers - SISO, SIPO, PISO, PIPO, Design of synchronous counters - Modulo N counters, Random Sequence counters, Johnson counter, Ring counter

UNIT IV 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation

UNIT V I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display and Alarm Controller.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Outline the Boolean functions and various minimization techniques.
CO2	Illustrate the combinational circuits used to perform basic digital operations
CO3	Develop a synchronous/asynchronous counters and shift registers using sequential logic.
CO4	Make use of 8086 processor architecture, addressing mode and instruction set to develop Assembly Language Programming
CO5	Explain interfacing of I/O devices with 8086 processor.

TEXT BOOKS:

1. Morris Mano, M & Michael D Ciletti, 2017, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog,* 6th ed, Pearson Education.
2. Nagoor Kani, A, 2017, *Microprocessors and Microcontrollers*, McGraw hill, 2017 edition.
3. Charles H Roth, 2013, *Fundamentals of Logic Design*, 6th ed, Thomson Learning.

REFERENCES:

1. Wakerly JF, 2002, *Digital Design: Principles and Practices*, 2nd Ed, *Prentice-Hall*.
2. Givone, DD, 2003, *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
3. Thomas L Floyd, 2011, *Digital Fundamentals*, 10th ed, Pearson Education Inc.
4. Stephen Brown & Zvonko Vranesic, 2013,*Fundamentals of Digital Logic with Verilog Design*, 3rd ed, McGraw-Hill Higher Education, New Delhi, India.

CS1311 DATA STRUCTURES LABORATORY USING PYTHON

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Understand the basic concepts of linear data structures.
- Gain knowledge about different non-linear data structures and its applications.
- Gain knowledge about different variants of tree structures.
- Be familiar with graph traversal methods and application of graphs.
- Be familiar with different searching, sorting and hashing techniques.

List of Experiments:

1. Basics of Python.
2. Array implementation of Stack and Queue ADTs.
3. Implementation of singly linked list.
4. Linked list implementation of Stack and Queue ADTs.
5. Applications of List ADT.
6. Applications of Stack and Queue ADTs.
7. Implementation of Binary Trees and operations of Binary Trees
8. Implementation of Binary Search Trees.
9. Implementation of AVL Trees.
10. Implementation of Heaps.
11. Graph representation, Traversal algorithms.
12. Applications of Graphs.
13. Implementation of searching and sorting algorithms.
14. Implementation of hashing with collision resolution techniques.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Develop programs to perform operations using stack and queues data structures
CO2	Apply the concepts of linked lists to solve a problem
CO3	Apply the appropriate non-linear data structure for solving the problem.
CO4	Make use of different searching and sorting algorithms
CO5	Build appropriate hash functions that result in a collision free scenario for data storage and retrieval

LIST OF LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Sl.No	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: Anaconda IDE	30
4.	Interpreter: Python3	30 users

CS1381 DATABASE MANAGEMENT SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to:

- Learn the commands for creating and manipulating the databases.
- Construct queries for retrieval of required data from database.
- Understand views, sequences and synonyms concepts of SQL.
- Learn the functions, procedures, triggers and exception handling in SQL.
- Develop GUI based application for storage and retrieval of data

LIST OF EXPERIMENTS:

1. **WRITE AND EXECUTE SIMPLE QUERIES USING SQL**
   a. DDL, TCL and DCL commands
   b. DML commands
   c. Aggregate Functions
2. **WRITE AND EXECUTE ADVANCED QUERIES USING SQL**
   a. Nested Queries and Sub queries
   b. SQL Join
3. **WRITE AND EXECUTE VIEWS, SYNONYMS, SEQUENCE**
4. **WRITE AND EXECUTE QUERIES USING PL/SQL**
   a. Simple programs
5. **WRITE AND EXECUTE QUERIES USING ADVANCED CONCEPTS OF PL/SQL**
   a. Cursors and Procedures
   b. Functions
   c. Triggers
   d. Exception Handling
6. **IMPLEMENT DATABASE CONNECTIVITY CONCEPTS**
   a. Design a Front End for a real time application
   b. Connect the database with the application
7. **MINI PROJECT**

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Choose appropriate DDL, DML, DCL and TCL commands for creating and manipulating the databases
CO2	Construct appropriate nested queries, sub queries and join queries for efficient retrieval of data
CO3	Organize database using views, sequences, and synonyms
CO4	Implement functions, procedures, triggers and exceptions using PL/SQL
CO5	Develop a GUI based environment for storage and retrieval of data for a real time application

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, HDD 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: XAMPP with Apache, MySQL & PHP (or) MySQL & JAVA.	Open source

EC1381 DIGITAL SYSTEM DESIGN AND MICROPROCESSORS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Design and implement the various combinational circuits.
- Design and implement combinational circuits using MSI devices.
- Design and implement sequential circuits.
- Implement and simulate 8086 programs in 8086 kit and MASM Assembler.
- Implement different I/Os with 8086 microprocessor.

LIST OF EXPERIMENTS:

Digital Experiments:

1. Verification of Boolean Theorems using basic gates

2. Design and implementation of combinational circuits using basic gates for arbitrary functions
3. Design and implementation of Half/Full Adder and Subtractor
4. Design and implementation of Encoder, Decoder, Multiplexer and Demultiplexer using logic gates
5. Design and implementation of Shift register (SISO, SIPO, PIPO) using Flip flops
6. Design and implementation of 2 bit Synchronous counters

Microprocessor Experiments:

8086 Programs using kits and MASM

1. Basic arithmetic and Logical operations
2. Move a data block without overlap
3. Code conversion, decimal arithmetic operations

Peripherals and Interfacing Experiments

1. Traffic light control
2. Stepper motor control
3. Keyboard and Display Interface

Mini project

1. Flashing of LEDS using NODE MCU/Arduino
2. Monitoring Temperature using LM35 sensor in NODEMCU/Arduino

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Experiment with the basics of gates.

CO2 Build different combinational circuits

CO3 Construct various sequential circuits

CO4 Experiment with 8086 microprocessor based programs.

CO5 Build different I/Os with 8086 microprocessor

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Digital trainer kits	15
2.	Digital ICs	50

3.	8086 Microprocessor trainer kit with power supply	15
4.	Traffic light control interfacing card compatible with 8086	5
5.	Stepper motor control interfacing compatible with 8086	5
6.	Keyboard & Display interface board compatible with 8086 kits	5

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION **6**

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work**.**

UNIT V GROUP & PAIR PRESENTATIONS **6**

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs.

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1473 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

OBJECTIVES:

To enable the students to

- Introduce the basics of random variables and some standard distributions that can describe real life phenomenon.
- Establish the basic concepts of two-dimensional random variables.
- Impart the knowledge of testing of hypothesis for small and large samples.
- Describe the basic principles in the design of simple experiments for comparing pairs of treatments.
- Introduce the basic concepts of statistical quality control that plays a vital role in the field of Engineering and Technology.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – marginal and conditional distributions –covariance – correlation – Karl Pearson's correlation coefficient – Rank correlation – Spearman's rank correlation coefficient – Kendall's rank correlation coefficient - linear regression.

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions – Statistical Hypothesis – Type I and Type II errors – Tests for single mean and difference of means of large samples (z-test) and Small samples (t-test) – F-test for variance – chi-square test for goodness of fit – independence of attributes – Demo using Excel.

UNIT IV DESIGN OF EXPERIMENTS 12

Basic Principles of experimental design – Completely randomized design – Randomized block design – Latin square design – 2 level factorial design – Demo using Excel.

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements ($\overline{X}$ and R charts for continuous data) – control charts for attributes (p, c, np and u charts for discrete data) – tolerance limits – Demo using Excel.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Solve various problems using random variables and distributions
CO2	Compute the correlation between two variables and linear regression equation for a set of data
CO3	Apply the concepts of testing of hypothesis for small and large samples in real life problems
CO4	Interpret the data using ANOVA and basic experimental design.
CO5	Apply the techniques of Statistical quality control in industrial Engineering problems

TEXT BOOKS:

1 Devore, J.L., 2017. *Probability and Statistics for Engineering and the Sciences*. Boston, Cengage Learning.

2 Johnson, R.A. and Gupta, C.B., 2017. *Miller and Freund's Probability and Statistics for Engineers*. New Delhi, Pearson India Education.

REFERENCES:

1 Milton, J.S. and Arnold, J.C., 2008. *Introduction to Probability and Statistics*. New Delhi, Tata McGraw Hill.

2 Ross, S.M., 2014. *Introduction to Probability and Statistics for Engineers and Scientists*. New Delhi, Elsevier.

3 Spiegel, M.R., Schiller, J., Srinivasan, R.A. and Goswami, D., 2017. *Introduction to Probability and Statistics for Engineers and Scientists*. New Delhi, Elsevier.

4 Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., 2007. *Probability and Statistics for Engineers and Scientists*. Asia, Pearson Education.

5 Gupta, S.C. and Kapoor, V.K., 2020. *Fundamentals of Mathematical Statistics*. Sultan Chand & Sons.

CS1401 ANALYSIS OF ALGORITHMS

L	T	P	C
3	0	2	4

OBJECTIVES:

To enable the students to

- Apply the knowledge of computing and mathematics to algorithm design
- Explain Bruteforce and Divide-and-Conquer techniques
- Identify the algorithm efficiency for Greedy and Dynamic programming techniques
- Be familiar with Iterative improvement techniques
- Understand the limitations of Algorithm power

UNIT I INTRODUCTION 9

Notion of an Algorithm - Fundamentals of Algorithmic Problem Solving - Important Problem Types - Performance analysis - space and time complexity - Growth of function – Big-Oh, Omega, theta notation - Asymptotic Notations and its properties-Recurrent equations and the master theorem - Empirical Analysis - Mathematical analysis for Recursive and Non-recursive algorithms - Visualization

UNIT II BRUTE FORCE AND DIVIDE-AND-CONQUER 9

Brute Force – String Matching - Closest-Pair and Convex-Hull Problems-Exhaustive Search - Traveling Salesman-Problem - Knapsack Problem - Assignment problem-Divide and conquer methodology – Merge sort – Quick sort – Randomized version of quick sort and analysis – Heap Sort - Binary search – Strassen's matrix multiplication - Closest pair and Convex hull problems

UNIT III GREEDY TECHNIQUE AND DYNAMIC PROGRAMMING 9

Greedy Technique– Container loading problem Minimum cost spanning tree Prim's algorithm-Kruskal's Algorithm-Dijkstra's Algorithm- Job sequencing with deadlines - Huffman Trees - Dynamic programming – Principle of optimality – Coin changing problem-Computing a Binomial Coefficient – Warshall's and Floyd' algorithm – Optimal Binary Search Trees – 0/1 Knapsack Problem and Memory functions

UNIT IV ITERATIVE IMPROVEMENT 9

The Simplex Method-The Maximum-Flow Problem – Maximum Matching in Bipartite Graphs-The Stable Marriage Problem.

UNIT V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

Lower-Bound Arguments-Decision Trees-P, NP and NP-Complete Problems-Coping with the Limitations - Backtracking – n-Queens problem – Hamiltonian Circuit Problem – Subset Sum Problem – Branch and Bound – Assignment problem – Knapsack Problem – Traveling Salesman Problem- Approximation Algorithms for NP – Hard Problems – Traveling Salesman problem – Knapsack problem

THEORY : 45 PERIODS

LIST OF EXPERIMENTS:

1. Implement sorting algorithms and compare the algorithm time complexity for various n values
2. Implementation of Greedy Technique– Container loading problem, Huffman Tree
3. Implementation of Dynamic Programming - 0/1 Knapsack algorithm
4. Implement subset sum problem using backtracking technique
5. Implementation of Iterative improvement technique - Stable marriage problem
6. Implement N-Queens problem using backtracking technique

PRACTICAL : 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, HDD 500 GB, 4 GB RAM)	30

2.	Printer	1
3.	Software: Python 3.6	Open source

TOTAL : 75 PERIODS

COURSE OUTCOMES:

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

CO1	Identify the time and space complexity of computational problems
CO2	Make use of Bruteforce and Divide and Conquer techniques for sorting and searching Problems
CO3	Apply Greedy and Dynamic Programming techniques for Graph and Combinatorial Problems
CO4	Identify the roles of iterative improvement technique to solve optimization problems.
CO5	Explain the use of Backtracking, Branch & Bound and approximation techniques to overcome the limitations of NP-Complete and NP-Hard Problems

TEXT BOOKS:

1. Anany Levitin, 2012, *Introduction to the Design and Analysis of Algorithms*, 3rd ed, Pearson Education.
2. Ellis Horowitz, Sartaj Sahni & Sanguthevar Rajasekaran, 2007, *Computer Algorithms/ C++*, 2nd ed, Universities Press.

REFERENCES:

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest & Clifford Stein, 2012, *Introduction to Algorithms*, 3rd ed, PHI Learning Private Limited.
2. Alfred V Aho, John E Hopcroft & Jeffrey D Ullman, 2006, *Data Structures and Algorithms*, Pearson Education, Reprint.

CS1402 SOFTWARE ENGINEERING WITH UML DESIGN

L	T	P	C
3	**0**	**0**	**3**

OBJECTIVES:

To enable the students to

- Learn the fundamental concepts of software process and requirements engineering
- Explore UML static modeling

- Explore UML dynamic modeling
- Learn the various management concepts
- Understand the different testing strategies

UNIT I SOFTWARE PROCESS AND REQUIRMENTS ENGINEERING 9

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process-Requirements Engineering- Functional and non-functional requirements- The software requirements document-Requirements specification- Requirements engineering processes-Requirements elicitation and analysis- Requirements validation- Requirements management

UNIT II STATIC MODELING 9

Use case Modeling - Relating Use cases – include, extend and generalization - Elaboration - Domain Models - Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class hierarchies - Aggregation and Composition - UML activity diagrams and modeling

UNIT III DYNAMIC MODELING AND IMPLEMENTATION 9

System sequence diagrams – Communication diagrams - Relationship between sequence diagrams and use cases - Logical architecture and UML package diagram – Logical architecture refinement - UML class diagrams – relationship – inheritance – Abstract classes –Operation contracts - Mapping design to code – Test driven development – Refactoring – UML tools and UML as blueprint - UML state machine diagrams and modeling - UML deployment and component diagrams – Designing for visibility - Adopting Agile modeling on an UP project

UNIT IV DESIGN AND MANAGEMENT CONCEPTS 9

Design Process-Design Concepts-Design Model-Software Configuration Management-The SCM Repository-The SCM process – Project Management Concepts: The management Spectrum-People-The Product-The process- The Project-Project Scheduling-Risk Management

UNIT V SOFTWARE TESTING STRATEGIES 9

Test Strategies for Conventional Software-Validation Testing-System Testing- Testing Conventional Applications: White-Box Testing - Basis Path Testing-Control Structure Testing - Black box testing: Equivalence Partitioning-Boundary Value Analysis

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Develop life cycle models for software development

CO2 Model the static features of a system.

CO3 Model the dynamic features of a system.

CO4 Illustrate the different management techniques.

CO5 Demonstrate the various testing methodologies.

TEXT BOOKS:

1. Roger S Pressman, 2014, *Software Engineering: A practitioner's Approach*, 7^{th} ed, McGraw-Hill International Edition.
2. Craig Larman, 2015, *Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design*," 3^{rd} ed, Pearson Publishers.

REFERENCES:

1. Bhuvan Unhelkar, 2018, *Software Engineering with UML*, 1^{st} edition, Auerbach Publications.
2. Martina Seidl, Marion Scholz, Christian Huemer & Gerti Kappel, 2015, *UML @ Classroom: An Introduction to Object-Oriented Modeling,* Springer Verlag.

IT1371 COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the basic structure, operations and instructions of a digital computer.
- Learn the implementation of fixed point and floating-point arithmetic operations.
- Be familiar with the basic processing unit and multiple functional units in a processor.
- Understand the hierarchical memory system and I/O organization.
- Learn the concepts of instruction-level parallelism, data-level parallelism and loop-level parallelism.

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional Units – Basic Operational Concepts – Bus Structures – Software – Performance: Processor Clock, Basic Performance Equation, Clock Rate – Instruction Set: CISC and RISC – Memory Locations and Addresses – Memory Operations – Instructions and Instruction Sequencing – Addressing Modes – Basic Input/output Operations.

UNIT II ARITHMETIC UNIT 9

Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast Multiplication – Integer Division – Floating Point Numbers and Operations.

UNIT III PROCESSING UNIT 9

Basic Processing Unit: Fundamental Concepts – Execution of a complete instruction – Multiple-bus organization – Hardwired Control – Microprogrammed control – Pipelining: Basic Concepts – Data Hazards – Instruction Hazards – Datapath and Control Considerations

UNIT IV MEMORY SYSTEMS & INPUT/OUTPUT ORGANIZATION 9

Memory Systems: Basic Concepts – Cache Memories – Performance Considerations – Virtual Memories – Memory Management Requirements – Secondary Storage – Input / Output Organization: Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Synchronous Bus – Asynchronous Bus.

UNIT V PARALLEL PROCESSING 9

Instruction-Level Parallelism: Concepts and Challenges – Basic compiler techniques for exposing ILP – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Examples and the Algorithm – Data-Level Parallelism: Introduction – Vector Architecture – Graphics Processing Units – Detecting and Enhancing Loop-Level Parallelism.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Summarize the functionalities of various parts, instruction sets and operations of a digital computer.

CO2 Utilize the logic design for fixed-point and floating point arithmetic.

CO3 Interpret the role of a processing unit and multiple functional units.

CO4 Explain the various elements in memory hierarchy and the basic and complex I/O structures.

CO5 Demonstrate how parallelism is used at instruction-level and data-level parallelism.

TEXT BOOK:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky & Naraig Manjikian, 2012, *Computer Organization and Embedded Systems*, 6th ed, Tata McGraw Hill.

REFERENCES:

1. David A. Patterson & John L. Hennessy, 2014, *Computer Organization and Design: The Hardware/Software Interface*", 5th ed, Morgan Kaufmann / Elsevier.
2. William Stallings, 2010, *Computer Organization and Architecture – Designing for Performance*, 8th ed, Pearson Education.
3. John P. Hayes, 2012, *Computer Architecture and Organization*, 3rd ed, Tata McGraw Hill.

AD1372 INTRODUCTION TO ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Understand the various characteristics of Intelligent agents
- Learn the different search strategies in Artificial Intelligence
- Be familiar with represent knowledge in solving Artificial Intelligence problems
- Understand the agent communication and Trust and Reputation
- Know about the various applications of Artificial Intelligence.

UNIT I INTRODUCTION 9

Introduction–Definition - The Foundations of Artificial Intelligence- Characteristics of Intelligent Agents -Turing test – Agents and Environments - Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents; Problem Solving Approach to Typical AI problems

UNIT II PROBLEM SOLVING USING SEARCHING 9

Problem-Solving Agents, Formulating problems, searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, searching with Partial Information, Informed Search Strategies, Greedy best-first search, A* Search-IDA*- Heuristic Functions, Local Search Algorithms and Optimization Problems - Constraint Satisfaction Problems – Constraint Propagation – Backtracking Search – Game Playing – Optimal Decisions in Games – Alpha – Beta Pruning.

UNIT III LOGIC AND INFERENCES 9

Propositional Logic - First Order Logic – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation – Ontological Engineering-Categories and Objects – Events – Mental Events and Mental Objects – Reasoning Systems for Categories.

UNIT IV AGENT COMMUNICATION 9

Architecture for Intelligent Agents – Agent communication - Agents and Objects – Negotiation and Bargaining –Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Robot – Hardware – Perception – Planning – Moving.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the various characteristics of intelligent agents.

CO2 Interpret appropriate search algorithms for Artificial Intelligence problem.

CO3 Illustrate a Knowledge Representation using first order logic.

CO4 Infer different ways of the agent communication and Trust and Reputation in Multi-agent systems.

CO5 Summarize the various application of AI.

TEXTBOOK:

1. Russell, S & Norvig, P, 2020, *Artificial Intelligence: A Modern Approach,* 4th ed, Prentice Hall.

REFERENCES:

1. Elaine Rich & Kevin Knight, 2008, *Artificial Intelligence*, 3rd ed, Tata McGraw-Hill.
2. Tim Jones, M, 2008, *Artificial Intelligence: A Systems Approach (Computer Science)*, 1st ed, Jones and Bartlett Publishers, Inc.
3. Nils J Nilsson, 2009, T*he Quest for Artificial Intelligence*, Cambridge University Press.
4. Gerhard Weiss, 2013, *Multi Agent Systems*, 2nd ed, MIT Press.
5. David L Poole & Alan K Mackworth, 2010, *Artificial Intelligence: Foundations of Computational Agents*, Cambridge University Press.

GE1471 PROFESSIONAL ETHICS AND HUMAN VALUES

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- Create an awareness on Engineering Ethics and Human Values.
- Instill Moral and Social Values and
- Impart Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 10

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue –Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time –Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Stress management Techniques.

UNIT II ENGINEERING ETHICS 9

Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg‘s theory – Gilligan‘s theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR)– Discrimination.

UNIT V GLOBAL ISSUES 8

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors –Moral Leadership –Code of Conduct – Corporate Social Responsibility.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Summarize the various Morals, Values, Ethics, Integrity and other Human Values

CO2 Describe the Senses of Engineering ethics, its related Theories and Models of Professional Roles

CO3 Explain the Codes of Ethics for various Engineering Experiments.

CO4 Examine the various Risk, Safety and Risk Benefit Analysis for a Product/Service in an Organization

CO5 Explain the Various Global Issues in Ethics and Review the Responsibilities and Rights of Professionals and Employees in an Organization

REFERENCES:

1. Mike W. Martin & Roland Schinzinger, 2017, *Ethics in Engineering*, 4th ed, McGraw Hill.
2. Govindarajan M, Natarajan S & Senthil Kumar, VS, 2004, *Engineering Ethics*, Prentice Hall of India.
3. Charles B. Fleddermann, 2012, *Engineering Ethics*, 4th ed, Prentice Hall.
4. Charles E Harris, Michael S Pritchard, Raw W James, Elaine E Englehardt & Michael J Rabins, 2019, *Engineering Ethics –Concepts and Cases*, 12th ed, Cengage Learning.

5. John R Boatright & Jeffery Smith, 2016, *Ethics and the Conduct of Business*, 8th ed, Pearson Education.
6. Edmund G Seebauer & Robert L Barry, 2001, *Fundamentals of Ethics for Scientists and Engineers*, South Asia Edition, Oxford University Press.

CS1411 CASE TOOLS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Capture the requirements specification for an intended software system and prepare SRS for a software system.
- Draw the entity relationship diagram and data flow diagram for the application.
- Draw the UML diagrams for the given specification
- Map the design properly to code
- Test the software system thoroughly for any scenarios

LIST OF EXPERIMENTS:

1. Identify the requirements specification for a software system and prepare SRS document for the identified system.
2. Draw the Entity Relationship Diagram and Data Flow Diagram for the selected case study
3. Study the basic concepts and diagrams of UML.
4. Identify use cases and develop the Use Case diagram for a system
5. Identify the conceptual classes and develop a Domain Model for a software system. Draw a Class Diagram for the identified system.
6. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagram.
7. Draw the UML Collaboration Diagram for the identified scenarios.
8. Draw relevant State Chart and Activity Diagrams for the same system.
9. Implement the system as per the detailed design
10. Test the software system for all the scenarios identified as per the use case diagram
11. Improve the reusability and maintainability of the software system by applying appropriate design patterns.
12. Implement the modified system and test it for various scenarios

SUGGESTED TOPICS FOR MINI-PROJECT:

1. Passport automation system.
2. Book bank
3. Exam registration
4. Stock maintenance system.
5. Online course reservation system
6. Airline/Railway reservation system
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system
11. Foreign trading system
12. Conference management system
13. BPO management system
14. Library management system
15. Student information system

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Identify the requirements specification for a software system and prepare SRS for applications.

CO2 Construct the entity relationship diagram and data flow diagram for the application.

CO3 Construct the UML diagrams for the given specification of the software system.

CO4 Utilize the design and map to code.

CO5 Experiment with the developed code using test cases.

LIST OF LAB EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

Sl.No	**Description of Equipment**	**Quantity Required**
1.	Hardware Requirements Personal Computers (Intel Core i3, 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	SOFTWARE TOOLS	

	Rational Suite 30 user License Open-Source Alternatives: ArgoUML, Visual Paradigm Eclipse IDE and JUnit, PCs	30

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1	Understand how the text positions the reader
CO2	Develop critical thinking while reading a text
CO3	Develop a descriptive paragraph
CO4	Make use of sentence structures effectively when creating an essay.
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

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S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Electronics and Communication Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of world.

MISSION:

To impart highly innovative and technical knowledge in the field of Electronics and Communication Engineering to the urban and unreachable rural student folks through Total Quality Education.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1:

To establish a strong foundation in Electronics and Communication Engineering necessary to formulate, model, analyze and solve real time problems.

PEO 2:

To inculcate professional skills and life skills for placement or to pursue higher studies in the relevant fields.

PEO 3:

To promote research and development activities and solve industrial problems with creative ideas.

PROGRAM OUTCOMES:

After going through the four years of study, the Electronics and Communication Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Ability to make use of attained technical knowledge in the field of Electronics and Communication Engineering for successful career and qualifying in competitive examinations at the national level.

PSO2:

Ability to develop workable solutions for real time challenges in Electronics and Communication Engineering

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B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1302	Linear Algebra and Partial Differential Equations	BS	3	1	0	4	4
2	AD1371	Data Structures and Algorithms	ES	3	0	0	3	3
3	EC1371	Digital Electronics	PC	3	0	0	3	3
4	EC1301	Electromagnetic Fields and Waves	PC	3	0	0	3	3
5	EC1302	Electronic Devices	PC	3	0	0	3	3
6	EC1303	Signals and Systems	PC	3	0	0	3	3
PRACTICAL								
7	AD1381	Data Structures and Algorithms Laboratory	ES	0	0	4	4	2
8	EC1311	Digital Circuits and Devices Laboratory	PC	0	0	4	4	2
9	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER IV

SI. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1401	Probability and Random Processes	BS	3	1	0	4	4
2	EC1401	Communication Theory	PC	3	0	0	3	3
3	EC1402	Discrete Time Signal Processing	PC	3	0	0	3	3
4	EC1403	Electronic Circuits - I	PC	3	0	0	3	3
5	EC1404	Linear Integrated Circuits	PC	3	0	0	3	3
6	EE1471	Control Systems Engineering	PC	3	0	0	3	3
PRACTICAL								
7	EC1411	Digital Signal Processing Laboratory	PC	0	0	4	4	2
8	EC1412	Linear Integrated Circuits Laboratory	PC	0	0	4	4	2
9	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1302 LINEAR ALGEBRA AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES:

The course will enable learners to

- To make them understand the basic concepts of vector spaces.
- To describe the concepts of linear transformation and diagonalization.
- To introduce the concept of inner product spaces in orthogonalization.
- To make them understand the procedure to solve partial differential equations.
- To introduce the standard techniques for solving wave and heat equations.

UNIT I VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations of vectors - Linear Span – Linear independence and linear dependence – Bases and dimensions

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT III INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of standard types of first order equations – Lagrange's linear equation – Classification of partial differential equations – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT V FOURIER SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

General Fourier series – Half range sine and cosine series – Method of separation of variables - Solutions of one dimensional wave equation and one dimensional heat equation – Steady state solution of two dimensional heat equation - Fourier series solutions in Cartesian coordinates.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Identify whether the given system of equation is linearly dependent or independent.
CO2	Apply the concept of eigenvalues and eigenvectors for diagonalization of a matrix
CO3	Calculate the orthonormal vector and minimal solution to the system of linear equation using inner product techniques.
CO4	Solve various types of partial differential equations.
CO5	Apply the Fourier series techniques in solving heat flow and wave equations.

TEXT BOOKS:

1. Friedberg, A, H, Insel, A, J, & Spence, L, 2004, *Linear Algebra*, Prentice Hall of India, New Delhi.
2. Grewal, B, S, 2014, *Higher Engineering Mathematics*, Khanna Publishers, 43rd Edition New Delhi.

REFERENCES:

1. James, G, 2007, *Advanced Modern Engineering Mathematics,* Pearson Education.
2. Kolman, B, & Hill, D, R, 2009, *Introductory Linear Algebra*, Pearson Education, New Delhi, First Reprint.
3. Kumaresan, S, 2010, *Linear Algebra, A Geometric Approach*, Prentice, Hall of India, New Delhi, Reprint.
4. Lay, D, C, 2015, *Linear Algebra and its Applications*, Pearson Education, 5th Edition.
5. Sundarapandian, V, 2008, *Numerical Linear Algebra*, Prentice Hall of India, New Delhi.

WEB REFERENCES:

1. https://fdocuments.in/document/introductory-linear-algebra-kolman-8e.html
2. https://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MATHEMATICS%20BY%20ERWIN%20ERESZIG1.pdf
3. http://www.math.toronto.edu/ivrii/PDE-textbook/PDE-textbook.pdf

AD1371 DATA STRUCTURES AND ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- Understand the fundamentals of algorithms and the concepts of List ADT.
- Learn linear data structures – stacks and queues.
- Understand the concepts of non-linear data structures, Trees.
- Learn the concepts of non-linear data structures, Graphs.
- Understand sorting, searching and hashing algorithms

UNIT I INTRODUCTION TO ALGORITHMS AND ADTs 9

Time and space complexity - Big O, Omega, Theta notation – List ADT – array based implementation, linked list implementation, singly linked lists, circularly linked lists, doubly linked lists, applications of lists.

UNIT II STACK AND QUEUE 9

Stack ADT – Operations, Applications, Evaluating arithmetic expressions, Conversion of Infix to postfix expression - Queue ADT – Operations, Circular Queue, Priority Queue, dequeue, applications of queues.

UNIT III TREES 9

Tree ADT - tree traversals - Binary Tree ADT - expression trees, applications of trees - binary search tree ADT–AVL Tree - B-Tree - Heap- Binary heap - Applications of heap.

UNIT IV GRAPHS 9

Definition, Representation of Graph, Types of graph, Breadth-first traversal, Depth-first traversal - Topological Sort - Bi-connectivity - Cut vertex - Euler circuits - Applications of graphs.

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching - Linear Search, Binary Search - Sorting - Bubble sort, Selection sort, Insertion sort, Shell sort, Radix sort - Hashing - Hash Functions, Separate Chaining, Open Addressing, Rehashing, Extendible Hashing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Illustrate the basic concepts of List ADT.

CO2 Explain Stack and Queue ADTs.

CO3 Summarize the concepts of non-linear data structures, Trees.

CO4 Outline the concepts of non-linear data structures, Graphs.

CO5 Apply appropriate sorting and searching techniques for problem solving.

TEXT BOOKS:

1. Weiss, M.A., 1997. *Data Structures and Algorithm Analysis in C, 2/e*. Pearson Education India.
2. Reema Thareja, 2011. *Data Structures Using C*, Second Edition, Oxford University Press.

REFERENCES:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest & Clifford Stein, 2002. *Introduction to Algorithms*, Second Edition, Mcgraw Hill.
2. Aho, Hopcroft & Ullman, 1983. *Data Structures and Algorithms*, Pearson Education.
3. Kochan, S.G., 2015. *Programming in C*. Pearson education.
4. Ellis Horowitz, SartajSahni, Susan & Anderson-Freed, 2008 *Fundamentals of Data Structures in C*, Second Edition, University Press.

EC1371 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To design the synchronous and Asynchronous counters and shift registers by using Flip Flops.
- To introduce the analysis and design procedures for synchronous sequential circuits

- To introduce the electronic circuits involved in the making of logic gates

UNIT I DIGITAL FUNDAMENTALS 9

Review of Number systems - Logic gates - Boolean algebra - Boolean postulates and laws - De-Morgan's Theorem, Principle of Duality - Simplification using Boolean algebra - Canonical forms, Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation.

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates - Design of combinational circuits - Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Code converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder.

UNIT III SEQUENTIAL CIRCUITS 9

Latches - Flip-Flops - SR, JK, D and T, Master Slave Flip Flops - Shift registers - SISO, SIPO, PISO, PIPO - Binary counters – Synchronous and asynchronous up/down counters, mod - N counter, Counters for random sequence - Johnson counter - Ring counter

UNIT IV SYNCHRONOUS CIRCUIT DESIGN 9

Design of Synchronous Sequential Circuits - State Table and State Diagram - Design of Mealy and Moore FSM - Overlapping & Non-overlapping Sequence detector - Hazards - Hazard free realization - Case study on Vending Machine FSM

UNIT V LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – RTL, TTL, ECL and CMOS - Basic memory structure – ROM, PROM, EPROM, EEPROM - RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL - FPGA - Basic Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Outline the Boolean functions and various minimization techniques.

CO2 Illustrate the combinational circuits used to perform basic digital operations.

CO3 Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4 Apply state machine models to design sequential logic circuits.

CO5 Design combinational circuits using programmable logic devices.

TEXT BOOKS:

1. M Morris Mano, M.D.C., 2017. *Digital design: with an introduction to the verilog HDL, VHDL, and system Verilog*, 6th Edition, Pearson Education.

REFERENCES:

1. Charles H.Roth, 2013. *Fundamentals of Logic Design*, 6th Edition, Thomson Learning.
2. Wakerly J F, 2002. *Digital Design: Principles and Practices*, 2nd Ed., Prentice Hall.
3. D. D. Givone, 2003. *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
4. Thomas L. Floyd, 2011. *Digital Fundamentals*, 10th Edition, Pearson Education Inc.
5. Stephen Brown & Zvonko Vranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, Third Edition, McGraw-Hill Higher Education, New Delhi, India.

EC1301 ELECTROMAGNETIC FIELDS AND WAVES

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To understand the concept of static electric field.
- To understand the concept of static magnetic field.
- To gain conceptual understanding of static electric and magnetic fields in materials.
- To understand the coupling between electric and magnetic fields in time varying conditions.
- To understand wave propagation in lossless and in lossy media.

UNIT I STATIC ELECTRIC FIELD 9

Coordinate Systems – Gradient , Divergence , Curl – Divergence theorem, Stokes theorem - Coulomb's Law– Electric Field Intensity – Electric Field due to discrete charges, charges distributed uniformly on an infinite line, finite line and infinite sheet. Electric Scalar Potential – Electric Flux Density – Gauss Law and its applications.

UNIT II STATIC MAGNETIC FIELD 9

Biot-Savart's Law– Magnetic Field intensity due to infinite and finite wire carrying current I – Ampere's circuital law. Magnetic flux density –Lorentz force equation – Force on a wire carrying a current placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic Vector Potential.

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation – Electric Polarization - Capacitance – Capacitance of parallel plate capacitor and coaxial cable – Capacitance of parallel plate capacitor with two dielectrics – Electrostatic energy - Energy density – Boundary conditions for electric fields – Electric current – Current density – Point form of ohm's law – Continuity equation for current. Inductance – Inductance of loops and solenoids – Mutual inductance –Energy density in magnetic fields – Magnetization and Permeability - Magnetic boundary conditions.

UNIT IV TIME-VARYING ELECTRIC AND MAGNETIC FIELDS 9

Faraday's law – Transformer and Motional electromotive forces - Displacement current – Maxwell's equations in integral form and differential form –Maxwell's equation in Phasor form - Poynting Vector and the flow of power – Poynting theorem. Case Study - Application of EM waves in Microwaves.

UNIT V ELECTROMAGNETIC WAVES 9

Wave equations for conducting and non-conducting media - Wave equations in Phasor form – Uniform plane waves in perfect dielectrics, conductors and free space - Skin effect- Introduction to EM Shielding Case Study: Biological Effects of Electromagnetic Waves.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Describe the fundamental concepts of static electric field.

CO2 Explain the fundamental concepts of static magnetic field.

CO3 Solve electrostatic and magneto static boundary problems.

CO4 Interpret Maxwell's equations for time dependent electromagnetic fields.

CO5 Determine parameters such as frequency, phase constant, velocity, skin depth and associated intrinsic impedance for different media.

TEXT BOOKS:

1. Mathew.N.O. Sadiku 2015, *Elements of Electromagnetics*, 6th Edition, Oxford University Press.
2. W.H. Hayt & J.A. Buck 2012, *Engineering Electromagnetics*, 8th Edition, McGraw-Hill (India).

REFERENCES:

1. D.K. Cheng 1989, *Field and Wave Electro Magnetics*, 2nd Edition, Pearson (India).
2. Kraus, Fleisch 2010, *Electromagnetics with Applications*, 5th Edition, McGraw-Hill.
3. Daniel Fleisch 2008, *A Student's Guide to Maxwell's Equations*, 1st Edition, Cambridge University Press.

EC1302 ELECTRONIC DEVICES

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To analyze simple diode Circuits
- To introduce BJT basic operation, characteristics and application
- To acquaint with the construction, theory and operation of Field Effect Transistors
- To interpret the Special Semiconductor Diodes, Power Devices and Display Devices
- To apply the concepts of DC power supplies

UNIT I SEMICONDUCTOR DIODES 9

PN junction Diodes - Formation of PN junction, working principle, VI characteristics - diode resistance - PN diode currents - diode current equation - transition and diffusion capacitance - voltage breakdown in diodes - Diode models - Diode Circuits

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

Principle and Operation of PNP, NPN transistors, Early effect, Current Equation, BJT as a switch and Amplifier, Breakdown Mechanisms of Transistors - Input and Output Characteristics of CE, CB, CC - Ebers Moll Model - Hybrid Model - Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

Principle and Operation of N channel and P channel JFET, Drain and Transfer Characteristics, Current Equation, Pinch off Voltage and its significance, Breakdown mechanisms of JFET. MOSFET - Characteristics, Threshold voltage, Channel Length Modulation, MOSFET Capacitor, D-MOSFET - E-MOSFET Characteristics - Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DIODES 9

Zener Diode - Varactor diode - Tunnel diode - Schottky diode - LED - Photo Diode - LCD, LDR, Opto Coupler, Solar Cell. SCR - DIAC – TRIAC.

UNIT V DC POWER SUPPLIES 9

HWR, FWR, full-wave bridge rectifier, power supply filters - ripple factor, efficiency analysis - bleeder resistor. Voltage regulation, Zener diode shunt regulator, transistor series regulator, transistor shunt regulator, design of complete DC power supply circuit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain the working principle of PN junction diode and its parameters.

CO2 Outline the working principle of BJT and various configuration and models.

CO3 Illustrate the working principle of FET to find equivalent circuits and its parameters.

CO4 Interpret the special semiconductor diodes operation of various power devices and display devices.

CO5 Explain the linear mode power supply and voltage regulators

TEXT BOOKS:

1. Thomas L. Floyd, 2012. *Electronic Devices*, 9^{th} edition, Pearson Education.

2. Donald A Neaman, 2012. *Semiconductor Physics and Devices*, 4^{th} Edition, Tata McGraw Hill.

REFERENCES:

1. R.S.Sedha, 2006. *A Text Book of Applied Electronics*, S.Chand Publications.
2. Ben. G. Streetman & Sanjay Kumar Banerjee, 2015. *Solid State Electronic Devices*, 7th Edition, Pearson Education India.
3. Robert Boylestad & Louis Nashelsky, 2008. *Electron Devices and Circuit Theory,* Pearson Prentice Hall, 10th edition.
4. Yang, 1978. *Fundamentals of Semiconductor devices*, McGraw Hill International Edition.
5. Adel S. Sedra & Kenneth C. Smith, 2017. *Microelectronic Circuits: Theory and Applications*, 7th Edition, Oxford University Press.

EC1303 SIGNALS AND SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce visualization and mathematical representation of continuous-time signals and systems
- To teach the applications of Laplace and Fourier transforms in the analysis of continuous- time signals
- To impart knowledge on the analysis of continuous time system using Fourier and Laplace Transform
- To teach the applications of Z- and Fourier transforms in the analysis of discrete – time signals
- To impart knowledge on the analysis of discrete time system using Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Basic Operations on Signals, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals, Classification of systems - CT systems and DT systems, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable, Static & Dynamic.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series for periodic signals - Fourier Transform - properties - Laplace Transforms and properties, RoC and its properties, Inverse Laplace transform

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response – properties of convolution, convolution integrals - Differential Equation-Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling and reconstruction, Aliasing – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties, Inverse Z Transform - Partial fraction method, Residue method

UNIT V LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS 9

Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems - DT systems connected in series and parallel.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 To identify the different types of continuous time and discrete time signals/systems.

CO2 To apply Fourier series, Continuous Time Fourier Transform and Laplace transform for the analysis of continuous time signals.

CO3 To make use of Fourier and Laplace transform to analyse continuous time systems.

CO4 To apply Discrete Time Fourier Transform and Z Transform for the analysis of discrete time signals.

CO5 To utilize Fourier and Z transform to analyze discrete time systems.

TEXT BOOKS:

1. Oppenhiem, A.V., Willsky, A.S. & Nawab, S.H., 2015. *Signals and systems*, Pearson.

REFERENCES:

1. Lathi, B.P., 2009. *Principles of Linear Systems and Signals,* Oxford University Press.
2. Ziemer, R.E., Tranter, W.H. & Fannin, D.R., 1993. *Signals and systems: continuous and discrete*, Macmillan College.
3. John Alan Stuller, 2007, *An Introduction to Signals and Systems*, Thomson.

AD1381 DATA STRUCTURES AND ALGORITHMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- Implement the linear Data structures Array, List, Stack and Queue
- Implement non-linear Data Structures – Trees for problem solving
- Implement non-linear Data Structures – Graph for problem solving
- Implement various sorting and searching algorithms.
- Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EXPERIMENTS

1. Implementation of List ADT using array and Linked list.
2. Implementation of Stack ADT using array and linked list.
3. Application of Stack - Conversion of infix expression into postfix expression.
4. Implementation of Queue ADT using array and linked list
5. Implementation of Binary Search Tree ADT
6. Implementation of Graph ADT using adjacency matrix and Graph traversal algorithms
7. Implementation of Linear search and binary search algorithms
8. Implementation of Bubble sort and Insertion sort Algorithms
9. Implementation of collision techniques in hashing.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Make use of linear Data structures Array, List, Stack and Queue to solve problems.

CO2 Apply non-linear Data Structures - Trees for problem solving.

CO3 Make use of non-linear Data Structures - Graph for problem solving

CO4 Utilize various sorting and searching algorithms to solve problems.

CO5 Apply appropriate hash functions in a Hash ADT for collision free data storage and retrieval

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, 250 GB, 1 GB RAM)	30
2.	Printer	1
3.	Server (Intel Core i3, 4 GB RAM) (High Speed Processor)	1
4.	Compilers: C / C++	30 users

EC1311 DIGITAL CIRCUITS AND DEVICES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To design and implement the Combinational logic circuits
- To design and implement the sequential logic circuits
- To learn the characteristics of basic electronic devices such as Diode, BJT,FET, SCR
- To analyze the characteristics of rectifiers with and without filters.
- To illustrate basic digital gate operation using Transistor-Transistor Logic (TTL) family.

LIST OF EXPERIMENTS

Digital Circuits Experiments:

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters
3. Design and implementation of Half/Full Adder and Subtractor
4. Design and implementation using MSI Devices
   a. 4 – bit binary adder / subtractor
   b. Full Adder using Multiplexers
5. Design and implementation of encoder, decoder, Multiplexer and De-multiplexer logic gates
6. Design and implementation of Shift register (SISO, SIPO, PIPO) using Flip flops
7. Design and implementation of Asynchronous and Synchronous counters (Up/ Down and Mod)

Electronic Devices Experiments:

1. Characteristics of PN Junction diode and Zener diode & Regulator using Zener diode
2. Characteristics of BJT (Common Emitter/ Common base)
3. Characteristics of FET
4. Characteristics of SCR
5. Design of NAND and NOR gates using Transistors
6. Development of DC power supply circuits using devices in PCB – Mini Project

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Build different combinational circuits.

CO2 Experiment with various sequential circuits.

CO3 Illustrate the working of basic electronic devices such as PN junction diode and Zener diode by plotting its characteristic curves.

CO4 Explain the working of electronic devices such as Transistors, FET and SCR in various modes and configurations.

CO5 Illustrate the various Modes in V-I Characteristics of SCR.

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation –– taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work**.**

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs.

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.

2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER – IV

MA1401 **PROBABILITY AND RANDOM PROCESSES**

L	T	P	C
3	1	0	4

OBJECTIVES:

The course will enable learners to

- To describe about probability, random variables and introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To introduce the concepts of two dimensional random variables.
- To make them understand the basic concepts of random processes for applications such as random signals, linear systems in communication engineering.
- To make them understand the concepts of correlation and spectral densities.
- To illustrate the concepts of Linear system with random inputs.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Distributions: Binomial, Poisson, Uniform, Exponential and Normal.

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of Random Variables- Central limit theorem.

UNIT III RANDOM PROCESSES 12

Classification – Stationary process – Markov process : Markov chain -Transition Probability Matrix– Chapman Kolomogrov Equations: Calculation of n step transition Probability, limiting Probability - Classification of States of a Markov Chain - Poisson process – Properties – Semi Random telegraph process - Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

Auto correlation functions – Cross correlation functions – Properties – Power spectral density – Cross spectral density – Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and Cross correlation functions of input and output.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Apply the concepts of probability, continuous and discrete random variables using various probability distributions.

CO2 Compute the correlation between two variables and linear regression equation for a set of data.

CO3 Make use of probability concepts in classifying the random processes.

CO4 Interpret the auto correlation and spectral densities of different signals in the random processes.

CO5 Apply the concepts of the linear system in communication Engineering.

TEXT BOOKS:

1. Oliver C Ibe, 2014, *Fundamentals of Applied Probability and Random Processes*, 2nd Edition, Elsevier.
2. Peebles, P Z 2002, *Probability, Random Variables and Random Signal Principles,* 4th Edition, Tata McGraw Hill, New Delhi.

REFERENCES:

1. Cooper, G R, & McGillem, C D, 2012, *Probabilistic Methods of Signal and System Analysis*, 3rd Indian Edition, Oxford University Press, New Delhi.
2. Hwei Hsu 2014, *Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes*, 3rd Edition, Tata McGraw Hill Education, New Delhi.
3. Miller, S L, & Childers, D G, 2004, *Probability and Random Processes with Applications to Signal Processing and Communications*, Academic Press.
4. Stark, H, & Woods, J W, 2012, *Probability and Random Processes with Applications to Signal Processing*, 4th Edition, Pearson Education, Asia.
5. Yates, R D, & Goodman D J, 2014, *Probability and Stochastic Processes*, 3rd Edition, Wiley, India.

WEB REFERENCES:

1. Probability and Random Processes, 2nd Edition (wordpress.com)
2. Probability Random Variables and Random Signal Principles Peebles 4th.pdf (engzenon.com)
3. probww.dvi

EC1401 COMMUNICATION THEORY

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the concepts of amplitude modulations and their spectral analysis
- To understand the generation and detection methods of frequency modulation
- To introduce random processes and their characteristics
- To understand noise impact on modulations
- To introduce analog to digital conversion techniques.

UNIT I AMPLITUDE MODULATION 9

Amplitude Modulation-DSBSC, DSBFC, SSB, VSB -Modulation index, Spectra, Power relations and Bandwidth –AM Generation –Square law and Switching modulator, DSBSC Generation –Balanced and Ring Modulator, SSB Generation –Filter, Phase Shift and Third Methods, VSB Generation –Filter Method, Hilbert Transform, Pre-envelope & complex envelope –comparison of different AM techniques, Superheterodyne Receiver

UNIT II ANGLE MODULATION 9

Phase and frequency modulation, Narrow Band and Wide band FM –Modulation index, Spectra, Power relations and Transmission Bandwidth -FM modulation –Direct and Indirect methods, FM Demodulation –FM to AM conversion, FM Discriminator

UNIT III RANDOM PROCESS 9

Random variables, Random Process, Stationary Processes, Mean, Correlation & Covariance functions, Power Spectral Density, Ergodic Processes, Gaussian Process, Transmission of a Random Process Through a LTI filter.

UNIT IV NOISE CHARACTERIZATION 9

Noise sources –Noise figure, noise temperature and noise bandwidth –Noise in cascaded systems. Representation of Narrow band noise –In-phase and quadrature, Envelope and Phase –Noise performance analysis in AM &FM systems –Threshold effect and capture effect , Pre-emphasis and de-emphasis for FM.

UNIT V SAMPLING & QUANTIZATION 9

Low pass sampling –Aliasing-Signal Reconstruction-Quantization -Uniform & non-uniform quantization -quantization noise -Logarithmic Companding –PAM, PCM –TDM, FDM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Illustrate the generation and detection methods of amplitude modulation schemes with its spectral characteristics.

CO2 Explain NBFM and WBFM with its generation and detection methods.

CO3 Make use of the probability, random process and noise theory concepts

CO4 Compare the noise performance of various analog modulation schemes.

CO5 Explain the principles of sampling and quantization.

TEXT BOOKS:

1. Simon Haykin, 2014, *Communication Systems*, 4th Edition, Wiley. (UNIT I-V).

REFERENCES:

1. J.G.Proakis & M.Salehi, 2014, *Fundamentals of Communication Systems, Pearson Education*. (UNIT I-IV).
2. B.P.Lathi, 2007, *Modern Digital and Analog Communication Systems*, 3rd Edition, Oxford University Press.
3. D.Roody, J.Coolen, 2006, *Electronic Communications*, 4th edition PHI.

EC1402 DISCRETE TIME SIGNAL PROCESSING

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To learn discrete Fourier transform, properties of DFT and its application to linear filtering.
- To understand the characteristics of digital filters, design digital IIR filters and apply these filters to filter undesirable signals in various frequency bands.
- To learn the characteristics of digital filters, design digital FIR filters.
- To understand the effects of finite precision representation on digital filters.
- To introduce the concepts of Digital Signal Processors

UNIT I DISCRETE FOURIER TRANSFORM 9

Review of signals and systems, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT).

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters, characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

UNIT III FINITE IMPULSE RESPONSE FILTERS 9

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations, polyphase realization

UNIT IV FINITE WORD LENGTH EFFECTS 9

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V MULTIRATE SIGNAL PROCESSING 9

Introduction to multirate signal Processing – Decimation, Interpolation – Polyphase decomposition of FIR filter – Multistage implementation of sampling rate conversion – Design of narrowband filters – Applications of Multirate signal Processing – Design of Phase shifters, Subband coding

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Solve Discrete Fourier Transform (DFT) and Fast Fourier transform (FFT) of any discrete time sequences.

CO2 Construct digital Butterworth and Chebyshev IIR filters using backward difference, impulse invariant and bilinear transformation methods.

CO3 Construct FIR filters using Fourier series, windowing and frequency sampling methods.

CO4 Identify the finite word length effects in IIR filters.

CO5 Explain different architectures of Digital Signal Processors with its functionalities.

TEXT BOOKS:

1. John G. Proakis & Dimitris G.Manolakis, 2007. *Digital Signal Processing - Principles, Algorithms & Applications*, Fourth Edition, Pearson Education / Prentice Hall.

REFERENCES:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, 2002. *Digital Signal Processing*, Second Edition, Pearson Education / Prentice Hall.
2. A. V. Oppenheim, R.W. Schafer & J.R. Buck, 2004. *Discrete-Time Signal Processing*, 8th Indian Reprint, Pearson.
3. Sanjit K. Mitra, 2007. *Digital Signal Processing – A Computer Based Approach*, Tata McGraw Hill.
4. Andreas Antoniou, 2006. *Digital Signal Processing*, Tata McGraw Hill.

EC1403 ELECTRONIC CIRCUITS - I

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To understand the methods of biasing transistors
- To design and analyze single stage and multistage amplifier circuits
- To analyze the frequency response of small signal amplifiers
- To analyze the power amplifiers.
- To troubleshoot and fault analysis of power supplies

UNIT I BIASING OF DISCRETE BJT, JFET AND MOSFET 9

BJT-Need for biasing- DC Load line, operating point - DC analysis of Transistor circuits- Various biasing methods for BJT- Bias Circuit Design -Thermal stability - Stability factors- Bias compensation using Diode, thermistor and sensistor - JFET-DC Load Line and Bias Point - Various biasing methods of JFET-JFET Bias Circuit Design- MOSFET Biasing -Biasing FET Switching Circuits.

UNIT II BJT AMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of BJT - Early effect - Analysis of CE, CC and CB amplifiers using Hybrid π equivalent circuits- AC Load Line Analysis -Darlington Amplifier - Bootstrap technique- Cascade, Cascode configurations- Differential amplifier, Constant current source, Basic BJT differential pair amplifier - Small signal analysis and CMRR.

UNIT III SINGLE STAGE FET, MOSFET AMPLIFIERS 9

Small Signal Hybrid π equivalent circuit of FET and MOSFET - Analysis of CS, CD and CG amplifiers using Hybrid π equivalent circuits - Basic FET differential pair amplifier - BiCMOS circuits.

UNIT IV FREQUENCY RESPONSE OF AMPLIFIERS 9

Amplifier frequency response - Frequency response of transistor amplifiers with circuit Capacitors - BJT frequency response- Short circuit current gain- Alpha Cut off frequency, Beta Cut off frequency and unity gain bandwidth - Miller effect - Frequency response of FET - High frequency analysis of CE and MOSFET CS amplifier - Transistor Switching Times.

UNIT V POWER AMPLIFIERS AND ELECTRONIC DEVICE TESTING 9

Power amplifiers- class A-Class B-Class AB-Class C-Power MOSFET-Temperature Effect-Class AB Power amplifier using MOSFET-Power Supply Performance and Testing - Troubleshooting and Fault Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Elucidate the different biasing circuits in amplifiers using BJT and FET.

CO2 Summarize about how small signal models are needed in various configurations of BJT and its simple, cascade and cascade amplifier circuits.

CO3 Identify the significance of JFET and MOSFET amplifiers using small signal analysis.

CO4 Interpret the low, high frequency response of amplifiers and to derive cut off frequencies for determining bandwidth.

CO5 Illustrate the performance of power amplifiers.

TEXT BOOKS:

1. Donald A Neaman, 2012, *Semiconductor Physics and Devices*, 4th Edition, Tata McGraw Hill Inc.

REFERENCES:

1. Salivahanan & N. Suresh Kumar, 2017, *Electronic Devices and Circuits*, 4th Edition, McGraw Hill Education (India) Private Ltd.
2. Millman J, Halkias.C. & SathyabradaJit, 2015, *Electronic Devices and Circuits*, 4th Edition, McGraw Hill Education (India) Private Ltd.
3. Robert Boylestad & Louis Nashelsky, 2008, *Electron Devices and Circuit Theory*, 10th Edition, Pearson Prentice Hall.
4. Floyd, 2012, *Electronic Devices*, 9th Edition, Pearson Education.
5. David A. Bell, 2008, *Electronic Devices & Circuits*, 5th Edition, Oxford University Press.
6. Rashid M, 2007, *Microelectronics Circuits*, Thomson Learning

EC1404 LINEAR INTEGRATED CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the basic building blocks of linear integrated circuits.
- To learn the linear and non-linear applications of operational amplifiers.
- To introduce the theory and applications of analog multipliers and PLL.
- To learn the theory of ADC and DAC.
- To introduce the concepts of waveform generation and introduce some special function ICs.

UNIT I BASICS OF OPERATIONAL AMPLIFIERS 9

Current mirror and current sources, Current sources as active loads - Voltage sources, Voltage References - Basic information about op-amps – Ideal Operational Amplifier – General operational amplifier stages - DC and AC performance characteristics, slew rate - Open and closed loop configurations - JFET Operational Amplifiers - Features of TL082.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic amplifier, Antilogarithmic amplifier, Comparators, Schmitt trigger, Precision rectifier, peak detector, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique - Analog multiplier ICs and their applications - Operation of the basic PLL, Closed loop analysis, Voltage controlled oscillator - Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing and clock synchronisation.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter, specifications – weighted resistor type - R-2R Ladder type, Voltage Mode and Current-Mode – switches for D/A converters - high speed sample and hold circuits, A/D Converter specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage to Time Conversion – Over sampling A/D Converters, Sigma Delta converters.

UNIT V WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS 9

Sine-wave generators - Multivibrators - Triangular wave generators, Saw-tooth wave generator - ICL8038 function generator - Timer IC 555, Latch - IC Voltage regulators, Three terminal fixed and adjustable voltage regulators, IC 723 general purpose regulator, Monolithic switching regulator, Low Drop Out (LDO) Regulators, Four quadrant power supply – Switched capacitor filter IC MF10 - Frequency to Voltage and Voltage to Frequency converters - Audio Power amplifiers - Video Amplifiers - Isolation Amplifiers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Outline the basic building blocks of Analog ICs such as Current mirror & Current sources, Voltage sources & Voltage References, along with the internal circuitry of op amp-IC 741.

CO2 Utilize the concepts of op amp for developing linear and non linear circuits.

CO3 Explain various types of analog multiplier and PLL ICs with their applications.

CO4 Interpret various A/D and D/A converters using operational amplifiers.

CO5 Build various waveform generators and other circuits using operational amplifier, IC 555 and special function ICs.

TEXT BOOKS:

1. D.Roy Choudhry, Shail Jain, 2018 *Linear Integrated Circuits*, Fifth Edition, New Age International Pvt. Ltd.
2. S.Salivahanan, V.S.Kanchana Bhaaskaran, 2015, *Linear Integrated Circuits*, Second Edition, TMH.

REFERENCES:

1. Ramakant A. Gayakwad, 2008, *Op-amps and linear integrated circuit technology*, 4^{th} Edition, Pearson Education.
2. R. Coughlin, F. Driscoll, 2001, *Operational Amplifiers and Linear Integrated Circuits*, 6th Edition, PHI Publishers.
3. Sergio Franco, 2016, *Design with Operational Amplifiers and Analog Integrated Circuits*, 4^{th} Edition, Tata MC Graw Hill.

EE1471 CONTROL SYSTEMS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

The course will enable learners to

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approaches for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS 9

Standard Inputs - Transient response& Steady state response-Measures of performance of the standard first order and second order system- Effect on an additional zero and an additional pole- Steady error constant and system type number-PID control-Analytical design for PD, PI,PID control systems.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation.

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Identify the various control system components and their representations.

CO2 Analyze the various time domain parameters.

CO3 Analysis the various frequency response plots and its system.

CO4 Apply the concepts of various system stability criterions.

CO5 Design various transfer functions of digital control system using state variable models.

TEXT BOOKS:

1. M.Gopal, 2012. *Control System – Principles and Design*, 4th Edition, Tata McGraw Hill.

REFERENCE BOOKS:

1. J.Nagrath & M.Gopal, 2007. *Control System Engineering*, 5th Edition, New Age International Publishers.
2. K. Ogata, 2012. *Modern Control Engineering*, 5th edition, PHI.
3. S.K.Bhattacharya, 2013. *Control System Engineering*, 3rd Edition, Pearson.
4. Benjamin.C.Kuo, 1995. *Automatic control systems*, 7th Edition, Prentice Hall of India.

EC1411 DIGITAL SIGNAL PROCESSING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To perform basic signal processing operations such as Linear Convolution, Circular
- Convolution, Auto Correlation, Cross Correlation and Frequency analysis in MATLAB
- To implement FIR and IIR filters in MATLAB and DSP Processor
- To study the architecture of DSP processor
- To design a DSP system to demonstrate the Multi-rate and Adaptive signal processing concepts

LIST OF EXPERIMENTS

I MATLAB / EQUIVALENT SOFTWARE PACKAGE

1. Generation of elementary Discrete-Time sequences
2. Convolution and Correlation
3. Frequency Analysis using DFT and FFT
4. Sampling and the effect of aliasing
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filter operations
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrates the filter operations
7. Implement multirate filters

II DSP PROCESSOR BASED IMPLEMENTATION

8. Study of architecture of Digital Signal Processor
9. Perform MAC operation using various addressing modes
10. Generation of various signals
11. Design and demonstration of FIR filter for Low pass, High Pass, Band Pass and Band Stop Filtering
12. Design and demonstration of Butterworth and Chebyshev IIR filters for Low pass, High Pass, Band Pass and Band Stop Filtering
13. Implement an Up-sampling and Down-sampling operation in DSP processor

III MINI PROJECT

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Develop MATLAB code for generating mathematical signals and various signal processing operations like linear &circular convolution and correlation.

CO2 Analyze the spectral components present in the discrete time signals using Discrete Fourier Transform.

CO3 Analyze FIR and IIR Filters using MATLAB.

CO4 Describe the architecture of Digital Signal Processor.

CO5 Construct various signal processing operations using Digital Signal Processor

EC1412 LINEAR INTEGRATED CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

The course will enable learners to

- To understand the basics of linear integrated circuits and available ICs.
- To understand characteristics of operational amplifier.
- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function IC.
- To get exposed to SPICE software for circuit design

LIST OF EXPERIMENTS

HARDWARE IC BASED EXPERIMENTS:

1. Inverting, Non inverting and Differential amplifiers.
2. Integrator and Differentiator.
3. Instrumentation amplifier
4. Active low-pass, High-pass and band-pass filters.
5. Astable & Monostable multivibrators and Schmitt Trigger using op-amp.
6. Phase shift and Wien bridge oscillators using op-amp.
7. Triangular and sawtooth Waveform Generator using op-amp.

8. Astable and monostable multivibrators using NE555 Timer.
9. PLL characteristics and its use as Frequency Multiplier.
10. DC power supply using LM317 and IC723.

SIMULATION USING SPICE:

1. Amplifiers using opamp
2. Active Filters using op-amp
3. Astable and Monostable Multivibrator using opamp and NE555 Timer.
4. Implementation of DA converter using MULTISIM.
5. Astable & Monostable multivibrators and Schmitt Trigger using op-amp in MULTISIM.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Design filters, amplifiers and oscillators using operational amplifiers.
CO2 Analyze the working of PLL and describe its application as a frequency multiplier.
CO3 Design DC power supply using ICs.
CO4 Analyze the performance of filters, multivibrators, converters and analog multiplier using SPICE
CO5 Design and analyze multivibrators using opamps and 555 Timer ICs.

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay.

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm

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S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Electrical and Electronics Engineering of this Institution the unique of its kind in the field of Research and Development activities in this part of the world.

MISSION:

Department of Electrical and Electronics Engineering is committed to

1. Inculcate technical knowledge by providing well-balanced curriculum to the urban and unreachable rural student community through "Total Quality Education"
2. Induce leadership and entrepreneurial skills with high standard of ethics and moral values to the student community.
3. Impart innovative skills to the student community by effectively involving them in research activities.
4. Create a wholesome environment to promote effective interaction of students with the industry experts

PROGRAM EDUCAITON OBJECTIVES:

Graduates of the programme will be able to

1. **Technical Knowledge:**
   Apply Technical knowledge acquired in the field of Electrical and Electronics Engineering and allied areas for practical or industrial problems for a successful professional career
2. **Problem Solving:**
   Develop and envisage appropriate solutions for real time technological problems faced by the industries and society.

3. **Personality Development**

   Demonstrate interpersonal skills, soft skills and leadership quality blended with ethical and social responsibility for a prospective career

4. **Life Long Learning:**

   Habituate life-long learning so as to adapt to the emerging needs of the profession.

PROGRAM OUTCOMES:

After going through the four years of study, the Electrical and Electronics Engineering graduates will have the ability to

	Graduate Attribute	**Programme Outcome**
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and	Understand the impact of the professional engineering

	sustainability	solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Ability to design and solve engineering problems by applying the fundamental knowledge of Engineering Mathematics, Basic Sciences, Electrical and Electronics Engineering

PSO2:

Ability to understand the recent technological developments in Electrical & Electronics Engineering and develop products / software to cater the Societal & Industrial needs

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. ELECTRICAL AND ELECTRONICS ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1372	Transforms and Linear Algebra	BS	3	1	0	4	4
2	EE1301	DC Machines and Transformers	PC	3	1	0	4	4
3	EE1302	Transmission and Distribution	PC	3	0	0	3	3
4	EE1306	Power Plant Engineering	ES	3	0	0	3	3
5	EE1371	Electronic Devices and Circuits	ES	3	0	0	3	3
PRACTICAL								
6	EE1311	DC Machines and Transformers Laboratory	PC	0	0	4	4	2
7	EE1316	Electronic Devices and Circuits Laboratory	ES	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**2**	**10**	**27**	**22**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1472	Numerical Methods and Probability	BS	3	1	0	4	4
2	IT1471	Object Oriented Programming using JAVA (Theory cum laboratory)	ES	3	0	2	5	4
3	EE1401	AC Machines	PC	3	1	0	4	4
4	EE1402	Linear and Digital Integrated Circuits	PC	3	1	0	4	4
5	EE1403	Measurements and Instrumentation	PC	3	0	0	3	3
PRACTICAL								
6	EE1411	AC Machines Laboratory	PC	0	0	4	4	2
7	EE1481	Linear and Digital Integrated Circuits Laboratory	PC	0	0	4	4	2
8	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**15**	**3**	**12**	**30**	**24**

MA1372 **TRANSFORMS AND LINEAR ALGEBRA**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To acquaint the students with Fourier transform and Z-transform techniques.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To make them understand the concepts of vector space, linear transformations and diagonalization
- To introduce the concept of inner product spaces in orthogonalization.

UNIT I FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT II Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

UNIT III VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations of vectors-Linear Span – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT V INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO.1 Compute the Fourier transforms of standard functions and learn the properties.

CO.2 Apply the techniques of Z- transform to get the solutions of difference equations.

CO.3 Test the given system of equation is linearly dependent or independent.

CO.4 Apply the concept of eigen values and eigenvectors for diagonalization of a matrix.

CO.5 Calculate the orthonormal vector and minimal solution to the system of linear equation using inner product techniques.

TEXT BOOKS:

1. Kreyszig, E., 2008. Advanced Engineering Mathematics. JohnWileyand sons. *Inc., New York*.
2. Grewal, B.S. and Grewal, J.S., 1996. Higher engineering mathematics. *2002, Khanna Publishers, New Delhi*.

REFERENCES:

1. Bali, N.P., Goyal, M. and Watkins, C., 2007. *Advanced Engineering Mathematics: A Complete Approach.* Laxmi Publications, Ltd..
2. James, G., 2011. *Solutions Manual to Advanced Modern Engineering Mathematics*.
3. O'neil, P.V., 2017. *Advanced engineering mathematics*. Cengage learning.
4. Ramana, B.V., 2006. *Higher Engineering Mathematics.* Tata McGraw-Hill Education.
5. Kumaresan, S., 2000. *Linear algebra: a geometric approach*. PHI Learning Pvt. Ltd..

WEB REFERENCES

1 http://soaneemrana.org/onewebmedia/ADVANCED%20ENGINEERING%20MAT EMATICS%20BY%20ERWIN%20ERESZIG1.pdf

2 http://sv.20file.org/up1/692_0.pdf

3 https://fdocuments.in/document/introductory-linear-algebra-kolman-8e.html

EE1301 DC MACHINES AND TRANSFORMERS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the concept of Magneto statics and the various laws governing it.
- To analyze the Magnetic-circuit and the working principle of electrical machines using the concepts of electromechanical energy conversion principles.
- To understand the principle of operation and Testing of transformers
- To understand the working principle of DC machine as Generator and Motor.

UNIT I MAGNETOSTATICS 12

Introduction Lorentz force, magnetic field intensity (H) – Biot–Savart's Law - Ampere's Circuit Law - Magnetic flux density (B) – B in free space, conductor, magnetic materials – Magnetization, Magnetic force, Torque Equation, Inductance, Energy density, Applications-Magnetic circuits Hysteresis and Eddy Current losses

UNIT II CONCEPTS IN ROTATING MACHINES AND INTRODUCTION TO TRANSFORMERS 12

Electromechanical energy conversion principles; Singly and multiply excited magnetic field systems-- rotating mmf waves. TRANSFORMERS - Construction – Principle of Operation – Equivalent Circuit Parameters- Losses

UNIT III TESTING OF TRANSFORMERS AND THREE PHASE TRANSFORMERS 12

Testing of Transformers – Efficiency and Voltage Regulation- All Day Efficiency-Sumpner's Test. Auto Transformer –Three Phase Transformers-Connections – Scott Connection– Vector Groups– Parallel Operation.

UNIT IV DC GENERATORS 12

Construction of DC Machine – Principle of Operation - Lap and Wave Windings-EMF Equations– Equivalent Circuit Model – Armature Reaction —-Commutation - Methods of Excitation- Interpoles and Compensating Winding-Characteristics of DC Generators-Applications

UNIT V DC MOTORS 12

Principle and Operations - Types–Characteristics of DC Motors -Starting and Speed Control of DC Motors –Plugging, Dynamic and Regenerative Braking -Testing and Efficiency – Retardation Test- Swinburne's Test and Hopkinson's Test –Applications of DC Motor

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO.1: Acquaint with the techniques of magnetic-circuit analysis and magnetic materials

CO.2: Describe the working of the electrical machines based on the principle of electromechanical energy conversion

CO.3: Discuss on the construction, working, performance analysis methods, testing of transformer and three phase transformer connections

CO.4: Elucidate about the construction, types, working and characteristics of DC generator

CO.5: Describe the working principle, types, characteristics, starting, speed control and testing of DC motors

TEXT BOOKS:

1. Nagrath, I.J. and Kothari.D.P., *Electric Machines'*, McGraw-Hill Education, 2000
2. Gupta, J.B., 2009. *Theory & Performance of Electrical Machines*. SK Kataria and Sons.
3. Theraja, B.L. and Theraja, A.K., 2005. *A text Book of Electrical Technology* vol 2 AC and DC machines.

REFERENCES:

1. Stephen J. Chapman, '*Electric Machinery Fundamentals*'4th edition, McGraw Hill Education Pvt. Ltd, 2010
2. B.R. Gupta ,'*Fundamental of Electric Machines*' New age International Publishers,3rd Edition ,Reprint 2015
3. S.K. Bhattacharya, '*Electrical Machines*' McGraw - Hill Education, New Delhi, 3rd Edition,2009
4. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, '*Electric Machinery'*, Sixth edition, McGraw Hill Books Company, 2003

EE1302 **TRANSMISSION AND DISTRIBUTION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the structure of electric power system and to develop expressions for the computation of transmission line parameters.
- To obtain the equivalent circuits for the transmission lines based on distance and to determine voltage regulation and efficiency.
- To understand the mechanical design of transmission lines and to analyze the voltage distribution in insulator strings to improve the efficiency.
- To study the types, construction of cables and methods to improve the efficiency.
- To study about distribution systems, types of substations.

UNIT I TRANSMISSION LINE PARAMETERS 9

Structure of Power System - Parameters of single and three-phase transmission lines with single and double circuits -Resistance, inductance and capacitance of solid, stranded and bundled conductors, Symmetrical and unsymmetrical spacing and transposition – application of self and mutual GMD; skin and proximity effects -Typical configurations, conductor types and electrical parameters of EHV lines – Case study - Commissioned Transmission lines in India.

UNIT II MODELLING AND PERFORMANCE OF TRANSMISSION LINES 9

Performance of Transmission lines - short line, medium line and long line – equivalent circuits, phasor diagram, attenuation constant, phase constant, surge impedance - transmission efficiency and voltage regulation - Formation of Corona – Critical Voltages – Effect on Line Performance.

UNIT III MECHANICAL DESIGN OF LINES 9

Mechanical design of OH lines – Line Supports –Types of towers – Stress and Sag Calculation – Effects of Wind and Ice loading. Insulators: Types, voltage distribution in insulator string, improvement of string efficiency, testing of insulators.

UNIT IV UNDER GROUND CABLES 9

Underground cables - Types of cables – Construction of single core and 3 core cables - Insulation Resistance – Potential Gradient - Capacitance of Single-core and 3 core cables - Grading of cables - Power factor and heating of cables.

UNIT V DISTRIBUTION SYSTEMS 9

Distribution Systems – General Aspects – Kelvin's Law – AC distributions: Power factors referred to receiving end voltage - Power factors referred to respective load voltages - DC distributions: Distributor fed at one end - Distributor fed at both ends - Distributor fed at the centre - Ring distributor. - Techniques of Voltage Control: Excitation control - tap changing transformers - Power factor improvement: Static capacitors - Phase advancers. –Types of Substations – Case study – Commissioned substations of various voltage levels in Tamil Nadu.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Explain structure of electric power system & determine the transmission line parameters for various conductor configurations.

CO2 Analyze the performance of different types of transmission lines using suitable model.

CO3 Describe mechanical design of overhead transmission lines and insulators.

CO4 Explain construction of UG cables and determine the capacitance of difficult types of cables.

CO5 Outline AC / DC distribution systems, types of substations and various method of voltage control.

TEXT BOOKS:

1. Mehta, V.K. and Mehta, R., 2011. *Principles of power systems*, S. *Chand, New Delhi, India*.
2. Wadhwa, C.L., 2006. *Electrical power systems*. New Age International.

REFERENCES:

1. Singh, S.N., 2008. *Electric power generation: transmission and distribution*. PHI Learning Pvt. Ltd..
2. Faulkenberry, L.M., 1996. *Electrical power distribution and transmission*. Pearson Education India.
3. Ingole, A., 2017. *Power transmission and distribution*. Pearson Education India.
4. Bayliss, C.R., Bayliss, C. and Hardy, B., 2012. *Transmission and distribution electrical engineering*. Elsevier.
5. Ramamurthy, G., 2004. *Handbook of electrical power distribution*. Universities Press.
6. Gupta, B.R. and Chand, S., 2008. Power system analysis and design. *New Delhi*.

EE1306 **POWER PLANT ENGINEERING**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce students to different aspects of power plant engineering with real time scenario.
- To familiarize the students to the working of different conventional and non-conventional power plants based on different fuels.
- To illustrate the economics of power generation and energy based on tariff structures.

UNIT I INTRODUCTION 7

Energy and Power – Sources of Energy. Energy Scenario – National and Global. Types of Power plants. Selection and location of power plants. Introduction to Distributed generation – Energy self-sufficient home - Case studies. Energy self-sufficient villages – Odanthurai (TN), Dharnai (Bihar)

UNIT II THERMAL POWER PLANTS 10

Steam power plant – Rankine cycle, Layout of modern coal power plant, Components and working, Super Critical Boilers, FBC Boilers. Diesel power plant and Gas turbine power plant – Layout, components and working. Case Study - Tuticorin Thermal Power Station

UNIT III NUCLEAR POWER PLANTS 9

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants. Case Study - Koodankulam Nuclear Power Station

UNIT IV RENEWABLE ENERGY POWER PLANTS 10

Solar power plants – Photovoltaic and Thermal, Design of l kW and 1 MW solar plant. Wind power plants – Vertical and Horizontal axes Wind Turbines. Hydro Electric Power Plants – Classification, layout and selection of turbines. Pumped storage plants. Biomass power plants. Tidal and Ocean Thermal Energy plants. Geothermal plants. Fuel cell – Types. Hybrid power plants. Case Studies: Kamudi Solar Power Unit, Kayathar Wind Farm.

UNIT V ECONOMICS OF POWER GENERATION 9

Load and load duration curves. Types of consumers - Residential, Commercial and Industrial. Electricity billing – costing of electrical energy – Tariff structures – Peer to peer energy trading. Economics of power plant – Fixed and variable cost. Payback period. Net Present Value, Internal Rate of Return. Emission calculation and carbon credit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Prepare checklist to find the suitability of a power plant in a particular location

CO2 Explain the layout, construction and working of the components of Steam, diesel and gas turbine power plants

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Demonstrate the working of various Renewable energy based power plants.

CO5 Calculate the cost of power generation, electricity billing and rate of return on power plant investments

TEXT BOOKS

1. Nag, P.K., 2014. *Power plant Engineering*, 4th Edition, McGraw Hill.
2. Rai, G.D., 2017. *Non-conventional energy sources,*6th Edition, Khanna Publishers

REFERENCES:

1. Rai, G.D., 2015. *An Introduction to Power plant Technology*, 3rd Edition, Khanna Publishers
2. Paul Breeze, 2019. *Power Generation Technologies*, 3rd Edition, Elsevier.
3. Godfrey Boyle, 2009. *Renewable energy*, 2nd Edition, Oxford University Press.
4. Rajput, R.K., 2016. *A text book of Power Plant Engineering,* 5th Edition, Laxmi Publications.

EE1371 ELECTRONIC DEVICES AND CIRCUITS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To apply the characteristics of diodes in wave shaping circuits.
- To sketch the various characteristics of BJT, FET and thyristor.
- To compute the various parameters of CE,CB, CC amplifiers.
- To understand the various concepts involved in multistage and feedback amplifier
- To comprehend the operation of power amplifiers and oscillators circuits

UNIT I SEMICONDUCTOR DIODES AND ITS APPLICATIONS 9

PN junction diode –Structure, operation and V-I characteristics, diffusion and transition capacitance –Applications of PN diode –Switch, clipper, clamper & Rectifier– Zener Diode-Characteristics – as a voltage regulator-Introduction to special diodes: Schottky diode, Varactor diode, Tunnel diode.

UNIT II BJT AND POWER ELECTRONIC DEVICES 9

Different currents and their relations in BJT- CE, CB and CC configuration- Biasing- Fixed bias- Collector to Base bias and Voltage divider Bias- JFET & MOSFET Characteristics-Thyristors: Characteristics and applications of SCR, DIAC and TRIAC. UJT characteristics and application as relaxation oscillator.

UNIT III AMPLIFIERS 9

Equivalent hybrid model for BJT-BJT small signal model (exact and approximate) –Mid-band Analysis of CE, CB, CC amplifiers- Gain and frequency response – Design of single stage RC coupled amplifier using BJT –Small signal analysis CS and CD configuration of FET amplifier.

UNIT IV MULTISTAGE AND FEEDBACK AMPLIFIER 9

Multistage amplifier: Coupling schemes for cascading amplifier, General analysis of N-stage cascaded amplifier, Darlington pair, Cascade and Bootstrap amplifiers. Feedback amplifier: Advantages of negative feedback, Mixing and Sampling networks – Types and effects, Voltage-Series, Voltage-Shunt, Current-Series and Current-Shunt amplifier circuits. Introduction to Tuned Amplifiers

UNIT V OSCILLATORS AND POWER AMPLIFIERS 9

Oscillators: Classification, Condition for oscillation - RC oscillators: RC phase shift and Wien Bridge oscillators - Resonant frequency oscillators: Hartley, Colpitts and crystal oscillators. Power amplifiers: Class A, Class B and Class AB amplifiers, Efficiency - Distortion in power amplifiers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Explain the Structure, operation, characteristics and applications of PN junction diode and special diodes.

CO2 Describe the structure and characteristics of various types of transistors and thyristors.

CO3 Analyze the operation of simple amplifier circuits in CB, CC, CE, CS and CD configurations.

CO4 Elucidate the operation of various configurations of multistage and feedback amplifiers.

CO5 Comprehend the operation of various power amplifiers and oscillators circuits.

TEXT BOOKS:

1. Millman, J., 1979. *Microelectronics McGraw-Hill*. New York, p.5.
2. Bell, D.A., 2008. *Fundamentals of Electronic Devices and Circuits: Lab Manual*. Oxford university press.

REFERENCES:

1.Sedra, A.S. and Smith, K.C., 2015. *Microelectronic circuits* seventh edition..

2.Kumar, B. and Jain, S.B., 2007. *Electronic devices and circuits.* PHI Learning Pvt. Ltd...

3.Floyd, T.L. and Buchla, D.M., 2004. *Electric circuits fundamentals*. Pearson/Prentice Hall.

4.Neamen, D.A., 2001. *Electronic circuit analysis and design (Vol. 2).* New York, NY.: McGraw-Hill.

5.Boylestad, R.L., 2009. *Electronic devices and circuit theory*. Pearson Education India.

6.Northrop, R.B., 2003. *Analysis and application of analog electronic circuits to biomedical instrumentation*. CRC press.

EE1311 DC MACHINES AND TRANSFORMERS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To study the load characteristics of DC machines and transformers
- To determine the performance characteristics of DC machines and transformers using direct and indirect tests.
- To study the different speed control methods of DC shunt motor To study the need for starters in DC motors
- To study the various connections in three Phase transformers

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC shunt generator- critical resistance and critical speed.
2. Load characteristics of DC compound generator with differential and cumulative connections.
3. Load test on DC shunt motor.
4. Load test on DC compound motor.
5. Load test on DC series motor.
6. Swinburne's test and speed control of DC shunt motor.
7. Hopkinson's test on DC motor – generator set.
8. Load test on single-phase transformer and three phase transformers.
9. Open circuit and short circuit tests on single phase transformer.
10. Sumpner's test on single phase transformers.
11. Separation of no-load losses in single phase transformer.

12 Study of starters and 3-phase transformers connections.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to correlate the theory and practice and to

CO1 Obtain the steady state characteristics of various types of DC Machines and transformers by performing the load test.

CO2 Conduct various tests on DC machines and Transformers and Analyze its performance characteristics.

CO3 Apply the various speed control of DC shunt motor

CO4 Analyze various starters used in DC motors.

CO5 Analyze various types of connections in three phase transformers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. DC Shunt Motor with Loading Arrangement – 3 nos
2. DC Shunt Motor Coupled with Three phase Alternator – 1 No.
3. Single Phase Transformer – 4 nos
4. DC Series Motor with Loading Arrangement – 1 No.
5. DC compound Motor with Loading Arrangement – 1 No.
6. Three Phase Induction Motor with Loading Arrangement – 2 nos
7. Single Phase Induction Motor with Loading Arrangement – 1 No.
8. DC Shunt Motor Coupled With DC Compound Generator – 2 nos
9. DC Shunt Motor Coupled With DC Shunt Motor – 1 No.
10. Tachometer -Digital/Analog – 8 nos
11. Single Phase Auto Transformer – 2 nos
12. Three Phase Auto Transformer – 1 No.
13. Single Phase Resistive Loading Bank – 2 nos
14. Three Phase Resistive Loading Bank. – 2 nos

EE1316 ELECTRONIC DEVICES AND CIRCUITS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To understand the behavior of various semiconductor devices based on experimentation.

LIST OF EXPERIMENTS

1. Characteristics of PN junction diode.
2. Characteristics of a NPN Transistor under common emitter configuration
3. Characteristics of JFET.
4. Characteristics of UJT and generation of saw tooth waveforms.
5. Frequency response characteristics of a Common Emitter amplifier.
6. Characteristics of photo diode & photo transistor.
7. Design and testing of RC phase shift oscillator.
8. Single Phase half-wave and full wave rectifiers with inductive and capacitive filters.
9. Differential amplifiers using FET.
10. Study of CRO for frequency and phase measurements.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 To obtain the characteristics of various semiconductor devices such as PN junction diode, BJT,JFET & UJT.

CO2 To design rectifiers and voltage regulators for simple applications.

CO3 To demonstrate working of differential amplifier and oscillator.

REFERENCES:

1. Kumar, B. and Jain, S.B., 2007. *Electronic devices and circuits*. PHI Learning Pvt. Ltd...

2. Floyd, T.L. and Buchla, D.M., 2004. *Electric circuits fundamentals*. Pearson/Prentice Hall.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1	Semiconducter devices like Diode, Zener Diode, NPN Transistors, JFET, UJT, Photo diode, Photo Transistor	-
2	Resistors, Capacitors and inductors	-
3	Necessary digital IC 8	-
4	Function Generators	10
5	Regulated 3 output Power Supply 5, ± 15V	10
6	Storage Oscilloscope	1
7	CRO	10
8	Bread boards	10

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation –– taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1	Develop their communicative competence in English with specific reference to listening
CO2	Prepare conversation with reasonable accuracy
CO3	Apply lexical Chunking for accuracy in speaking
CO4	Demonstrate their ability to communicate effectively in GDs.
CO5	Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, M, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford, UK.: Oxford University Press.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now. Level 3,* Oxford, UK.: Oxford University Press.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford, UK.: Oxford University Press.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford, UK.: Oxford University Press.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford, UK.: Oxford University Press.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford, UK.: Oxford University Press.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1472 NUMERICAL METHODS AND PROBABILITY

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To make the students to understand the knowledge of various techniques of differentiation and integration.
- To evaluate the solution of differential equation with initial and boundary conditions.
- To introduce the basic concepts of probability and random variables.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations: Fixed point iteration method – Newton Raphson method – Solution of linear system of equations: Gauss elimination method – Pivoting – Gauss Jordan method – Inverse of a matrix by Jordan Method – Iterative methods of Gauss Jacobi and Gauss Seidel – Dominant Eigen value of a matrix by Power method
.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Difference operators and relations –Interpolation with equal intervals: Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials – Numerical integration : Trapezoidal rule– Simpson's 1/3 rule – Simpson's 3/8 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL AND BOUNDARY VALUE PROBLEMS FOR DIFFERENTIAL EQUATIONS 12

Initial value problem: Taylors, Euler, Modified Euler and Fourth order Runge - Kutta method for solving first order equation. Boundary value problem: Finite difference method for linear differential equations – Laplace equations – One dimensional heat flow equation by implicit and explicit method – One dimensional wave equation by explicit method

UNIT V PROBABILITY AND RANDOM VARIABLE 12

Probability - The axioms of probability - Conditional probability - Baye's theorem - Discrete and continuous random variables - Moments - Moment generating functions – Distributions; Binomial, Poisson, Uniform, Exponential and Normal.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO.1 Compute numerical solutions to system of linear equations, algebraic, transcendental equations and Eigen value problems.

CO.2 Construct approximate polynomial to represent the data and find the intermediate values of unknown function using interpolation.

CO.3 Apply numerical methods to find the values of differentiation and integration.

CO.4 Solve the initial and boundary value problem numerically.

CO.5 Apply the concepts of probability distributions to solve engineering problems.

TEXT BOOKS:

1. Grewal, B.S. and Grewal. JS, 1996. *Numerical methods in Engineering and Science*. Khanna Publishers.
2. Milton, J.S. and Arnold, J.C., 1990. *Introduction to probability and statistics (Vol. 4).* New York: McGraw-Hill.

REFERENCES:

1. Rao, K.S., 2017. *Numerical methods for scientists and engineers*. PHI Learning Pvt. Ltd..
2. GUNAVATHI, K., 2008. *Numerical Methods Vol-IV (Tamil Nadu).* S. Chand Publishing.
3. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., 2007. *Probability and Statistics for Engineers and Scientists:* Pearson Prentice Hall. Upper Saddle River, USA.
4. Lipschutz, S. and Schiller, J., 1998. *Introduction to Probability and Statistics*, Schaum's Outline Series.
5. Gupta, S.C. and Kapoor, V.K., 2020. *Fundamentals of mathematical statistics*. Sultan Chand & Sons.

WEB REFERENCES:

1 https://fac.ksu.edu.sa/sites/default/files/numerical_analysis_9th.pdf
2 http://www.elcom-hu.com/Mshtrk/Statstics/9th%20txt%20book.pdf
3 https://cds.cern.ch/record/644736/files/3764367156_TOC.pdf

IT1471 OBJECT ORIENTED PROGRAMMING USING JAVA
(Theory cum Laboratory)

L	T	P	C
3	0	2	4

PRE-REQUISITE:

1. Fundamentals of Computing and Programming

OBJECTIVES:

- Build software development skills using JAVA programming for real world applications
- Understand and apply the OOPs features like Arrays, Strings and Packages
- Use of inheritance and inner class to develop JAVA applications
- Develop JAVA applications using Exceptions, Generic Programming and Multithreading
- Apply the concepts of I/O streams and Event driven Programming

UNIT 1 FUNDAMENTALS OF JAVA AND OBJECT ORIENTED PROGRAMMING
11 + 4 = 15

THEORY COMPONENT:

JAVA as a Programming Platform – JAVA Buzzwords – History of JAVA–Introduction to Object Oriented Programming – Using Predefined Classes – Defining Your Own Classes - Static Fields and Methods – Method Parameters - A Simple JAVA Program – Comments – Data Types – Variables and Constants – Operators- Input and Output

LAB COMPONENT:

Implementation of the following problems using JAVA

1. **Using Predefined Classes of JAVA**
   a. Write a JAVA Program to add two big integer numbers using BigInteger class
   b. Write a JAVA Program to display the calendar of the given month using LocalDate class

2. **Defining Your Own Classes for Simple JAVA Programs**
    a. Implement a JAVA program to find the area of rectangle and circle
    Implement a JAVA Program to find the sum and average of three numbers

UNIT 2 BASIC CHARACTERISTICS OF OBJECT ORIENTED PROGRAMMING

THEORY COMPONENT: 8 + 12 = 20

Control Flow - Object Construction- Packages-Documentation Comments- Arrays-Strings

LAB COMPONENT:

Implementation of the following problems using JAVA

1. **Control Flow - Conditional Statements and Multiple Selection Statements**

a. Prepare Electricity bill using JAVA. Create a class with the following member: Consumer number, Consumer name, previous month reading, current month reading and type of EB connection.

Calculate the domestic connection bill amount using the following tariff:

First 100 units – Rs. 1.50
per unit 101-200 units –
Rs. 3 per unit 201- 500
units – Rs. 4.50 per unit
>501 units – Rs. 7 per unit

Calculate the commercial connection bill amount using the following tariff:

First 100 units – Rs. 2.50
per unit 101-200 units –
Rs. 5 per unit 201- 500
units – Rs. 6.50 per unit
>501 units – Rs. 9 per unit

Control Flow – Looping Statements

a. Write a JAVA program to check whether the given number is Armstrong or not
b. Write a JAVA program to find the factorial of a given number

2. **Object Construction**

a. Develop a JAVA program to define a class called Account which contains two private data elements, an integer account number and a floating point account balance, and three methods:

A constructor that allows the user to set initial values for account number and account balance and a default constructor that prompts for the input of the values for the above data members.

A method which reads a character value for transaction type (D for deposit and W for withdrawal), and a floating point value for transaction amount, and updates account balance.

A method, which prints on the screen the account number and account balance.

3. Packages

a. Develop a JAVA application using packages to implement the following currency converter Dollar to Indian Rupees, Euro to Indian Rupees

4. Arrays

a. Develop a JAVA program to find the largest and smallest number in an array
b. Develop a JAVA program to perform matrix multiplication

5. Strings

a. Write a JAVA program to check whether the given string is a palindrome or not.

Control Flow – Looping Statements

a. Write a JAVA program to check whether the given number is Armstrong or not
b. Write a JAVA program to find the factorial of a given number

6. Object Construction

a. Develop a JAVA program to define a class called Account which contains two private data elements, an integer account number and a floating point account balance, and three methods:

A constructor that allows the user to set initial values for account number and account balance and a default constructor that prompts for the input of the values for the above data members.

A method which reads a character value for transaction type (D for deposit and W for withdrawal), and a floating point value for transaction amount, and updates account balance.

A method, which prints on the screen the account number and account balance.

7. **Packages**

   a. Develop a JAVA application using packages to implement the following currency converter Dollar to Indian Rupees, Euro to Indian Rupees

8. **Arrays**

   a. Develop a JAVA program to find the largest and smallest number in an array
   b. Develop a JAVA program to perform matrix multiplication

9. **Strings**

   a. Write a JAVA program to check whether the given string is a palindrome or not.

UNIT 3 INHERITANCE AND INTERFACES 9 + 6 = 15

THEORY COMPONENT:

Classes, Super classes and Sub classes – The Cosmic Super class – Generic Array

Lists – Object Wrappers and Autoboxing – Interfaces - Inner classes

LAB COMPONENT:

Implementation of the following problems using JAVA

10. **Inheritance**

    a. Use the abstract class Shape that include two integers and an empty method named printArea(). Construct the classes Rectangle, Triangle and Circle inherited from the class Shape. The Derived classes should include only the method printArea() that print the area of the given shape.

11. **Generic Array Lists**

    a. Write a JAVA program to perform string operations using ArrayList. Write functions for the following
       i) Append – add at end
       ii) Insert – add at particular index
       iii) List all string starts with given letter

12. **Interfaces and Inner Classes**

    a. Write a JAVA program with a class named as “circle” that implements an interface named as “circleinterface” and define the methods named as “area” and “circum” in the class to find the area and circumference of the circle.

b. Write a JAVA program to perform subtraction of two numbers using inner class

UNIT 4 EXCEPTION AND MULTITHREADING 8 + 4 = 12

THEORY COMPONENT:

Dealing with Errors – Catching Exceptions – Using Exceptions – Why Generic Programming? – Defining a Simple Generic Class – Generic Methods – Bounds for Type Variables – What are Threads? – Thread States – Thread Properties – Synchronization

LAB COMPONENT:

Implementation of the following problems using JAVA

13. Exception and Generic Programming

a. Implement the exception handling for dividing two numbers
b. Create a JAVA program that finds the maximum value based on the given type of elements using generic functions in java.

14. Multithreading

a. Write a JAVA program that implements a multi-threaded application that has three threads.
First thread generates a random integer every 1 second.
If the value is even, second thread computes the square of the number.
If the value is odd, the third thread will print the value of cube of the number.

UNIT 5 STREAMS AND EVENT DRIVEN PROGRAMMING 9 + 4 = 13

THEORY COMPONENT:

Byte Stream – Character Stream – Reading and Writing from console and files – Swing and the MVC design pattern - **Components:** Text field, Input, Choice, Text Area, Buttons, **Layout Management:** Border layout – **Listener:** ActionListener.

LAB COMPONENT:

Implementation of the following problems using JAVA

15. Streams

a. Create a JAVA program to write a student profile into a file and read the contents from the file and display it on the screen.

16. User Interface Components with Swing

a. Create a JAVA GUI application to convert miles to kilometres when pressing the “Convert!” button. Note that you need to implement the ActionListener interface and override the actionPerformed() method. Note that 1 mile is equal to 1.609 kilometres.

TOTAL: 45 + 30 = 75 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course the students should be able to

CO1 Develop JAVA applications using Sequence statements

CO2 Apply the basic features of Object Oriented Programming to give solutions to simple JAVA applications

CO3 Build a JAVA application using Inheritance and Interface

CO4 Utilize the concept of Exception, Generic Programming and Multithreaded Programming of JAVA for developing console basedapplications

CO5 Design graphics-based JAVA applications using files and Event driven Programming

TEXT BOOK:

1. Cay, S., 2016. *Core Java-Volume I: Fundamentals*. Prentice Hall.

REFERENCES:

1. Schildt, H. and Coward, D., 2014. *Java: the complete reference* (p. 1312). New York: McGraw-Hill Education.
2. Deitel, P.J. and Deitel, H.M., 2014. *Java SE 8 for programmers*. Pearson Education.
3. Deitel, P.J., 2002. *Java how to program*. Pearson Education India.

SOFTWARE SPECIFICATIONS:

1. JDK8
2. Eclipse / Netbeans

EE1401 **AC MACHINES**

L	T	P	C
3	1	0	4

OBJECTIVES:

To impart knowledge on the following Topics

- Construction and performance of salient and non – salient type synchronous generators.
- Principle of operation and performance of synchronous motor.
- Construction, principle of operation and performance of induction machines.
- Starting and speed control of three-phase induction motors.
- Construction, principle of operation and performance of single-phase induction motors and special machines.

UNIT I SYNCHRONOUS GENERATOR 12

Constructional details – Types of rotors –winding factors- emf equation – Synchronous reactance – Armature reaction – Phasor diagrams of non-salient pole synchronous generator connected to infinite bus--Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input- Voltage regulation – EMF, MMF, ZPF and ASA methods – steady state power- angle characteristics– Two reaction theory –slip test -short circuit transients - Capability Curves

UNIT II SYNCHRONOUS MOTOR 12

Principle of operation – Torque equation – Operation on infinite bus bars - V and Inverted V curves – Power input and power developed equations – Starting methods – Current loci for constant power input, constant excitation and constant power developed-Hunting – natural frequency of oscillations – damper windings- synchronous condenser.

UNIT III THREE PHASE INDUCTION MOTOR 12

Constructional details – Types of rotors –- Principle of operation – Slip –cogging and crawling- Equivalent circuit – Torque-Slip characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests - Circle diagram – Separation of losses – Double cage induction motors –Induction generators – Synchronous induction motor.

UNIT IV STARTING AND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR 12

Need for starting – Types of starters – DOL, Rotor resistance, Autotransformer and Star-delta starters – Speed control – Voltage control, Frequency control and V/f control – Slip power recovery scheme-Braking of three-phase induction motor: Plugging, dynamic braking and regenerative braking.

UNIT V SINGLE PHASE INDUCTION MOTORS AND SPECIAL MACHINES 12

Constructional details of single-phase induction motor – Double field revolving theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors – Capacitor-start capacitor run Induction motor- Construction and working principle of: Shaded pole induction motor - Linear induction motor – AC series motor - Stepper motors.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Describe the construction, working principle and performance characteristics of Synchronous Machines.

CO2 Explain principle of operation, characteristics and starting methods of Synchronous motor.

CO3 Illustrate the construction, working, characteristics and various testing methods of three phase Induction motor.

CO4 Differentiate between different types of starting and speed control methods in three-phase Induction motor

CO5 Discuss on the construction and working principle of Single-phase Induction motor and Special Machines.

TEXT BOOK:

1. D.P. Kothari and I.J. Nagrath, 2018. *'Electric Machines'*, 5thEdition, McGraw Hill.

REFERENCES:

1. P.S. Bhimbhra, 2003. *'Electrical Machinery'*, Khanna Publishers.
2. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 2003. *'Electric Machinery'*,

Mc Graw Hill.

3. Vincent Del Toro, 2016. *'Basic Electric Machines'* Pearson India Education.
4. Stephen J. Chapman, 2010. *'Electric Machinery Fundamentals',* 4th Edition, McGraw Hill.

EE1402 LINEAR AND DIGITAL INTEGRATED CIRCUITS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To describe the IC fabrication procedure.
- To analyze circuit characteristics with signal analysis using OP-AMP ICs.
- To design and construct application circuits with ICs such as OP-AMP, 555,565 etc.
- To introduce the fundamentals of digital circuits for the design of combinational logic circuits (Number systems, Boolean algebra).
- To analyze and design synchronous and asynchronous sequential circuits

UNIT I IC FABRICATION 9

IC classification, fundamentals of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realization of monolithic ICs and packaging Fabrication of diodes, capacitance and resistance

UNIT II INTRODUCTION OF OP-AMP & ITS CHARACTERISTICS 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of OP-AMP – summer, differentiator and integrator

UNIT III APPLICATIONS OF OPAMP& SPECIAL IC'S 9

Instrumentation amplifier, first and second order active filters, V/I & I/V converters, comparators, multivibrators, waveform generators, clippers, clampers, peak detector, S/H circuit-555 Timer circuit – Functional block, characteristics & applications; 566-voltage controlled oscillator circuit; 565-phase locked loop circuit functioning and applications.

UNIT IV NUMBER SYSTEMS , BOOLEAN ALGEBRA & DESIGN OF COMBINATIONAL LOGIC CIRCUITS USING GATES 9

Number system, error detection, corrections & codes conversions, Boolean algebra: De-Morgan's theorem, switching functions and minimization using K-maps & Quine McCluskey method Design of adder, subtractor, comparators, code converters, encoders, decoders, multiplexers and demultiplexers.

UNIT V DESIGN AND ANALYSIS OF SYNCHRONOUS & A SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Flip flops - SR, D, JK and T, shift registers, counters, state assignments analysis and design of synchronous sequential circuits, state diagram; state reduction Latches - SR - D , Asynchronous sequential logic circuits-Transition table, flow table – race conditions – circuits with latches, analysis of asynchronous sequential logic circuits – introduction to design – implication table

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 To describe and examine the various IC fabrication procedure

CO2 To discuss the DC& AC characteristics and basic applications of OP-AMP

CO3 To discuss the various applications of OP-AMP and special IC's such as 555, 565 and 566

CO4 To examine the structure of various number systems, Boolean algebra and design of combinational logic circuits

CO5 To design and analyze synchronous and asynchronous sequential circuits

TEXT BOOKS:

1. D. Roy Choudhery, Sheil B. Jain, *Linear Integrated Circuits*, second edition, New Age publishers, 2010.
2. Morris Mano.M, '*Digital Logic and Computer Design*', Prentice Hall of India, 3rd Edition, 2005.

EE1403 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

To impart knowledge on

- Basic functional elements of Measurement & Instrumentation
- Fundamentals of electrical instruments used for measuring Electrical Quantities
- Fundamentals of Electronic Instruments & Measurement of Magnetic Parameters
- Comparative methods for measurement of Resistance, Inductance & Capacitance
- Various transducers and the data acquisition systems.

UNIT I INTRODUCTION 9

Functional elements of a generalized instrument – Static and dynamic characteristics – Errors in measurement – Statistical estimation of measurements data: Arithmetic mean, Average deviation, Standard deviation, Variance and Probable error of mean – Standards and calibration

UNIT II ELECTRICAL MEASURING INSTRUMENTS 9

Principle and types of analog and digital voltmeters – Moving Iron & Moving Coil Instruments – Torque Equation, Range Extension of Ammeters and Voltmeters, Principle of multi meters, Electro Dynamometer Meters – Single and three phase watt meters and energy meters, Construction, working principle of Instrument transformers

UNIT III MAGNETIC MEASUREMENT & ELECTRONIC INSTRUMENTS 9

Magnetic measurements – Determination of B-H curve and measurements of iron loss. Magnetic disk – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Data Loggers.

UNIT IV COMPARATIVE METHODS OF MEASUREMENTS 9

D.C potentiometers, D.C (Wheat stone, Kelvin and Kelvin Double bridge) & A.C bridges (Maxwell, Anderson and Schering bridges), transformer ratio bridges, self-balancing bridges. Interference & screening – Multiple earth and earth loops - Electrostatic and electromagnetic Interference – Grounding techniques.

UNIT V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive, capacitive & inductive Transducers – Piezoelectric, Hall effect, optical and digital transducers – Elements of data acquisition system – Smart sensors-Thermal Imagers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Calibrate the parameter of a measuring instruments and interpret the measurement data

CO2 Measure the Electrical Parameters using appropriate Electrical measuring Instruments

CO3 Choose a specific Electronic Instrument based on needs and Measure Magnetic parameters

CO4 Apply comparative methods for measurement of resistance, inductance and capacitance

CO5 Select a transducer for measuring electrical and non-electrical quantities.

TEXT BOOKS

1. Sawhney, A.K. and Sawhney, P., 2016. *A course in Electrical and Electronic Measurements and Instrumentation*. Dhanpat Rai & Company.
2. Doebelin, E.O. and Manik, D.N., 2007. *Measurement systems: application and design*

REFERENCES:

1. Gupta, B.J., 2008. *A Course In Electronics & Electrical Measurements And Instrumentation.* SK Kataria and Sons.
2. Purkait, P., 2013. *Electrical and electronics measurements and instrumentation*. McGraw- Hill Education.

L	T	P	C
0	0	4	2

EE1411 **AC MACHINES LABORATORY**

OBJECTIVES:

To impart knowledge on

- determining regulation of synchronous machines
- analyzing performance characteristics of synchronous & induction machines
- predetermination of the performance characteristics of induction machines

PRACTICAL EXPERIMENTS:

1. Regulation of three-phase alternator by EMF and MMF methods.
2. Regulation of three-phase alternator by ZPF and ASA methods
3. Regulation of three-phase salient pole alternator by Slip test
4. Load test on three-phase alternator (with resistive, inductive and capacitive loads)
5. V and Inverted V curves of three-phase Synchronous Motor
6. Load test on three-phase squirrel cage induction motor
7. Load test on three-phase slip ring induction motor
8. Predetermination of performance characteristics of three-phase induction motor by circle diagram and equivalent circuit.
9. Separation of No-load losses of three-phase induction motor
10. Load test on single-phase induction motor
11. Equivalent circuit of single-phase induction motor.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Obtain performance characteristics on AC generators and motors by performing load test.

CO2 Demonstrate methods/techniques used for the determination of regulation of alternators

CO3 Predetermine the performance characteristics of induction machines

REFERENCES:

1. D.P. Kothari and I.J. Nagrath, 2018. *'Electric Machines'*, 5thEdition, McGraw Hill.
2. P.S. Bhimbhra, 2003. *'Electrical Machinery'*, Khanna Publishers.
3. A.E. Fitzgerald, Charles Kingsley, Stephen. D. Umans, 2003. *'Electric Machinery'*, Mc Graw Hill.
4. Vincent Del Toro, 2016. *'Basic Electric Machines'* Pearson India Education.
5. Stephen J. Chapman, 2010. *'Electric Machinery Fundamentals',* 4th Edition, McGraw Hill.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Name of the Equipment	Quantity Required
1.	Synchronous Induction motor 3HP	1
2.	DC Shunt Motor Coupled with Three-phase Alternator	4
3.	DC Shunt Motor Coupled with Three-phase Slip ring Induction motor	1
4.	Three Phase Induction Motor with Loading Arrangement	2
5.	Single-Phase Induction Motor with Loading Arrangement	2
6.	Tachometer -Digital/Analog	8
7.	BLDC Motor	1
8	Single Phase Auto Transformer	2
9	Three Phase Auto Transformer	3
10	Single-Phase Resistive Loading Bank	2
11	Three-Phase Resistive Loading Bank	2
12	Capacitor Bank	1
13	SPST switch	2

EE1481	LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

After the Completion of the course the students will be able

- To analyze circuit characteristics with signal analysis using an Operational Amplifier
- To design and construct application circuits with ICs as 555, etc.
- To design combinational logic circuits using digital IC's

Experiments using Linear Integrated Circuits (ICs) Analog circuits:

1. Design and Implementation of various circuits using OP-AMP – Inverting, Non- inverting, Adder, Subtractor & Comparator.
2. Design and Implementation of Integrator and Differentiator circuit
3. Design and Implementation of OP-AMP based Clamper circuit/ clipper circuits.
4. Design and Implementation of Astable multi-vibrator using 555 – Timer IC
5. Study of Voltage Controlled Oscillator to generate waveforms (Sine, triangular and square wave)

Digital Circuits

6. Implementation of Boolean Functions using logic gates and Karnaugh Map
7. Design and Implementation of Adder, Subtractor, Parity Checker and code converter using basic logic gates and special IC's
8. Design and Implementation of MUX, DEMUX, Encoder and Decoder using special IC's
9. Design of Synchronous and Asynchronous counter using Flip flops and special IC's
10. Design of Shift registers using Flip flops.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Design and demonstrate analog electronic circuits using OP-AMP

CO2 Design and demonstrate analog electronic circuits using timer 555.

CO3 Design and demonstrate digital circuits involving Boolean functions using basic logic gates.

CO4 Design and demonstrate combinational circuits such as adder, subtractor, code converters, encoders and decoders.

CO5 Design and demonstrate sequential logic circuits such as Flip-Flops, Counters (synchronous and asynchronous), and Shift Registers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S.No	Name of the Equipment's	Quantity Required	Remarks
1.	Dual ,(0-30V) variability Power Supply	10	
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	Function Generator	8	1 MHz
5.	IC Tester (Analog	2	
6.	Bread board	10	
7.	Computer (PSPICE installed)	1	
Consumable's (sufficient quantity)			
IC 741/ IC NE555/566/565			
Digital IC types			
LED			
LM317			
LM723			
ICSG3524 / SG3525			
Transistor – 2N3391			
Diodes, IN4001,BY126			
Zener diodes			
Potentiometer			
Step-down transformer 230V/12-0-12V			
Capacitor			

Resistors 1/4 Watt Assorted
Single Strand Wire

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1	Understand how the text positions the reader
CO2	Develop critical thinking while reading a text
CO3	Develop a descriptive paragraph
CO4	Make use of sentence structures effectively when creating an essay.
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCES:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E. ELECTRONICS AND INSTRUMENTATION ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

Vision of the Department:

To develop competent Electronics and Instrumentation Engineers with Societal, Environmental and Human Values through Quality Education, Training and Research

Mission of the Department:

Department of Electronics and Instrumentation Engineering is committed to

1. Impart technical knowledge and skills to meet the industry needs .
2. Build self-learning capability among the students to update the recent technology.
3. Tie up with the industries and research institution.
4. Create passion for serving the society with moral and ethical values.

Program Educational Objectives (PEOs):

Graduates of the programme will be able to

PEO 1:

Work in the Design, Automation, Testing and Software Industries.

PEO 2:

Pursue higher studies and research in the field of Process Control, Biomedical, Robotics & Automation and Renewable Energy Resources.

PEO 3:

Be an Entrepreneur by building leadership quality and teamwork.

PROGRAM OUTCOMES:

After going through the four years of study, the Electronics and Instrumentation Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Program Specific Outcomes (PSOs):

PSO 1: Design and develop mathematical model for transducer, process control system.

PSO 2: Select and use appropriate hardware circuit and software tools to control industrial and automation process

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B.E.ELECTRONICS AND INSTRUMENTATION ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1372	Transforms and Linear Algebra	FC	3	1	0	4	4
2	EE1371	Electronic Devices and Circuits	PC	3	0	0	3	3
3	EI1301	Digital Logic Circuits	PC	3	0	0	3	3
4	EI1302	Electrical Machines	PC	3	0	0	3	3
5	EI1303	Sensors and Transducers	PC	3	0	0	3	3
PRACTICALS								
6	EI1311	Devices and Machines Laboratory	PC	0	0	4	4	2
7	EI1312	Sensors and Transducers Laboratory	PC	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**21**

SEMESTER IV

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1472	Numerical Methods and Probability	FC	3	1	0	4	4
2	IT1471	Object Oriented Programming using JAVA (Theory Cum Lab)	FC	3	0	2	5	4
3	EI1401	Electrical and Electronics Measurements	PC	3	0	0	3	3
4	EI1402	Industrial Instrumentation	PC	3	0	0	3	3
5	EI1403	Linear Integrated Circuits and its Applications	PC	3	0	0	3	3
PRACTICALS								
6	EI1411	Industrial Instrumentation Laboratory	PC	0	0	4	4	2
7	EE1481	Linear and Digital Integrated Circuits Laboratory	PC	0	0	4	4	2
8	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**2**	**10**	**30**	**22**

SEMESTER III

MA1372 TRANSFORMS AND LINEAR ALGEBRA

L	T	P	C
3	1	0	4

OBJECTIVES:

- To acquaint the students with Fourier transform and Z-transform techniques.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To make them understand the concepts of vector space, linear transformations and diagonalization
- To introduce the concept of inner product spaces in orthogonalization.

UNIT I FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT II Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

UNIT III VECTOR SPACES 12

Vector spaces –Subspaces – Linear combinations of vectors-Linear Span – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 12

Linear transformation – Null space and range space – Dimension theorem – Matrix representation of a linear transformation – Eigen values and eigenvectors – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT V INNER PRODUCT SPACES 12

Inner products spaces – Orthogonal vectors- Gram Schmidt orthogonalization process - Orthogonal complement – Least square approximation - Minimal solution to system of linear equations

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing the course the students will be able to

CO1 Compute the Fourier transforms of standard functions and learn the properties.

CO2 Apply the techniques of Z- transform to get the solutions of difference equations.

CO3 Test the given system of equation is linearly dependent or independent.

CO4 Apply the concept of eigen values and eigenvectors for diagonalization of a matrix.

CO5 Calculate the orthonormal vector and minimal solution to system of linear equation using inner product techniques.

TEXT BOOKS:

1. Erwin kreyszig, 2015. *Advanced Engineering Mathematics*, John Wiley & Sons, 10th Edition, New Delhi.
2. Grewal B,S, 2017. *Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, New Delhi.
3. Friedberg, A.H., Insel, A.J. &Spence L,2004.,*Linear Algebra*, Prentice Hall of India, New Delhi.

REFERENCE BOOKS:

1. Bali, N, Goyal, M,& Watkins C, 2009*, Advanced Engineering Mathematics,* Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.
2. Glyn James, 2011, *Advanced Modern Engineering Mathematics*, Pearson Education, 4th Edition, New Delhi.
3. Peter V, O'Neil, 2012, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi.
4. Ramana, 2010, B,V*, Higher Engineering Mathematics*, Tata McGraw Hill, 11th Reprint, New Delhi
5. Kumaresan, S.,2010, *Linear Algebra ,A Geometric Approach*, Prentice , Hall of India, New Delhi, Reprint.

EE1371	ELECTRONIC DEVICES AND CIRCUITS (Common to EEE & EIE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the characteristics of diodes in wave shaping circuits.
- To sketch the various characteristics of BJT, FET and thyristor.
- To compute the various parameters of CE, CB, CC amplifiers.
- To understand the various concepts involved in multistage and feedback amplifier
- To comprehend the operation of power amplifiers and oscillators circuits

UNIT I SEMICONDUCTOR DIODES AND ITS APPLICATIONS 9

PN junction diode –Structure, operation and V-I characteristics, diffusion and transition capacitance – Applications of PN junction diode – Switch, clipper, clamper & Rectifier-halfwave, full wave, bridge Rectifier– Zener Diode- Characteristics – as a voltage regulator. Introduction to Special diodes- Schottky diode, Varactor Doide, Tunnel Diode.

UNIT II BJT AND POWER ELECTRONIC DEVICES 9

Different currents and their relations in BJT- CE, CB and CC configuration- Biasing - Fixed bias- Collector to Base bias and Voltage divider Bias - JFET & MOSFET Characteristics - Thyristors: Characteristics and applications of SCR, DIAC and TRIAC - UJT characteristics and application as relaxation oscillator.

UNIT III AMPLIFIERS 9

Equivalent hybrid model for BJT-BJT small signal model (exact model and approximate model) – Mid-band Analysis of CE, CB, CC amplifiers- Gain and frequency response – Design of Single Stage RC coupled amplifier using BJT- Small signal analysis - CS and CD configuration of FET amplifiers.

UNIT IV MULTISTAGE AND FEEDBACK AMPLIFIER 9

Multistage amplifier: Coupling schemes for cascading amplifier, General analysis of N-stage cascaded amplifier, Darlington pair, Cascade and Bootstrap amplifiers.
Feedback amplifier: Advantages of negative feedback, Mixing and Sampling networks – Types and effects, Voltage-Series, Voltage-Shunt, Current-Series and Current-Shunt amplifier circuits. Introduction to Tuned amplifiers

UNITV OSCILLATORS AND POWER AMPLIFIERS 9

Oscillators: Classification, Condition for oscillation - RC oscillators: RC phase shift and Wien Bridge oscillators - Resonant frequency oscillators: Hartley, Colpitts and Crystal oscillators. Power amplifiers: Class A, Class B, and Class AB amplifiers, Efficiency - Distortion in power amplifiers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1	Explain the structure, operation, characteristics and applications of PN junction a diode special diodes
CO2	Describe the structure and characteristics of various types of transistors and thyristors.
CO3	Analyze the operation of amplifier circuits in CB, CC, CE, CS and CD configurations
CO4	Elucidate the operation of various configurations of multistage and feedback amplifiers.
CO5	Comprehend the operation of various power amplifiers and oscillators circuits.

TEXT BOOKS:

1. Jacob Millman 2009. *Microelectronics*, McGrawhill, 22nd reprint.
2. David, A, Bell 2009. *Fundamentals of Electronic devices and circuits* , Oxford University higher education, 6th edition

REFERENCE BOOKS:

1. Sedra & Smith 2015. *Microelectronic circuits*, Oxford University Press, 7th Edition.
2. Balbir Kumar & Shai,.B,Jain 2014. *Electronic devices and circuits,* PHI learning private limited, 2nd edition.
3. Thomas,L,Floyd 2017. *Electronic devices*, Pearson prentice hall, 10th Edition.
4. Donald,A,Neamen 2003. *Electronic Circuit Analysis and Design*, Tata McGraw Hill, 3rd Edition.
5. Robert,L,Boylestad 2009. *Electronic devices and circuit theory*, Pearson Education, 10th edition.
6. Robert,B, Northrop 2004. *Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation*, CRC Press.

EI1301 **DIGITAL LOGIC CIRCUITS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To review the concept of number system and logic families
- To design the combinational and sequential logic circuits

UNIT I REVIEW OF NUMBER SYSTEM AND LOGIC FAMILIES 7

Review of number systems and conversions-binary, octal, decimal, hexa-decimal and others, Review of codes and conversions-binary, BCD, Gray, Excess-3,bi-quinary code, error detecting and error checking . Digital Logic Families – Introduction to RTL, DTL, TTL, ECL and MOS families – wired and operation, characteristics of digital logic family – comparison of different logic families

UNIT II SIMPLIFICATION OF BOOLEAN THEOREM 7

Introduction to gates-Switching function-Boolean theorems- Simplification using Boolean Algebra- Representation of SOP & POS- Karnaugh map (up-to 6 variables)- Quine Mc-Cluskey method to simplify Boolean functions. Introduction to VHDL.

UNIT III COMBINATIONAL LOGIC CIRCUIT 12

Adder & Subtractor- Half, Full, 4 bit parallel and series adder/subtractor- Carry look ahead adder-BCD adder-Multiplexer, Demultiplexer, Encoder and Decoder- VHDL coding for combinational circuits.

UNIT IV SYNCHRONOUS SEQUENTIAL CIRCUIT 12

Flipflop & Latches-RS, JK, D and T flip flop- Master-Slave flip flop-Conversions- Design of Synchronous and Asynchronous counters- up ,down, up-down-mod-Ring and Johnson counter-Shift register- VHDL coding for synchronous sequential circuit.

UNIT V ASYNCHRONOUS SEQUENTIAL CIRCUIT AND PLD 7

Asynchronous sequential logic circuits-Transition table, flow table – race conditions – circuits with latches, analysis of asynchronous sequential logic circuits – introduction to design –implication table- hazards-programmable logic array and devices.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the learner will be able to:

CO1	Interpret, convert and represent different number systems
CO2	Manipulate and examine Boolean algebra, logic operations, Boolean functions and their simplification
CO3	Analyze the different combinational circuits
CO4	Design synchronous sequential circuits
CO5	Describe the concept of asynchronous sequential circuits and PLDs

TEXT BOOKS:

1. James, W, Bignel 2007. *Digital Electronics*, Cengage learning, 5th Edition.
2. Morris Mano,M, 2013. *Digital Design with an introduction to the VHDL*, Pearson Education.
3. Mandal 2013. *Digital Electronics Principles & Application*, McGraw Hill Education.

REFERENCE BOOKS:

1. Kothari,D.P., & Dhillon,J.S., 2016. *Digital circuits and Design*, Pearson Education.
2. Comer, 2012. *Digital Logic & State Machine Design*, Oxford Press.
3. William Keitz, 2013. *Digital Electronics-A Practical Approach with VHDL*, Pearson Education.
4. Thomas, L,Floyd 2015. *Digital Fundamentals*, Pearson Education ,11th edition.
5. Charles, H,.Roth, Jr, Lizy & Kurian John, 2013. *Digital System Design using VHDL*, Cengage.
6. Donald, P, Leach, Albert Paul Malvino & Goutam Sha, 2010. *Digital Principles and Applications*, The McGraw Hill, 7th edition.

EI1302 **ELECTRICAL MACHINES**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart basic knowledge on different AC & DC Machines.
- To introduce the concept of special machines to motivate the students to solve complex problems related to machines.
- To impart knowledge on testing and controlling of different machines.
- Make the students familiar with the testing and controlling of different machines

UNIT I TRANSFORMERS 9

Principle, Construction and Types of Transformer - EMF equation - Phasor diagrams - Regulation and efficiency of a transformer - Introduction to three phase transformer Connection. Applications of Current and Potential Transformer - Autotransformer

UNIT II DC MACHINES 9

D.C. Machines: – Principle of operation and construction of motor and generator – torque equation – Various excitation schemes – Characteristics of Motor and Generator – Starting, Speed control of D.C. Motor.

UNIT III SINGLE PHASE & THREE PHASE INDUCTION MOTOR 9

Types of single phase induction motors –Double field revolving theory- Capacitor start capacitor run motors – Shaded pole motor – Repulsion type motor - Three phase Induction motor-Construction - principle of operation - Equivalent Circuit- Types - Torque-slip characteristics - Starting methods and Speed control of induction motors.

UNIT IV SYNCHRONOUS MACHINES 9

Principle of operation, type - EMF Equation and Phasor diagrams - Synchronous motor- Rotating Magnetic field Starting Methods , Torque V- Curves, inverted – V curves – Hunting

UNITV SPECIAL MACHINES 9

Universal motor – Hysteresis motor – Switched reluctance motor – Brushless D.C motor.- Permanent magnet synchronous motor - Stepper motor

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the learner will be able to:

CO1	To understand basic concepts and working principle of electrical machines
CO2	To understand the performance characteristics of machines
CO3	To identify suitable machines for carrying out interdisciplinary projects
CO4	To apply the knowledge on various machines to choose appropriate machines for specific application useful for society.
CO5	To understand the working principle of new machines and to learn their concepts.

TEXT BOOKS:

1. Fitzgerald,A.E., Kingsley C., Umans, S. & Umans S.D., 2003. *Electric Machinery,* McGraw-Hill, 6th Edition, Singapore.
2. Cotton, H., 1999. *Advanced Electrical Technology,* Sir Isaac Pitman and Sons Ltd., London.

REFERENCE BOOKS:

1. Del Toro. V, 1995. *Electrical Engineering Fundamentals,* Prentice Hall of India, New Delhi, 2nd Edition
2. Theraja, B.L,*2007. A Text book of Electrical Technology,* Vol.II, S.C Chand and Co., New Delhi.
3. Lecture series on *Electrical Machines I and Electrical Machines II* by Dr.Krishna Vasudevan, IIT Madras

EI1303 SENSORS AND TRANSDUCERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the students to various sensors and transducers for measuring mechanical quantities.
- To make the students familiar with the specifications of sensors and transducers.
- To teach the basic conditioning circuits for various sensors and transducers.
- To introduce about advancements in sensor technology

UNIT I INTRODUCTION 9

Basics of Measurement – Classification of errors – Error analysis-Odds and Uncertainty – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor- SQUID sensor , Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV OPTICAL, PRESSURE AND TEMPERATURE SENSORS 9

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD. Acoustic Sensors – flow measurement- electromagnetic flow meter, ultrasonic flow meter, Remote Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors

UNITV SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 To understand the basics of measurement system and static and dynamic characteristics of measurement system.

CO2 To select the appropriate sensor/transducer used to measure motion, proximity and Range.

CO3 To select the appropriate transducer used to measure force, magnetic field.

CO4 To select the appropriate transducer used to measure light intensity, pressure and temperature

CO5 To design signal conditioning circuit for various transducers

TEXT BOOKS:

1. John P. Bentley, 2005. *Principles of Measurement Systems*, Pearson Education, 4th Edition.
2. Doebelin, E.O., 2008. *Measurement Systems - Application and Design, McGraw-Hill* Edition.
3. Sawhney ,A.K., 2015. *A course in Electrical & Electronic Measurement Instrumentation*, Dhanpat Rai and Co (P) Ltd.

REFERENCE BOOKS:

1. Murthy ,D. V. S, 2012. *Transducers and Instrumentation*, PHI , 2nd Edition.
2. James, W,Dally,1993. *Instrumentation for Engineering Measurements*, Wiley, 2nd Edition.
3. John, G,Webster, 2008. *Sensors and Signal Conditioning*, Wiley Inter Science, 2nd Edition.
4. Neubert, H.K.P., 1999. *Instrument Transducers - An Introduction to their Performanc and Design*, Oxford University Press, 2nd Edition.
5. Patranabis, 2005. *Sensors and Transducers*, Prentice Hall, 2nd Edition.
6. Waldemar Nawrocki, 2005. *Measurement Systems and Sensors*, Artech House.

EI1311 DEVICES AND MACHINES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To facilitate the students to study the characteristics of various semiconductor devices.
- To provide practical knowledge on the analysis of regulators and oscillators.
- To obtain the no load and load characteristics of D.C machines.
- To obtain the speed characteristics of D.C motor.
- To find out regulation characteristics of Transformer.

LIST OF EXPERIMENTS:

Simulation and experimental Characterization of Semiconductor diode and Zener diode.

1. Simulation and experimental Characterization of a NPN Transistor under

common emitter configurations.

2. Simulation and experimental Characterization of JFET (Draw the equivalent circuit)
3. Simulation and experimental Characterization of UJT and generation of saw tooth Waveforms
4. Simulation of Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
5. Simulation and experimental Characterization of RC and LC phase shift oscillators.
6. Load test on D.C. shunt motor.
7. Speed control of D.C. shunt motor
8. Open circuit and Load characteristics of D.C. shunt generator.
9. Open circuit and short circuit tests on single phase transformer (Determination of equivalent circuit parameters).
10. Load test on single phase induction motor.

Content Beyond Syllabus:

1. Load Test on Three Phase Induction Motor
2. Simulation of NPN transistor under CB,CC configuration

TOTAL: 60 PERIODS

Equipment Needed for 30 students

FOR DEVICES LAB:

1. Circuit Simulation Software (5 Users) (Pspice / Matlab /other Equivalent software Package) with PC.

2. Sufficient number of power supply, Galvanometer, Bread board, Multimeter, resistors, Decade Capacitance box, Decade resistance box, Decade Inductance box, CRO.

3. Semiconductor devices like Diode, Zener Diode, NPN Transistors, JFET, and UJT.

FOR MACHINES LAB:

1. DC Shunt Motor with Loading Arrangement - 3
2. Single Phase Transformer - 3
3. Single Phase & Three Phase Induction Motor with Loading Arrangement - 1
4. Single Phase Auto Transformer - 3
5. Single Phase Resistive Loading Bank - 2
6. Sufficient number of Ammeters, Voltmeters, (or multimeters), switches, tachometers, Wattmeters

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Gain knowledge on the proper usage of various electronic equipment and simulation tools for design and analysis of electronic circuits.

CO2 Get hands-on experience in studying the characteristics of semiconductor devices.

CO3 Analyze various electronic circuits such as voltage regulators, transistor amplifiers and oscillators.

CO4 Use the basic concepts to obtain the no load and load characteristics of D.C machines.

CO5 Analyze and draw conclusion from the characteristics obtained by conducting experiments on machines.

EI1312 SENSORS AND TRANSDUCERS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To familiarize the students to the basic principles of various transducers.
- To impart knowledge in static and dynamic characteristics of sensors.
- To impart knowledge in the design of signal conditioning circuits for transducers.

LIST OF EXPERIMENTS:

1. Characteristics of (Resistive and Thermo emf) temperature sensor
2. Characteristics of Piezoelectric measurement system
3. Measurement of displacement using LVDT
4. Characteristics of Hall effect sensor
5. Measurement of strain using strain gauges
6. Measurement of torque using Strain gauges
7. Measurement using proximity sensors
8. Characteristics of capacitive measurement systems
9. Loading effects of Potentiometer
10. Design of Opto-coupler using photoelectric transducers
11. Characteristics of Micro pressure and Micro accelerometer sensing device
12. Study of speed measuring devices and Gyroscope

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. Regulated power supply – 8 No
2. Strain gauge and Load cell kit. – 1 No
3. Variable power supply – 1 No
4. Loads for measurement – one set
5. LVDT trainer kit – 1 No.

6. Hall effect characteristics trainer – 1 No.
7. Speed control trainer kit – 1 No.
8. Multimeter – 2 No.
9. Photo conductive trainer kit – 1 No.
10. Thermistor Trainer kit – 1 No.
11. Heater – 1 No.
12. Thermistor – 1 No.
13. Thermometer – 1 No.
14. Thermocouple trainer kit – 1 No.
15. Thermocouple and RTD trainer kit – 1 No
16. Thermocouple and RTD sensors – 1 No.
17. Bread board – 5 No.
18. Decade resistance box – 5 No.
19. Multimeter – 3 No.
20. Fixed resistance – 1 No.
21. Unknown resistors – 1 No.
22. Decade Capacitance box – 1 No.
23. CRO – 3 No.
24. Function Generator – 1 No.
25. Decade Inductance box – 1 No.
26. OptoCoupler- 1
27. Crompton potentiometer- 1
28. Microaccelerometer-1

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1	Analyze the characteristics of different sensors
CO2	Incorporate the measurement of different parameters for the given conditions
CO3	Analyze the effects of load and Calibrate the equipment
CO4	Design opto-coupler using electric transducer

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills

- Make effective presentations.

Unit I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk

Unit II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

Unit III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

Unit IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

Unit V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations –

TOTAL : 30 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs

CO5 Explain directions and instructions in academic and business contexts

TEXTBOOKS:

1. Brooks, Margret, 2011 , *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,*Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar,2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate,2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack,2006,*Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter,2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1472 NUMERICAL METHODS AND PROBABILITY

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To make the students to understand the knowledge of various techniques of

differentiation and integration.

- To evaluate the solution of differential equation with initial and boundary conditions.
- To introduce the basic concepts of probability and random variables.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations: Fixed point iteration method – Newton Raphson method – Solution of linear system of equations: Gauss elimination method – Pivoting – Gauss Jordan method – Inverse of a matrix by Jordan Method – Iterative methods of Gauss Jacobi and Gauss Seidel – Dominant Eigen value of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Difference operators and relations –Interpolation with equal intervals: Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials – Numerical integration : Trapezoidal rule– Simpson's 1/3 rule –Simpson's 3/8 rule – Romberg's Method - Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL AND BOUNDARY VALUE PROBLEMS FOR DIFFERENTIAL 12

Initial value problem: Taylors, Euler, Modified Euler and Fourth order Runge - Kutta method for solving first order equation. Boundary value problem: Finite difference method for linear differential equations – Laplace equations – One dimensional heat flow equation by implicit and explicit method – One dimensional wave equation by explicit method

UNITV PROBABILITY ANDRANDOM VARIABLE 12

Probability - The axioms of probability - Conditional probability - Baye's theorem - Discrete and continuous random variables - Moments - Moment generating functions – Distributions; Binomial, Poisson, Uniform, Exponential and Normal.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Compute numerical solutions to system of linear equations, algebraic, transcendental equations and Eigen value problems.

CO2 Construct approximate polynomial to represent the data and find the intermediate values of unknown function using interpolation.

CO3 Apply numerical methods to find the values of differentiation and integration.

CO4 Solve the initial and boundary value problem numerically.

CO5 Apply the concepts of probability distributions to solve engineering problems

TEXT BOOKS:

1. Grewal, B. S., and Grewal, J. S., 2016, *Numerical methods in Engineering and Science*, Khanna Publishers,10th Edition Reprint.
2. Milton, S. J., and Arnold, J. C., 2001, *Introduction to Probability and Statistics*, McGraw Hill-Education,4th Edition.

REFERENCE BOOKS:

1. SankarRao K., 2018, *Numerical Methods for Scientists and Engineers*, Prentice Hall of India Private, 4th Edition.
2. Kandasamy, P., Thilagavathy K., and Gunavathy, K., 2014, *Numerical Methods* Chand Co. Ltd , 3rd Edition Reprint .
3. Walpole, R.E., Myers, R. H., Myers, S. L., and Ye, K.E., 2007, *Probability and Statistics for Engineers and Scientists,* Pearsons Education, 8th Edition
4. Lipschutz,S., and Schiller, J., 2011 ,*Schaum's outlines - Introduction to Probability Statistics*, Tata McGraw-Hill, 1st Edition.
5. Gupta, S. C., and Kapoor, V. K., 2015, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons,11thEditionReprint

IT1471 OBJECT ORIENTED PROGRAMMING USING JAVA
(Common to EEE,EIE & MTR)

L	T	P	C
3	0	2	4

PRE-REQUISITE :

- Fundamentals of Computing and Programming

OBJECTIVES:

- Build software development skills using JAVA programming for real world applications
- Understand and apply the OOPs features like Arrays, Strings and Packages
- Use of inheritance and inner class to develop JAVA applications

- Develop JAVA applications using Exceptions, Generic Programming and Multithreading
- Apply the concepts of I/O streams and Event driven Programming

UNIT I FUNDAMENTALS OF JAVA AND OBJECT ORIENTED PROGRAMMING 11+4

Theory Component:

JAVA as a Programming Platform – JAVA Buzzwords – History of JAVA – Introduction to Object Oriented Programming – Using Predefined Classes – Defining Your Own Classes - Static Fields and Methods – Method Parameters - A Simple JAVA Program – Comments – Data Types – Variables and Constants – Operators- Input and Output

Lab Component:

Implementation of the following problems using JAVA

1. **Using Predefined Classes of JAVA**
   a. Write a JAVA Program to add two big integer numbers using BigInteger class
   b. Write a JAVA Program to display the calendar of the given month using LocalDate class
2. **Defining Your Own Classes for Simple JAVA Programs**
   a. Implement a JAVA program to find the area of rectangle and circle
   b. Implement a JAVA Program to find the sum and average of three numbers

UNIT II BASIC CHARACTERISTICS OF OBJECT ORIENTED PROGRAMMING 8+12

Theory Component:

Control Flow - Object Construction- Packages-Documentation Comments- Arrays- Strings

Lab Component:

Implementation of the following problems using JAVA

3. **Control Flow - Conditional Statements and Multiple Selection Statements**
   a. Prepare Electricity bill using JAVA. Create a class with the following member: Consumer number, Consumer name, previous month reading, current month

reading and type of EB connection.

Calculate the domestic connection bill amount using the following tariff:

First 100 units – Rs. 1.50 per unit

101-200 units – Rs. 3 per unit

201- 500 units – Rs. 4.50 per unit

>501 units – Rs. 7 per unit

Calculate the commercial connection bill amount using the following tariff:

First 100 units – Rs. 2.50 per unit

101-200 units – Rs. 5 per unit

201- 500 units – Rs. 6.50 per unit

>501 units – Rs. 9 per unit

4. **Control Flow – Looping Statements**
   a. Write a JAVA program to check whether the given number is Armstrong or not
   b. Write a JAVA program to find the factorial of a given number
5. **Object Construction**
   a. Develop a JAVA program to define a class called Account which contains two private data elements, an integer account number and a floating point account balance, and three methods:
   A constructor that allows the user to set initial values for account number and account balance and a default constructor that prompts for the input of the values for the above data members.
   A method which reads a character value for transaction type (D for deposit and W for withdrawal), and a floating point value for transaction amount, and updates account balance.
   A method, which prints on the screen the account number and account balance.
6. **Packages**
   a. Develop a JAVA application using packages to implement the following currency converter Dollar to Indian Rupees, Euro to Indian Rupees
7. **Arrays**
   a. Develop a JAVA program to find the largest and smallest number in an array
   b. Develop a JAVA program to perform matrix multiplication
8. **Strings**
   a. Write a JAVA program to check whether the given string is a palindrome or not.

UNIT III INHERITANCE AND INTERFACES 9+6

Theory Component:

Classes, Super classes and Sub classes – The Cosmic Super class – Generic Array Lists – Object Wrappers and Autoboxing – Interfaces - Inner classes

Lab Component:

Implementation of the following problems using JAVA

9. **Inheritance**
    a. Use the abstract class Shape that include two integers and an empty method named printArea(). Construct the classes Rectangle, Triangle and Circle inherited from the class Shape. The Derived classes should include only the method printArea() that print the area of the given shape.
10. **Generic Array Lists**
    a. Write a JAVA program to perform string operations using ArrayList. Write functions for the following
        i) Append – add at end
        ii) Insert – add at particular index
        iii) List all string starts with given letter
11. **Interfaces and Inner Classes**
    a. Write a JAVA program with a class named as "circle" that implements an interface named as "circleinterface" and define the methods named as "area" and "circum" in the class to find the area and circumference of the circle.
    b. Write a JAVA program to perform subtraction of two numbers using inner class

UNIT IV EXCEPTION AND MULTITHREADING 8+4

Theory Component:

Dealing with Errors – Catching Exceptions – Using Exceptions – Why Generic Programming? – Defining a Simple Generic Class – Generic Methods – Bounds for Type Variables – What are Threads? – Thread States – Thread Properties – Synchronization

Lab Component:

Implementation of the following problems using JAVA

12. **Exception and Generic Programming**

a. Implement the exception handling for dividing two numbers
b. Create a JAVA program that finds the maximum value based on the given type of elements using generic functions in java.

13. Multithreading

a. Write a JAVA program that implements a multi-threaded application that has three threads.
   First thread generates a random integer every 1 second.
   If the value is even, second thread computes the square of the number.
   If the value is odd, the third thread will print the value of cube of the number.

UNIT V STREAMS AND EVENT DRIVEN PROGRAMMING 9+4

Theory Component:

Byte Stream – Character Stream – Reading and Writing from console and files – Swing and the MVC design pattern - **Components:** Text field, Input, Choice, Text Area, Buttons, **Layout Management:** Border layout– **Listener:**ActionListener.

Lab Component:

Implementation of the following problems using JAVA

14. Streams

a. Create a JAVA program to write a student profile into a file and read the contents from the file and display it on the screen.

15. User Interface Components with Swing

a. Create a JAVA GUI application to convert miles to kilometres when pressing the "Convert!" button. Note that you need to implement the ActionListener interface and override the actionPerformed() method. Note that 1 mile is equal to 1.609 kilometres.

TOTAL: 45+30PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1	Develop JAVA applications using Sequence statements
CO2	Apply the basic features of Object Oriented Programming to give solutions to simple JAVA applications
CO3	Build a JAVA application using Inheritance and Interface
CO4	Utilize the concept of Exception, Generic Programming and Multithreaded Programming of JAVA for developing console based applications
CO5	Design graphics-based JAVA applications using files and Event driven Programming

TEXT BOOKS:

1. Cay,S.Horstmann, 2019.*Core JAVA Volume – I Fundamentals*, Pearson Education,11th edition.

REFERENCE BOOKS:

1. Herbert Schildt, 2014,*Java: The Complete Reference*, McGraw Hill Education, 11th edition.
2. Paul Deitel,& Harvey Deitel, 2015.*Java SE8 for Programmers*, Pearson Education,3rd edition.
3. Deitel, P.J., & Deitel, H.M., 2011.*Java: How to Program Java 2*, Prentice Hall, 7th edition.

EI1401 **ELECTRICAL AND ELECTRONIC MEASUREMENTS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To expose the students to the design of bridges for the measurement of resistance, capacitance and inductance.
- To give an overview of current, voltage and power measuring electrical and electronics instruments.
- To give an overview of test and measuring instruments.

UNIT I MEASUREMENT OF R,L,C 9

Resistance Measurement - DC Bridges: Wheatstone bridge, Kelvin double bridge, High Resistance measurement-Loss of charge method, Direct deflection methods-Earth Resistance Measurements- AC Bridges: Inductance Measurement - Maxwell‘s bridge, Hay‘s bridge, Anderson bridge -Capacitance Measurement: Schering bridge – Measurement of Q factor - Western digital ac bridge- Sources and errors in AC bridge circuits.

UNIT II MEASUREMENT OF VOLTAGE AND CURRENT 9

Classification of electrical instruments - Deflecting, controlling and damping torques - D‘Arsonval Galvanometer: Principle and operation – Different types of electrical measuring instruments: Principle, construction and operation of Moving coil, Moving iron, Electro dynamometer, Induction and Rectifier types, Errors and compensation – Extension of range of voltmeter and ammeter.

UNIT III MEASUREMENT OF POWER AND ENERGY 9

Electrodynamometer type wattmeter: Theory & its errors, Methods of correction – LPF wattmeter – Phantom loading – Induction type kWh meter – Induction type energy meter – Calibration of wattmeter and Energy meter.

UNIT IV POTENTIOMETERS AND INSTRUMENT TRANSFORMERS 9

DC potentiometer: Basic circuit, standardization, Laboratory type (Crompton's) – AC potentiometers: Drysdale (polar) type, Gall-Tinsley (coordinate) type – Applications of DC and AC potentiometers – Leeds Northrup self balancing potentiometer – Instrument Transformers: C.T and P.T – construction, theory, operation and characteristics.

UNIT V ELECTRONIC MEASUREMENTS 9

Electronic voltmeter, current measurement with electronic instruments- Digital Multimeter – Digital frequency meter – Programmable decade frequency synthesizer – Basic swept receiver spectrum analyzer – Digital Storage Oscilloscope-Mixed Signal Oscilloscope- LED, LCD and Organic LED displays.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Select the suitable method for measuring Resistance, Inductance and Capacitance.

CO2 Understand the working principle, theory of operation and solve the problems in diffe types of indicating instruments

CO3 Understand the working principle, theory of operation and solve the problems Electrodynamometer type wattmeter and induction type Energy meter

CO4 Express the concept of AC and DC Potentiometer and the working principle operation of Current and potential transformer

CO5 Illustrate the construction and working of various electronic measuring devices

.

TEXT BOOKS:

1. Sawhney, A.K., 2019, *A Course in Electrical & Electronic Measurements and Instrumentation*, DhanpatRai and Company Private Limited,11th Edition.
2. Gupta, J.B., 2003, *A Course in Electronic and Electrical Measurements and*

Instrumentation, S.K. Kataria and Sons, Delhi.

REFERENCE BOOKS:

1. Golding, E.W., & Widdis, F.C., 2011, *Electrical Measurements and Measuring Instruments*, A.H.Wheeler and Company.
2. Kalsi, H.S., 2010, *Electronic Instrumentation*, Tata McGraw Hill Education Private Ltd, Third edition.
3. Martin, U. Reissland, 2001, *Electrical Measurement – Fundamental Concepts and Applications*, New Age International Private Limited.
4. Rajput, R.K., 2013, *A Course in Electrical & Electronic Measurements and Instrumentation*, S.Chand Publications, 4th edition.

EI1402 **INDUSTRIAL INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES:

- Learn about Tachometer, Torque meter and various densitometers.
- Have an adequate knowledge about pressure transducers.
- Have an idea about the temperature standards, calibration, thermocouples and pyrometer techniques.
- Study about various types of flow meters and their calibration.
- Have sound knowledge about various types of viscometers, level measurements, humidity and moisture measurements adopted in industries.

UNIT I SPEED, TORQUE & DENSITY MEASUREMENTS 9

Measurement of Speed- Revolution Counter, Drag cup tachometer, Stroboscope, AC & DC tacho generators, Capacitive tachometer- Speed measurement using reluctance pick-up, photo-transducer- Torque measurements using strain gauges and magneto elastic principle – Density measurements for liquids and gases.

UNIT II PRESSURE MEASUREMENT 9

Manometers, Bourdon gauges, Bell gauges, Electrical types – Vacuum gauges, McLeod gauge, Knudsen gauge, Pirani gauge, thermo couple gauge, ionization gauge, Differential Pressure transmitter – Pneumatic and electrical types-Calibration of pressure gauges.

UNIT III TEMPERATURE MEASUREMENT 9

Temperature Scales, Temperature Standard, Bimetallic thermometer, filled – in thermometers, Vapour pressure thermometers, Laws of thermocouples- cold junction compensation of thermocouples, thermo pile, installation of thermocouples-radiation pyrometer, optical pyrometer.

UNIT IV FLOW MEASUREMENT 9

Variable head flow meters, orifice plate, venturi tube, dall tube, flow nozzle, pilot tube-rotameter, mass flowmeter, positive displacement meter, turbine flow meter, solid flow measurement, flow meter calibration.

UNITV LEVEL, HUMIDITY, MOISTURE, VISCOSITY MEASUREMENTS 9

Measurement of level: Sight glass, float gauges, bubbler tube, Differential pressure methods – Hydra step systems- Electrical types of level gauges using resistance, Capacitance, Nuclear radiation and ultrasonic sensors. Humidity: dew point, psychrometers – Hydrometers Moisture measurement in Granular materials, wood and paper. Viscosity terms- Saybolt viscometer – Rotameter Type viscometer.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Describe the different methods to measure speed, torque and density.

CO2 Understand the different techniques and its operation of pressure measuring instrument used in process industries.

CO3 Select the appropriate temperature measuring instruments in the process industries.

CO4 Select the appropriate flow measuring instrument under specific conditions.

CO5 Comprehend the concept of the operation of measurement level, viscosity, humidity and moisture used in industries.

TEXT BOOKS:

1. Doebelin, E.O., and Manik, D.N., 2011, *Measurement systems Application and Design*, McGraw-Hill Education, 6th edition.

2. Patranabis, D., 2017, *Principles of Industrial Instrumentation*, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 3rd Edition.

REFERENCE BOOKS:

1. Liptak, B.G., 2014. *Instrumentation Engineers Handbook (Measurement)*, CRC Press, 4th edition.
2. Sawhney, A.K., & Sawhney,P., 2018. *A Course on Mechanical Measurements, Instrumentation and Control*, Dhanpath Rai and Co.
3. Eckman.D.P., 2016. *Industrial Instrumentation*, Wiley Eastern Ltd.
4. Jayashankar, V., *Lecture Notes on Industrial Instrumentation*, NPTEL, E-Learning Course, IIT Madras.
5. Alok Barua, *Lecture Notes on Industrial Instrumentation*, NPTEL, E-Learning Course, IIT Kharagpur.
6. Jain, R.K., 2008. *Mechanical and Industrial Measurements*, Khanna Publishers, New Delhi.
7. Singh,S.K., 2010. *Industrial Instrumentation and Control*, Tata McGraw Hill Education Pvt. Ltd., 3rd edition.

EI1403 LINEAR INTEGRATED CIRCUITS AND ITS APPLICATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide in-depth instructions on the characteristics and applications of operational amplifiers, timers and voltage regulators.

UNIT I IC FABRICATION 9

IC classification – Various processes in monolithic IC Fabrication techniques –Epitaxial growth, masking and etching, diffusion of impurities -Fabrication of diodes, capacitance, resistance FETs and PV Cell

UNIT II CHARACTERISTICS OF OP-AMP 9

Ideal OP-AMP – DC and AC Characteristics – Inverting and Non–inverting Amplifier – Differential amplifier – Summer, differentiator and integrator. V-I & I-V Converters.

UNIT III APPLICATIONS OF OP-AMP 9

Instrumentation amplifier – Log and antilog amplified-Filters – Comparators – Multivibrators – Peak detector, Sample and Hold circuit – D/A converters – A/D converters.

UNIT IV SPECIAL ICS 9

555 Timers - Monostable and Astable Multivibrators – Schmitt Triggers – Voltage Controlled Oscillator IC 566 – Phase Locked Loops – Applications-Analog multiplier AD633

UNITV APPLICATION ICS 9

IC voltage regulators – LM78XX, 79XX – Variable voltage regulators -switching regulators LM317,723 – LM 380 power amplifier, ICL 8038 function generator– SMPS

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Describe the IC fabrication procedure for basic electronic circuits.

CO2 Infer the characteristics of OP -AMP ICs.

CO3 Design the basic applications of Op–amp.

CO4 Interpret the internal functional blocks and the applications of special ICs.

CO5 Illustrate the operation of application ICs.

TEXT BOOKS:

1. Gayakwad, R.A., 2009.*Op-amps & Linear Integrated Circuits*, Prentice Hall of India, New Delhi, 4th edition.
2. Roy Choudhury, & Shail Jain, 2014.*Linear Integrated Circuits*, New Age International Publishers, 7th Edition.
3. David,A. Bell, 2011.*Op–amp & Linear ICs*, Prentice Hall Private Limited.

REFERENCE BOOKS:

1. Sergio Franco, 2002, *Design with operational amplifiers and Analog Integrated circuits*, Tata McGraw Hill.
2. Sedra Smith, 2009, *Microelectronic Circuits*, Oxford University Press, 6thEdition.
3. Jacob Millman, & Christos,C. Halkias,2003, *Integrated Electronics – Analog and Digital circuits system*, Tata McGraw Hill Private Limited.
4. Robert, F. Coughlin, & Fredrick, F. Driscoll, 2002, *Op–amp and Linear ICs*, Pearson Education, 4th Edition.

EI1411	INDUSTRIAL INSTRUMENTATION LABORATORY	L	T	P	C
		0	0	4	2

OBJECTIVES:

- To impart an adequate knowledge and expertise to handle equipment generally available in an industry.
- To make the students aware about calibration of meters, sensors and transmitters.
- To make the students conscious about the working and operation of different types of analytical instruments.
- To identify, formulate and analyze problems regarding sensors and transmitter.

LIST OF EXPERIMENTS:

1. Measurement of speed, torque and vibration
2. Calibration of ammeter, voltmeter and wattmeter using multifunction calibrator
3. Calibration of pressure gauge using dead weight tester.
4. Measurement of level using d/p transmitter and fibre optics system.
5. Measurement of flow using orifice plate
6. Calibration of rotameter and thermocouple.
7. Design of linearizing circuits and cold junction compensation circuit for thermocouples.
8. Design of orifice plate and rotameter.
9. Design and Testing of Electromagnetic Flow meters.
10. Measurement of temperature using IR thermometer and IC sensor
11. Measurement of Absorbance and Transmittance of Test solutions using UV-Spectrometer.
12. Measurement of Conductivity, Moisture and Viscosity of test solutions.
13. Standardization and measurement of pH values of different solutions
14. Measurement and analysis of ECG and pulse rate.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1.	Tacho meter	1
2.	Torque trainer	1
3.	Piezo electric vibration measurement system	1
4.	Multifunction Calibrator	1
5.	Dead weight tester with pressure gauge	1
6.	DP transmitter	1
7.	Fibre optics level measurement system	1
8.	Orifice plate	1
9.	Rotameter and Thermocouple	1

10.	Electromagnetic Flow sensor	1
11.	IR thermometer & LM 35	1
12.	UV – Visible spectrophotometer	1
13.	Conductivity meter	1
14.	Saybolt Viscometer	1
15.	pH meter	1
16.	ECG trainer	1
17.	Pulse rate trainer	1

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1	Demonstrate the industrial instruments for measuring industrial process parameters
CO2	Suggest a suitable measuring instrument for an industrial application.
CO3	Design the instrumentation circuits for temperature and flow measurement systems.
CO4	Interpret the industrial process parameters such as flow, level, temperature, pressure, viscosity, pH, conductivity, UV absorbance and transmittance at the specific conditions.
CO5	Analyze physiological parameters such as BP, ECG and pulse rate.

EE1481 LINEAR AND DIGITAL INTEGRATED CIRCUITS LABORATORY

(Common to EEE & EIE)

L	T	P	C
0	0	4	2

OBJECTIVES:

- To analyze circuit characteristics with signal analysis using an Operational Amplifier
- To design and construct application circuits with ICs as 555, etc.
- To design combinational logic circuits using digital IC's

EXPERIMENTS USING

Analog circuits :

1. Design and Implementation of amplifier circuits using OPAMP – Inverting, Non-inverting, Adder, Subtractor & Comparator.
2. Design and Implementation of Integrator and Differentiator circuit using OPAMP
3. Design and Implementation of OPAMP based Clamper circuit/ clipper circuits.
4. Design and Implementation of Astable multi-vibrator using 555 – Timer IC
5. Study of Voltage Controlled Oscilloscope to generate waveform

Digital Circuits

6. Implementation of Boolean Functions using logic gates and Karnaugh Map
7. Design and Implementation of Adder, Subtractor, Parity Checker and code converter using basic logic gates and special IC's
8. Design and Implementation of MUX, DEMUX, Encoder and Decoder using special IC's
9. Design of Synchronous and Asynchronous counter using Flip flops and special IC's
10. Design of Shift registers using Flip flop and special IC.

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS: (3 per Batch)

S.No	Name of the Equipment's	Quantity Required	Remarks
1.	Dual (0-30V) variability Power Supply	10	
2.	CRO	9	30MHz
3.	Digital Multimeter	10	Digital
4.	Function Generator	8	1 MHz
5.	IC Tester (Analog)	2	
6.	Bread board	10	
7.	Computer (PSPICE installed)	1	
Consumable's (sufficient quantity)			
IC 741/ IC NE555/566/565			
Digital IC types			
LED			
LM317			
LM723			
ICSG3524 / SG3525			
Transistor – 2N3391			
Diodes, IN4001,BY126			
Zener diodes			
Potentiometer			
Step-down transformer 230V/12-0-12V			
Capacitor			
Resistors 1/4 Watt Assorted			
Single Strand Wire			

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Design and demonstrate analog electronic circuits using operational amplifier

CO2 Design and demonstrate analog electronic circuits using timer 555.

CO3 Design and demonstrate digital circuits involving Boolean functions using basic logic gates.

CO4 Design and demonstrate combinational circuits such as adder, subtractor, code converters, encoders and decoders.

CO5 Design and demonstrate sequential logic circuits such as Flip-Flops, Counters (synchronous and asynchronous), and Shift Registers.

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph

UNIT II CRITICAL READING 6

Reading-Read for details-Use of graphic organizers to review and aid comprehension Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III PARAGRAPH WRITING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques-Writing– Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV ESSAY WRITING 6

Reading– Genre and Organization of Ideas- Writing– letter of recommendation- Email writing- visumes – Job application- project writing-writing convincing proposals.

UNIT V EFFECTIVE WRITING 6

Reading– Critical reading and thinking- understanding how the text positions the reader-identify Writing– Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon Successful Completion of this course, the students will be able to

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F. Margot, & Colin, S. Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4),* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss.2006, *Effective Academic Writing (Level 3),* Oxford University Press: Oxford.
2. Suresh Kumar, E., and *et al*, 2012, *Enriching Speaking and Writing Skills*, Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and *et al*. 2004, *Inspired to Write. Readings and Tasks to develop writing skills*. Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000, *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn, & Marsh Durham, 2004, *The Professional Writing Guide: Knowing Well*

and Knowing Why, Business& Professional Publishing: Australia.

WEB RESOURCES:

1. http://learnenglishteens.britishcouncil.org/skills/reading
2. http://learnenglish.britishcouncil.org/skills/reading
3. http://www.readingrockets.org/article/25-activities-reading-and-writing-fun
4. http://linguapress.com/advanced.html

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

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S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. INFORMATION TECHNOLOGY

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the department of Information Technology the unique of its kind in the field of Research and Development activities in this part of world

MISSION:

To impart highly innovative and technical knowledge in the field of Information Technology to the urban and unreachable rural student folks through Total Quality Education.

PROGRAM EDUCATIONAL OBJECTIVES:

PEO 1:

Technical Knowledge : Graduates will be able to identify, analyze and create solutions for real life, industrial and societal needs by applying the principles and practices of Information Technology.

PEO 2:

Teamwork &Ethics : Graduates will be able to collaborate effectively and ethically in a multi-disciplinary team as a member &/ as a leader.

PEO 3:

Lifelong Learning : Graduates will be able to adopt the contemporary technologies in the field of Information Technology to provide solutions for challenging environments.

PROGRAM OUTCOMES:

After going through the four years of study, the Information Technology graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1 :

Demonstrate technical and interpersonal skills to design and develop IT enabled solutions to meet the real time industrial and societal needs

PSO2:

Exhibit an ability to adapt to the evolutionary changes in computing

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Regulation - 2020

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CURRICULUM AND SYLLABI

(III &IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1301	Discrete Mathematics and Probability	BS	3	1	0	4	4
2	IT1371	Computer Organization and Architecture	PC	3	0	0	3	3
3	IT1301	Object Oriented Programming	PC	3	0	0	3	3
4	EC1306	Digital Systems	ES	3	0	0	3	3
5	EE1308	Fundamentals Of Electrical and Electronics Engineering	ES	3	0	0	3	3
PRACTICAL								
6	IT1311	Object Oriented Programming Laboratory	PC	0	0	4	4	2
7	EC1316	Digital Systems Laboratory	ES	0	0	4	4	2
8	EE1282	Fundamentals of Electrical and Electronics Engineering Laboratory	ES	0	0	4	4	2
9	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**1**	**14**	**30**	**23**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	CS1371	Database Management Systems	PC	3	0	0	3	3
2	IT1401	Data Structures	PC	3	0	0	3	3
3	IT1402	Operating Systems	PC	3	0	0	3	3
4	IT1403	Software Engineering	PC	3	0	0	3	3
5	EC1406	Communication Engineering	PC	3	0	0	3	3
PRACTICAL								
6	CS1381	Database Management Systems Laboratory	PC	0	0	4	4	2
7	IT1411	Data Structures Laboratory	PC	0	0	4	4	2
8	IT1412	Operating Systems Laboratory	PC	0	0	4	4	2
9	HS1421	An Introduction to Advanced Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**15**	**0**	**14**	**29**	**22**

SEMESTER III

MA1301 DISCRETE MATHEMATICS AND PROBABILITY

L	T	P	C
3	1	0	4

OBJECTIVES:

- To make the students understand the principles of proposition and predicate logic to validate the statements in a given context.
- To make the students aware of the basic terminologies and ideas to solve simple problems using combinatorics.
- To make the students understand the basic concepts of graph theory.
- To make the students aware of the basics of random variables and standard distributions to solve simple real life problems.
- To make the students understand the basic concepts of two dimensional random variables.

UNIT I PROPOSITION AND PREDICATE LOGIC 12

Basic connectives – Truth Table – Tautological Implications – Propositional equivalences – Normal Forms – Rules of inference – Predicates and quantifiers – Nested quantifiers – Universe of Discourse – Theory of inference for Predicate calculus.

UNIT II COMBINATORICS 12

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – principle of Inclusion and exclusion and its applications.

UNIT III GRAPH THEORY AND ITS APPLICATIONS 12

Graphs – Matrix representation of graphs – Graph isomorphism – connectivity – Eulerian and Hamiltonian graphs (Proof excluded) – Prim's Algorithm – Dijkstra's Algorithm – Problems.

UNIT IV PROBABILITY AND RANDOM VARIABLE 12

Probability – conditional probability – Baye's theorem – Random variables – Expectation of Random Variables – Moments – Moment generating functions –Characteristic function – Distributions: Geometric, Uniform, Exponential and Normal.

UNIT V TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of Random Variables – Central limit theorem (proof excluded).

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Use Predicate and Propositional logic to derive new inference from a given scenario
CO2	Solve problems using Mathematical Induction, Permutation & Combination and Recurrence relations
CO3	Solve problems using Mathematical Induction, Permutation & Combination and Recurrence relations
CO4	Demonstrate the use of probability and distributions to solve real life problems
CO5	Compute the correlation of two random variables and linear regression equation for a set of data

TEXT BOOKS:

1. Rosen, K.H, 2011, *Discrete Mathematics and its Applications*, Tata McGraw Hill Pub. Co. Ltd, 7th Edition, New Delhi.
2. Johnson, R.A, Miller, I., & Freund J, 2015, *Miller and Freund's Probability and Statistics for Engineers*, Pearson Education, 8th Edition, Asia.

REFERENCES:

1. Grimaldi, R.P, 2007, *Discrete and Combinatorial Mathematics: An Applied Introduction*, Pearson Education Asia, 4th Edition, Delhi.
2. Lipschutz, S, & Mark Lipson, 2010, *Discrete Mathematics*, Tata McGraw Hill Pub. Co. Ltd, 3rd Edition, New Delhi.
3. Koshy, T, 2006, *Discrete Mathematics with Applications*, Elsevier Publications.
4. Ross, S.M, 2004, *Introduction to Probability and Statistics for Engineers and Scientists*,

Elsevier, 3rd Edition.

5. Spiegel, M.R, Schiller, J, &Srinivasan, R.A., 2004, *Schaum's Outline of Theory and Problems of Probability and Statistics*, Tata McGraw Hill Edition.

WEB REFERENCES:

1. http://discrete.openmathbooks.org/pdfs/dmoi-tablet.pdf
2. https://www.cis.upenn.edu/~jean/discmath-root-b.pdf
3. http://www.r-5.org/files/books/computers/algo-list/statistics/probability/Sheldon_M_Ross-Introduction_to_Probability_and_Statistics-EN.pdf

IT1371 COMPUTER ORGANIZATION AND ARCHITECTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the basic structure, operations and instructions of a digital computer.
- Learn the implementation of fixed point and floating-point arithmetic operations.
- Be familiar with the basic processing unit and multiple functional units in a processor.
- Understand the hierarchical memory system and I/O organization.
- Learn the concepts of instruction level parallelism, data level parallelism and loop level parallelism.

UNIT I BASIC STRUCTURE OF COMPUTERS 9

Functional Units – Basic Operational Concepts – Bus Structures – Software – Performance: Processor Clock, Basic Performance Equation, Clock Rate – Instruction Set: CISC and RISC – Memory Locations and Addresses – Memory Operations – Instructions and Instruction Sequencing – Addressing Modes – Basic Input/output Operations.

UNIT II ARITHMETIC UNIT 9

Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed Operand Multiplication – Fast Multiplication – Integer Division – Floating Point Numbers and Operations.

UNIT III PROCESSING UNIT 9

Basic Processing Unit: Fundamental Concepts – Execution of a complete instruction – Multiple-bus organization – Hardwired Control – Microprogrammed control – Pipelining: Basic Concepts – Data Hazards – Instruction Hazards – Datapath and Control Considerations.

UNIT IV MEMORY SYSTEMS & INPUT / OUTPUT ORGANIZATION 9

Memory Systems: Basic Concepts – Cache Memories – Performance Considerations – Virtual Memories – Memory Management Requirements – Secondary Storage – Input / Output Organization: Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Synchronous Bus – Asynchronous Bus.

UNIT V PARALLEL PROCESSING 9

Instruction-Level Parallelism: Concepts and Challenges – Basic compiler techniques for exposing ILP – Overcoming Data Hazards with Dynamic Scheduling – Dynamic Scheduling: Examples and the Algorithm – Data-Level Parallelism: Introduction – Vector Architecture – Graphics Processing Units – Detecting and Enhancing Loop-Level Parallelism.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Summarize the functionalities of various parts, instruction sets and operations of a digital computer.

CO2 Utilize the logic design for fixed-point and floating point arithmetic.

CO3 Interpret the role of a processing unit and multiple functional units.

CO4 Explain the various elements in memory hierarchy and the basic and complex I/O structures.

CO5 Demonstrate how parallelism is used at instruction-level and data-level parallelism.

TEXT BOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, *"Computer Organization and Embedded Systems"*, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCES:

1. David A. Patterson and John L. Hennessy, *"Computer Organization and Design: The Hardware/Software Interface*", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
2. William Stallings, *"Computer Organization and Architecture – Designing for Performance*", Eighth Edition, Pearson Education, 2010.
3. John P. Hayes, *"Computer Architecture and Organization*", Third Edition, Tata McGraw Hill, 2012.

IT1301 OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- understand Object Oriented Programming concepts and basic characteristics of JAVA
- enhance the programming skill using inheritance and interfaces
- use exception handlers and generic programming for developing JAVA applications
- build a JAVA applications using event driven programming and I/O streams
- develop a JAVA application with multithreading programming

UNIT I INTRODUCTION TO OBJECT ORIENTED CONCEPTS AND JAVA PROGRAMMING 10

Introduction to Object Oriented Programming: Abstraction, Objects and Classes, Encapsulation, Inheritance, Polymorphism – **Introduction to JAVA:** Characteristics of Java, The Java Environment, Java Source File Structure, Compilation – **Fundamental Programming Structures in Java:** Data type and Variables, Operators, Decision making and Looping – **Classes:** Predefined class, User defined class, Access modifiers – **Object:** Object reference, Object cloning, Reflection – **Methods:** Types of method definition – Arrays – Strings – **Constructor:** Default constructor, Parameterized constructor – **Package:** Predefined package, util package, Understanding class path, User defined package – Javadoc comments.

UNIT II INHERITANCE AND POLYMORPHISM 9

Inheritance: Single Inheritance, Multilevel Inheritance, Hierarchical Inheritance, Super keyword – Interface – **Polymorphism:** Method overloading, Method overriding – **Non-Access modifiers:** Abstract class and method, Static keyword, Final keyword – **Inner class:** Nested classes, Static inner class, Anonymous class.

UNIT III EXCEPTION HANDLING AND GENERIC PROGRAMMING 9

Exception Handling: Garbage collection, Finalize() method, Throwable interface, Types of exception, **Exception handlers:** Try, Catch, Finally, Throw, Throws, User define exception – **Generic programming:** Generic class, Generic method, Restrictions and limitations, Inheritance rule for generic types, Wild card types, Reflections and generics – Collection framework: Map/List, Set, Array List / Linked List, Hash Set Collection Classes, TreeMap – Lambda expression.

UNIT IV STREAMS AND EVENT DRIVEN PROGRAMMING 10

Input and Output: Byte stream, Character stream, Reading and writing from console and files, Object Streams and Serialization – **Java Database Connectivity (JDBC):** Creating a database, Insertion operation, Deletion operation, Updation operation, Display operation – Event Driven programming: Introduction to Swing, MVC Framework, Frame, **Components:** Text field, Input, Choice, Text Area, Buttons, Checkboxes, Radio Buttons, Lists, Menus, Dialog Box, Windows, Mouse, **Layout Management:** Border layout, Flow layout, Card layout, Grid layout, Gridbag layout – **Listeners:**ActionListener, ItemListener, MouseListener, KeyboardListener, WindowListener – Adapter classes.

UNIT V MULTITHREADING PROGRAMMING 7

Multithreading: Thread states, Thread life cycle, Thread properties, Thread priorities, Thread synchronization – Archive – Case study.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Demonstrate the basic concepts of object oriented programming using JAVA
CO2	Make use of the OOP concept and non-access modifiers to solve real world problems
CO3	Choose an appropriate exception handler and generic data type for writing a JAVA application
CO4	Select the appropriate features of event driven programming and I/O streams to give solution to real time problems

CO5 Apply multithreading programming to generate synchronized threads

TEXT BOOKS

1. Cay S. Horstmann, Gary Cornell, *"Core Java: Volume I – Fundamentals",* Prentice Hall, Tenth Edition, 2015.
2. Cay S. Horstmann, Gary Cornell, *"Core Java: Volume II – Fundamentals*", Prentice Hall, Tenth Edition, 2016.

REFERENCE BOOKS

1. Herbert Schildt, *"Java: The Complete Reference"*, Eleventh Edition, McGraw Hill Education, 2014.
2. Paul Deitel ,HarveyDeitel *" Java SE8 for Programmers"*, Pearson Education, Third Edition,2014.
3. P.J.Deitel&H.M.Deitel, *"Java: How to Program Java 2"*, Prentice Hall, Seventh Edition, 2011.

EC1306 DIGITAL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To present the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To design the synchronous and Asynchronous counters and shift registers by using Flip Flops.
- To introduce the modelling of logic circuits by Verilog HDL.
- To introduce different types of memory and its design.

UNIT I DIGITAL FUNDAMENTALS 9

Review of Number systems, Logic gates, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation

UNIT II COMBINATIONAL CIRCUITS 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Code converters.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip-Flops-SR, JK, D & T, Shift Registers - SISO, SIPO, PISO, PIPO, Design of Synchronous Sequential Circuits - State Table and State Diagrams, Design of Counters - Modulo N counters, Random Sequence counters, Johnson counter, Ring counter, Up/Down counters.

UNIT IV MODELLING OF LOGIC CIRCUITS BY VERILOG HDL 9

Lexical Conventions, Ports and Modules, Gate Level Modelling, Operators, Data Flow Modelling, Behavioral level Modelling - Modelling of Combinational and Sequential Logic Circuits using Verilog HDL.

UNIT V MEMORY AND PROGRAMMABLE LOGIC DEVICES 9

RAM - ROM - Basic Structure, Types - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL. Hazards - Hazard free realization.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Outline the Boolean functions and various minimization techniques.

CO2 Illustrate the combinational circuits used to perform basic digital operations.

CO3 Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4 Implement combinational and sequential logic circuits using Verilog HDL.

CO5 Design combinational circuits using programmable logic devices and Memory Devices.

TEXT BOOKS

1. M. Morris Mano, Michael D. Ciletti, 2017, *Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog*, 6th Edition, Pearson Education.

REFERENCE BOOKS

1. Charles H.Roth, 2013, *Fundamentals of Logic Design*, 6th Edition, Thomson Learning.
2. Wakerly J F, 2002, *Digital Design: Principles and Practices*, 2nd Edition, Prentice-Hall.
3. D. D. Givone, 2003, *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
4. Thomas L. Floyd, 2011, *Digital Fundamentals*, 10th Edition, Pearson Education Inc.
5. Stephen Brown &ZvonkoVranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, Third Edition, McGraw-Hill Higher Education, New Delhi, India.

EE1308 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the basic concepts involved in the analysis of electrical circuits and systems.
- To impart knowledge on electric machinery such as motors, generators and transformers.
- To describe how devices such as semiconductor diodes, transistor and operational amplifier are used in the design and analysis of electronic circuits.
- To comprehend the principles of digital circuits and its applications using Flip flops, Registers, Counters, Multiplexer and De multiplexer,
- To explain the construction and operation of different types of measuring instruments and transducers.

UNIT I BASIC ELECTRICAL CIRCUITS AND SYSTEMS 9

Electrical circuit elements (R, L and C) - Dependent and independent DC sources – Ohm's Law- Kirchhoff's laws - mesh current and node voltage methods (Analysis with only independent DC source) - Three phase supply (Star & Delta connection) - Basics of Energy Tariff calculation.

UNIT II ELECTRICAL MACHINES 9

Principles of operation and characteristics of; DC machines (Series, Shunt Motors and Generator) - Construction and working of Transformers (single and three phase), AC generators - single phase capacitor start/run induction motors.

UNIT III ELECTRONIC DEVICES & CIRCUITS 9

Types of Materials – Silicon & Germanium- N type and P type materials – Operation & VI characteristics; PN Junction Diode &Zener Diode – Bipolar Junction Transistor Characteristics – Introduction to Operational Amplifier –Inverting Amplifier –Non Inverting Amplifier – Passive Filters (Low pass & High Pass).

UNIT IV DIGITAL ELECTRONICS 9

Number System – Basic Boolean laws – Demorgan's theorem– Logic Gates - Introduction to combinational Circuits (Half adder, Full adder, Multiplexer and Demultiplexer) - Introduction to sequential Circuits (SR, JK, D, T Flip-Flops - Registers and Modulo Counters).

UNIT V MEASUREMENTS & INSTRUMENTATION 9

Classification of instruments - Types of indicating Instruments – Construction and working; Induction Wattmeter, Ammeter (moving coil and moving iron type), Voltmeter (moving coil and moving iron type) – CRO – three-phase power measurements (Two wattmeter method) - Introduction to transducers (LVDT, RTD and Piezoelectric).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1	Solve simple dc circuits using basic electrical laws
CO2	Describe the construction and working principle of various DC and AC Machines.
CO3	Elucidate characteristics of various semiconductor devices used in electronic circuits.
CO4	Design simple digital circuits for various electronic applications.
CO5	Explain the construction and working of electrical measuring instruments and transducers.

TEXT BOOKS:

1. Muthusubramanian, R., Salivahanan, R. and Muraleedharan, K.A., 2009. *Basic Electrical & Electronics Engineering*. Tata McGraw Hill Education Private Limited.

REFERENCES:

1. Theraja, B.L., 2006. *Fundamentals of Electrical Engineering and Electronics in SI System of Units (including Rationalized MKSA System)*. Chand.
2. Bird, J., 2014. *Electrical circuit theory and technology*. Routledge.
3. AlMorris, A.S. and Langari, R., 2012. *Measurement and instrumentation: theory and application*. Academic Press.
4. Prasad, R., 2014. *Fundamentals of Electrical Engineering*. PHI Learning Pvt. Ltd.

IT1311 OBJECT ORIENTED PROGRAMMING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- build software development skills using JAVA programming for real-world applications
- understand and apply the OOPs concepts like inheritance, interfaces
- handle the exceptions that arise in JAVA applications
- apply the concepts of event driven programming and JDBC to store and retrieve data from database
- develop applications using generic programming and multithreading

LIST OF EXPERIMENTS:

1. **Implementation of Basic Java programs**
   a. Make use of appropriate control statements
      i. To perform linear search
      ii. To perform matrix operations
      iii. To generate prime numbers
      iv. Pattern printing – Floyd's triangle
   b. Build a user defined classes and object
   c. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff.

i. If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   - First 100 units – Rs. 1 per unit
   - 101-200 units – Rs. 2.50 per unit
   - 201 -500 units – Rs. 4 per unit
   - > 501 units – Rs. 6 per unit

ii. If the type of the EB connection is commercial, calculate the amount to be paid as follows:
   - First 100 units – Rs. 2 per unit
   - 101-200 units – Rs. 4.50 per unit
   - 201 -500 units – Rs. 6 per unit
   - > 501 units – Rs. 7 per unit

2. Implementation of user defined Packages.

a. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa) , time converter (hours to minutes, seconds and vice versa) using packages.

3. Implementation of Inheritance concepts

a. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.

4. Implementation of Interfaces concept

a. Design a Java interface for ADT Stack. Implement this interface using array. Provide necessary exception handling in both the implementations.

5. Implement a Java program that make use of Non access modifiers

a. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area().
   - Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape.
   - Each one of the classes contains only the method print Area () that prints the area of the given shape.

6. **Implement a Java program using various Exception handling**
    a. Write a Java program to use exception handlers
7. **Files and IO streams.**
    a. Write a Java program that reads a file name from the user, displays information about whether the file exists, whether the file is readable, or writable, the type of file and the length of the file in bytes.
8. **Implementation of JDBC**
    a. Make use of Q1.c. Create a table that contains cid, cname, address, date_of_payment, previous_month_reading, current_month_reading, connection_type, amount. Perform the following operations:
        i. Insert the electricity meter reading units details of customer
        ii. Display the details of the customer of the type Domestic and commercial
        iii. Update the address of the specific customer
        iv. Delete the details of a specific customer
        v. Display the total bill amount generated in a specific duration
        vi. Display the details of the customer who is paying highest amount
9. **Implement a real time application using Event driven program**
    a. Design a calculator using Event-driven programming paradigm of Java with the following options.
        i. Decimal manipulations
        ii. Scientific manipulations
10. **Implementation of Generics programming**
    a. Write a Java program to find the maximum value from the given type of elements using a generic function.
11. **Utilize the appropriate Collection framework for any real time application**
    a. Write a program to perform string operations using ArrayList. Write functions for the following
        i. Append
        ii. Insert
        iii. Search
        iv. List all string starts with given letter
12. **Implementation of Multithreading programming**
    a. Write a java program that implements a multi-threaded application that has three threads.

i. First thread generates a random integer every 1 second and if the value is even
ii. Second thread computes the square of the number and prints. If the value is odd
iii. Third thread will print the value of cube of the number.

13. Mini project

TOTAL: 60 PERIODS

SOFTWARE SPECIFICATIONS:

1. JDK8
2. Eclipse / Netbean
3. MySQL

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Develop JAVA applications using Fundamental Programming Structures
CO2	Make use of the OOPs features to implement various JAVA applications
CO3	Apply the exception handling mechanism to handle the exceptions that arise in JAVA applications
CO4	Build Java application using event driven programming and JDBC concepts
CO5	Utilize Generics programming and Multithreaded programming for developing JAVA applications

REFERENCES

1 Herbert Schildt, *"Java: The Complete Reference*", Eleventh Edition, McGraw Hill Education, 2014.

2 https://www.eclipse.org/

3 https://netbeans.org/

EC1316 DIGITAL SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- understand the various basic logic gates.
- design and implement the various combinational circuits
- design and implement combinational circuits using MSI devices
- design and implement sequential circuits
- understand and code with HDL programming

LIST OF EXPERIMENTS:

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement Half/Full Adder and Subtractor.
4. Design and implement combinational circuits using MSI devices:
    - 4–bit binary adder / subtractor
    - Parity generator / checker
    - Magnitude Comparator
    - Application using multiplexers and demultiplexers.
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Design and implement asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.
10. Design and implementation of a simple digital system (Mini Project).

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Experiment with the basics of gates.

CO2 Build different combinational circuits.

CO3 Construct various sequential circuits.

CO4 Model combinational & Sequential circuits using HDL.

CO5 Make use of the concepts for implementation of a simple digital system.

EE1282 FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

(Common to CIVIL, MECH & IT)

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- give practical exposure to students on various electrical and electronics components.
- perform standard tests on basic electrical machines used in domestic and industrial applications.
- give hands-on practice on design and simulation of simple analog and digital circuits.

LIST OF EXPERIMENTS:

1. Verification of Ohm’s Law & Kirchhoff’s Laws.
2. Load test on separately excited DC generator.
3. Load test on DC Shunt Motor.
4. Load test on Single phase Transformer.
5. Load test on Single phase Induction motor.
6. Characteristics of PN Junction Diode.
7. Characteristics of BJT (CE Configuration).
8. Study of Logic gates.
9. Verification of Half adder and Full adder.
10. Study of CRO and measurement of AC signals.
11. Measurement of three-phase power using Digital Power meter and two wattmeter method.
12. Characteristics of LVDT and RTD.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon successful completion of course the students will be able to

CO1 Demonstrate load test to determine the performance characteristics of various AC & DC Machines.

CO2 Analyze the characteristics of semiconductor devices.

CO3 Design simple digital logic circuits.

CO4 Illustrate the performance of various measuring instruments & transducers.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S. No.	NAME OF THE EQUIPMENT	QUANTITY
1.	D. C. Motor Generator Set	2
2.	D.C. Shunt Motor	2
3.	Single Phase Transformer	2
4.	Single Phase Induction Motor	2
5.	Ammeter AC and DC	20
6.	Voltmeters AC and DC	20
7.	Watt meters LPF and UPF	4
8.	Resistors & Breadboards	-
9.	Cathode Ray Oscilloscopes	4
10.	Dual Regulated power supplies	6
11.	A.C. Signal Generators	4
12.	Transistors (BJT, JFET)	-

HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work**.**

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking

CO4 Demonstrate their ability to communicate effectively in GDs.

CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin & Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari, 2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

CS1371 DATABASE MANAGEMENT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

To enable the students to

- learn the fundamentals of data models and to represent a database system using ER diagrams
- study SQL and relational database design
- understand the internal storage structures using different file and indexing techniques which will help in physical database design
- understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures
- learn about file organization and query processing

UNIT I INTRODUCTION TO DATABASE & ER MODEL 9

Introduction to Databases - File System Vs Database System - Database System Architecture- Database Users and Administrator - Data Models - Entity Relationship Model - E-R Diagrams - Design Issues - Extended E-R Features - Introduction to Relational Model - ER to Relational Schema Mapping

UNIT II RELATIONAL MODEL & SQL 9

Structure of Relational Databases - Relational Query Languages - Relational Algebra – SQL: DDL, DML, DCL, TCL - Simple Queries, Complex Nested Queries, Correlated Nested Queries, Joins, Aggregate Functions, Grouping - PL/SQL : Functions, Procedures, Triggers, Views - Embedded SQL - Dynamic SQL

UNIT III NORMALIZATION 9

Pitfalls in Bad Relational database design - Functional Dependencies (Closure of Functional dependencies) - Closure of Attributes - Normal Forms : First, Second, Third, Boyce Codd Normal Form, Multivalued Dependencies : Fourth Normal Form, Join Dependencies : Fifth Normal Form –Domain Key Normal Form

UNIT IV TRANSACTION AND CONCURRENCY CONTROL 9

Transaction processing concepts - Need for concurrency control and recovery - Recoverability – Transaction Recovery – Serializability : Conflict Serializability, View Serializability, Testing for Serializability - Concurrency Control : Lock Based Protocols (Two phase locking Techniques, Strict Two Phase Locking, Deadlocks, Multiple Granularity) Timestamp Based protocol, Validation Based protocol

UNIT V FILE ORGANIZATION & QUERY PROCESSING 9

File Organization : Organization of Records in Files, Indexing and Hashing, Ordered Indices - Query Processing: Measures of Query Cost (Selection, Sorting and Join Operation), Query Tuning, Query Optimization (Transformation of Relational Expressions, Choice of Evaluation Plans, Materialized Views) – No SQL – Mongo DB.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Infer the basic concepts of database system and model ER diagram for real time applications.

CO2 Use appropriate SQL commands to store and access data from Relational Database.

CO3 Construct normalized database for real world scenario using functional dependencies.

CO4 Illustrate the importance of concurrency control in transaction to maintain consistency in a database.

CO5 Interpret the mechanisms incorporated in file organization and Query

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, *Database System Concepts*, 6th edition, Tata McGraw Hill. 2017.
2. RamezElmasri, Shamkant B. Navathe, *Fundamentals of Database Systems,* 6th edition, Pearson Education, 2011.

REFERENCES BOOKS

1. C.J. Date, A. Kannan& S. Swamynathan, *An Introduction to Database Systems,* 8th edition, Pearson Education, 2006.

2. Raghu Ramakrishnan, *Database Management Systems*, 4th edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, *Database Management Systems*, Tata McGraw Hill, 2011.

IT1401 DATA STRUCTURES

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- understand the concepts ofADTs
- Learn linear data structures – lists, stacks, andqueues
- apply Tree and Graphstructures
- understand sorting, searching and hashingalgorithms

UNIT I LINEAR DATA STRUCTURES - LIST 9

ADTs- List - Array & Singly linked list: Polynomial Manipulation, Merging of Two lists - Doubly linked list: Palindrome Checking - Circular linked list: Round Robin Scheduling, Josephus Problem.

UNIT II LINEAR DATA STRUCTURES - STACKS, QUEUES 9

Stack - Polish Form : Infix to Postfix, Evaluation of Postfix - Parenthesis Checking- Palindrome Checking- Recursion Avoidance – Queue- FIFO Scheduling- Deque- Priority Queue: Priority Based Scheduling.

UNIT III NON LINEAR DATA STRUCTURES - TREES 9

Trees - Binary Search Tree: Traversal - AVL Tree - B Tree - B+ Trees - Heap

UNIT IV NON LINEAR DATA STRUCTURES - GRAPHS 9

Graphs – Traversal: BFS, DFS - Minimum Path: Dijkstra’s - Spanning Tree: Prims,Kruskal - Bi-connectivity & Cut vertices - Topological Sort - Euler’s Tour

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

Searching: Linear Searching, Binary Searching – Sorting : Bubble Sort - Insertion Sort - Selection Sort - Shell Sort - Radix Sort - Indexing – Hashing: Closed Hash, Open hash, Collision Avoidance: Linear, Quadratic, Double Hashing – Rehashing - Extendible Hashing

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Utilize an appropriate linear data structure to provide solution for real life scenario

CO2 Make use of Stack and Queue ADTs for problem solving.

CO3 Illustrate the structural properties and operations on various types of Tree ADTs in balanced search.

CO4 Select an appropriate graph algorithms to solve real life problems.

CO5 Choose an appropriate sorting, searching or indexing strategy for effective data storage and retrieval.

TEXT BOOKS:

1. Horowitz &Sahni, *Fundamentals of Data Structures in C,* 2ndedition, Orient Publication, 2008.

2. Aho, Hopcroft& Ullman, *Data Structures and Algorithms,* Addison Wesley., 1983.

REFERENCES:

1.Aaron M. Tenenbaum, YedidyahLangsam& Moshe J. Augenstein, *Data Structures Using C and C++,* PHI Publications, 2006.

2.Jean Paul Trembley& Paul G. Sorenson, 2017, *An Introduction to Data Structures with applications,* 2nd edition, McGraw Hill Publications

3. Mark Allen Weiss, *Data Structures and Algorithm Analysis In C,* 2nd edition, Addison-Wesley, 2002.

IT1402 OPERATING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to:

- Acquire basic knowledge on operating system structures and its functions
- Study the concept of process management and deadlock
- Learn the basics of memory management and its techniques

- Understand the structure of file, Directory and I/O systems
- Familiar with some operating systems

UNIT I INTRODUCTION 9

Introduction to Operating Systems - Computer System Organization - Architecture - Evolution of Operating System - Operating System Structure - Operations - Process, Memory, Storage Management - Protection and Security - Distributed Systems - OS Services - User interface - System Calls - System Programs - Process Concept - Scheduling - Operations on Processes - Cooperating Processes - Inter process Communication - Threads

UNIT II PROCESS MANAGEMENT 10

Scheduling : Scheduling Criteria - Scheduling Algorithms - Multiple Processor Scheduling - Algorithm Evaluation - The Critical Section Problem - Synchronization Hardware - Semaphores - Classic Problems of Synchronization - Critical Regions - Monitors - Deadlocks - Deadlock Characterization - Methods for Handling Deadlocks - Deadlock Prevention - Deadlock Avoidance - Deadlock detection and Recovery

UNIT III MEMORY MANAGEMENT 9

Introduction - Swapping - Contiguous Memory Allocation - Paging - Segmentation - Segmentation with Paging - Virtual Memory: Background - Demand Paging - Page Replacement - Allocation of Frames - Thrashing

UNIT IV FILE AND I/O SYSTEMS 8

File Concept - Access Methods - Directory Structure - File System Mounting - Protection - Directory Implementation - Allocation Methods - Free Space Management - Disk Scheduling - Disk Management - Swap Space Management - Protection. I/O Systems: I/O Hardware - Application I/O Interface - Kernel I/O Subsystem.

UNIT V CASE STUDY 9

The Linux System: History - Design Principles - Kernel Modules - Process Management Scheduling - Memory management - File systems - Input and output - Inter Process Communication - Mobile OS - iOS and Android - Architecture and SDK Framework, Media Layer, Services Layer, Core OS Layer, File System.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1 Elucidate the evolution of operating system along with its structure and functions

CO2 Demonstrate the various process management algorithms

CO3 Illustrate the performance of various memory management techniques

CO4 Describe file, Directory system and I/O Management techniques

CO5 Summarize some popular operating systems like Linux, Mobile OS like iOS and Android

TEXTBOOK:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, *Operating System Concepts,* John Wiley & Sons Inc., 9th Edition, 2013

REFERENCE BOOKS:

1. Andrew S. Tanenbaum, *Modern Operating Systems*, Addison Wesley, Second Edition, 2001.
2. William Stallings*, Operating Systems: Internals and Design Principles,* Prentice Hall, Seventh Edition, 2011.
3. Charles Crowley, *Operating Systems: A Design-Oriented Approach,* Tata McGraw Hill Education, 1996.
4. D M Dhamdhere, *Operating Systems: A Concept-based Approach*, Tata McGraw-Hill Education, Second Edition, 2007.
5. Neil Smyth*, iPhone iOS 4 Development Essentials – Xcode,* Fourth Edition, Payload media, 2011.
6. Daniel P Bovet and Marco Cesati*, Understanding the Linux kernel,* 3rd edition, O'Reilly, 2005.

IT1403 SOFTWARE ENGINNERING

L	T	P	C
3	0	0	3

OBJECTIVES:

This course enables the students to

- Understand the phases in a software project development
- Learn how to elicit and formulate requirements
- Understand the various software design methodologies
- Learn various testing and maintenance measures

- Familiarize the activities in software project management

UNIT I SOFTWARE PROCESS MODELS 9

Introduction to software engineering – Software Process – Perspective Process Models: Waterfall Model – Incremental Process Models – Evolutionary Process Model – Concurrent Models. Specialized Process Models: Component-Based Development – Formal Methods Model – Aspect-Oriented Software Development. Agile Process Model: Introduction to Agility – Agile Process – Agile Manifesto and Principles – Extreme Programming – Scrum Process.

UNIT II REQUIREMENT ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional Requirements – Non-Functional Requirements – User Requirements – System Requirements – Software Requirements Document. Requirement Engineering Process: Feasibility Studies – Requirements Elicitation and Analysis – Requirements Validation – Requirements Management – Requirements Modelling – Data Dictionary.

UNIT III SOFTWARE DESIGN 9

Design Process – Design Concepts – Design Model – Design Heuristic – Architectural Design: Architectural styles – Architectural Design – Mapping Data Flow and Transaction Flow into Software Architecture. User Interface Design: Interface Analysis – Interface Design. Component-Level Design: Designing Class-Based Components.

UNIT IV TESTING AND MAINTENANCE 9

Taxonomy of Software Testing – Types of Testing: Black Box Testing – White Box Testing – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing – Debugging. Software Implementation Techniques: Coding Practices – Refactoring. Maintenance and Reengineering: BPR model – Reengineering Process Model – Reverse and Forward Engineering – Testing Tools.

UNIT V SOFTWARE PROJECT MANAGEMENT 9

Estimation: LOC – FP Based Estimation – Make/Buy Decision – COCOMO I & II Model. Project Scheduling: Project Scheduling – Scheduling – Earned Value Analysis. Project Planning: Project Plan – Planning Process. Risk Management: Software Risks – Risk Identification – Risk Projection – RMMM – RMMM Plan. Software Configuration Management: SCM Repository –

SCM Process – CASE TOOLS.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Compare and contrast the various Process Models to develop software projects.

CO2 Explain the concepts of requirement engineering and analysis modelling.

CO3 Illustrate the software design process and various types of design models.

CO4 Paraphrase the relevant coding standards, testing practices and Reengineering Process Model.

CO5 Outline the various activities involved in the software project management.

TEXT BOOKS:

1. Roger S. Pressman, *Software Engineering– A Practitioner's Approach*,Eightth Edition, McGraw-Hill International Edition,2015.
2. Ian Sommerville, *Software Engineering*,9th Edition, Pearson Education Asia,2011.

REFERENCES:

1. Rajib Mall, *Fundamentals of Software Engineering*, Third Edition, PHI Learning. PrivateLimited, 2009.
2. PankajJalote, *Software Engineering, A Precise Approach*, Wiley India, 2010.
3. Kelkar S.A., *Software Engineering*, Prentice Hall of India Pvt Ltd, 2007.
4. Stephen R.Schach, *Software Engineering*, Tata McGraw-Hill Publishing Company Limited, 2007.

EC1406 COMMUNICATION ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand analog communication techniques.
- To learn data and pulse communication techniques
- To understand digital communication techniques

- To be familiarized with source and Error control coding.
- To gain knowledge on multi-user radio communication.

UNIT I ANALOG COMMUNICATION 9

Introduction to Communication Systems - Modulation – Types - Need for Modulation. Theory of Amplitude Modulation – DSB-SC,SSB,VSB Techniques – FM Direct, Indirect method - Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).

UNIT II PULSE AND DATA COMMUNICATION 9

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) –DM, ADM. Data Communication: History of Data Communication - Standards Organizations for Data Communication- Data Communication Circuits - Data Communication Codes - Data communication Hardware - serial and parallel interfaces.

UNIT III DIGITAL COMMUNICATION 9

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT IV SOURCE AND ERROR CONTROL CODING 9

Entropy, Source encoding theorem, Shannon fano coding, Huffman coding, mutual information, channel capacity, Error Control Coding, linear block codes, cyclic codes - ARQ Techniques.

UNIT V MULTI-USER RADIO COMMUNICATION 9

Global System for Mobile Communications (GSM) - Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse - Channel Assignment and Handover Techniques - Overview of Multiple Access Schemes - Satellite Communication applications- Bluetooth.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Explain the different analog communication techniques and their comparison.

CO2 Interpret various pulse communication systems with the fundamentals of data communication for serial and parallel interface.

CO3 Compare the different types of digital communication methods used for high bit rate transmission.

CO4 Explain the concepts of source, error control and block coding techniques for enhancing the rating of transmission and minimizing the errors in transmission.

CO5 Illustrate the various radio communication medium like GSM, CDMA, Satellite communication and Bluetooth for enhancing the number of users.

TEXT BOOKS

1. WayneTomasi2009,*Advanced Electronic Communication Systems*, 6th Edition, Pearson Education.

REFERENCE BOOKS

1. Simon Haykin 2004, *Communication Systems*, 4th Edition, John Wiley & Sons.
2. Rappaport T.S 2007, *Wireless Communications: Principles and Practice*, 2nd Edition, Pearson Education.
3. H.Taub, D L Schilling and G Saha 2007, *Principles of Communication*, 3rd Edition, Pearson Education.
4. B. P.Lathi 2007, *Modern Analog and Digital Communication System*, 3rd Edition, Oxford University Press.
5. Blake 2002, *Electronic Communication Systems*, Thomson Delmar Publications.
6. Martin S.Roden 2002, *Analog and Digital Communication System*, 3rd Edition, Prentice Hall of India.
7. B.Sklar 2007, *Digital Communication Fundamentals and Applications*, 2nd Edition Pearson Education.

CS1381 DATABASE MANAGEMENT SYSTEMS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to

- learn the commands for creating and manipulating the databases
- construct queries for retrieval of required data from database
- understand views, sequences and synonyms concepts of SQL

- learn the functions, procedures, triggers and exception handling in SQL
- develop GUI based application for storage and retrieval of data

LIST OF EXPERIMENTS:

1. **WRITE AND EXECUTE SIMPLE QUERIES USING SQL**
   a. DDL, TCL and DCL commands
   b. DML commands
   c. Aggregate Functions
2. **WRITE AND EXECUTE ADVANCED QUERIES USING SQL**
   a. Nested Queries and Sub queries
   b. SQL Join
3. **WRITE AND EXECUTE VIEWS, SYNONYMS, SEQUENCE**
4. **WRITE AND EXECUTE QUERIES USING PL/SQL**
   a. Simple programs
5. **WRITE AND EXECUTE QUERIES USING ADVANCED CONCEPTS OF PL/SQL**
   a. Cursors and Procedures
   b. Functions
   c. Triggers
   d. Exception Handling
6. **IMPLEMENT DATABASE CONNECTIVITY CONCEPTS**
   a. Design a Front End for a real time application
   b. Connect the database with the application
7. **MINI PROJECT**

TOTAL: 60 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Personal Computers (Intel Core i3, HDD 500 GB, 4 GB RAM)	30
2.	Printer	1
3.	Software: XAMPP with Apache, MySQL & PHP (or)	Open source

	MySQL & JAVA.	

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Choose appropriate DDL, DML, DCL and TCL commands for creating and manipulating the databases..

CO2 Construct appropriate nested queries, sub queries and join queries for efficient retrieval of data.

CO3 Organize database using views, sequences, and synonyms.

CO4 Implement functions, procedures, triggers and exceptions using PL/SQL.

CO5 Develop a GUI based environment for storage and retrieval of data for a real time application.

REFERENCES

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, *Database System Concepts*, 6th edition, Tata McGraw Hill, 2017.
2. RamezElmasri, Shamkant B. Navathe, *"Fundamentals of Database Systems"*, 6th edition, Pearson Education, 2011.

IT1411 DATA STRUCTURESLABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- implement linear and non-linear datastructures
- understand the different operations of searchtrees
- implement graph traversalalgorithms
- get familiarized to sorting and searchingalgorithms

LIST OF EXPERIMENTS:

1. Array implementation of List ADT
2. Linked implementation of List ADT
    a. Singly Linked List -Merging of Two Lists

    b. Circular Linked List - Josephus Problem
    c. Doubly Linked List - Palindrome Checking
3. Array implementation of Stack and Queue ADTs
4. Linked list implementation of Stack and Queue ADTs
5. Applications of Stack ADT - Implementation and evaluation of Polish Form
6. Applications of Queue ADT - Implementation of Deque
7. Implementation of Binary Search Trees
8. Implementation of AVL Trees
9. Implementation of Heaps using Priority Queues
10. Graph Representation and Traversal Algorithms
    a. Adjacency Matrix Representation
    b. Adjacency List Representation
11. Applications of Graphs - Single Source Shortest Path
12. Implementation of Searching Algorithms
    a. Linear Search
    b. Binary Search
13. Implementation of Sorting Algorithms
    a. Bubble Sort
    b. Insertion Sort
    c. Selection Sort
    d. Shell Sort
    e. Radix Sort
14. Implementation of Hashing Techniques: Open Hashing
    a. Linear Probing
    b. Quadratic Probing

TOTAL: 60 PERIODS

SOFTWARE SPECIFICATIONS:

1. C Compiler

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Implement linear data structures - Array, List, Stack and Queue ADTs for problem solving
CO2	Implement non-linear, hierarchical data structure - Trees for problem solving
CO3	Implement non-linear, non-hierarchical data structure - Graph for problem solving
CO4	Implement various Searching and Sorting Algorithms
CO5	Apply appropriate hash functions in a hash ADT to facilitate collision free data storage and retrieval

REFERENCES:

1. Horowitz &Sahni, *Fundamentals of Data Structures in C,* 2nd edition, Orient Publication, 2008.

2. Aho, Hopcroft& Ullman, *Data Structures and Algorithms*, Addison Wesley, 1983.

IT1412 OPERATING SYSTEMS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

This course enables the students to

- Practice basic commands of operating systems ,execute system calls of UNIX operating system and practice basic shell programming
- Implement process synchronization mechanisms in operating systems
- Learn various process management schemes in operating systems
- Practice with different memory management mechanisms
- Implement the file allocation techniques

LIST OF EXPERIMENTS

1. **Unix Commands**
   a. Basics of UNIX commands
2. **System Calls - Commands and Implementation Using C**
   a. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
   b. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
3. **Shell Programming**

a. Shell Programming

4. CPU Scheduling

a. Write C programs to implement the various CPU Scheduling Algorithms

5. IPC - Semaphores, Shared Memory

a. Implementation of Semaphores

b. Implementation of Shared memory and IPC

6. Deadlock Detection and Avoidance

a. Bankers Algorithm for Deadlock Avoidance

b. Implementation of Deadlock Detection Algorithm

7. Threading and Its Synchronization

a. Implementation of Threading & Synchronization Applications

8. Memory Allocation Methods

a. Implementation of the following Memory Allocation Methods for fixed partition

i) First Fit ii) Worst Fit iii) Best Fit

b. Implementation of Paging Technique of Memory Management

9. Page Replacement Algorithms

a. Implementation of the following Page Replacement Algorithms

i) FIFO ii) LRU iii) LFU

10. File Allocation and Organization Techniques

a. Implementation of the various File Organization Techniques

b. Implementation of the following File Allocation Strategies

i) Sequential ii) Indexed iii) Linked

TOTAL: 60 PERIODS

SOFTWARE SPECIFICATIONS:

1. Linux Operating System
2. CC / GCC Compiler

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Practice UNIX commands, system calls and write shell scripts involving selection and loops

CO2 Create processes and implements inter process communication with synchronization

CO3 Execute various CPU scheduling algorithms

CO4 Implement deadlock avoidance and detection algorithms

CO5 Illustrate various memory allocation methods, page replacement algorithms, file allocation and organization techniques

REFERENCES:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, *Operating System Concepts Essentials*, John Wiley & Sons Inc., 10th Edition, 2018
2. Andrew S. Tanenbaum, *Modern Operating Systems*, Addison Wesley, Second Edition, 2001.

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

OBJECTIVES:

L	T	P	C
0	0	2	1

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.

2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.

2. E. Suresh Kumar and et al. 2012*, Enriching Speaking and Writing Skills,* Second Edition, Orient Black swan: Hyderabad.

3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills,* Cambridge University Press: Cambridge.

4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.

5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why*, Business & Professional Publishing: Australia.

WEB RESOURCES:

http://learnenglishteens.britishcouncil.org/skills/reading https://learnenglish.britishcouncil.org/skills/reading

https://www.readingrockets.org/article/25-activities-reading-and-writing-fun

https://linguapress.com/advanced.htm

KAMARAJ
COLLEGE OF ENGINEERING & TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING
ACCREDITED BY NBA, NEW DELHI

B.E.MECHANICAL ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Mechanical Engineering the unique of its kind in the field of Research and Development activities in the prominent field of Mechanical Engineering in this part of the world.

MISSION:

To impart highly innovative and technical knowledge in the field of Mechanical Engineering to the urban and unreachable rural students folks through “TOTAL QUALITY EDUCATION”.

PROGRAMME EDUCATIONAL OBJECTIVES:

Educational objectives of the Bachelor of Mechanical Engineering Programme can be divided into

PEO 1: Graduates of the Programme will excel in Technical Knowledge and apply Innovative Skills in the field of Mechanical Engineering.

PEO 2: Graduates will contribute to the Technological Development and Research activities through “Total Quality Education”.

PEO 3: Graduates of the Programme will accomplish the Leadership Qualities and Social responsibilities through “Life Long Learning”.

PROGRAM OUTCOMES:

After going through the four years of study, the Mechanical Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering

		practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1: Graduates will be able to create and analyze the Research and Development activities related to Design and Manufacturing

PSO 2: Graduates will be able to Design and Develop need based products in Mechanical Engineering and allied Industries.

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

ACCREDITED BY NBA, NEW DELHI

B.E.MECHANICAL ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & VI)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1303	Probability, Statistics and Numerical Methods	BS	3	0	0	3	3
2	ME1301	Engineering Thermodynamics	PC	3	0	0	3	3
3	ME1302	Fluid Mechanics and Machinery	PC	3	0	0	3	3
4	ME1303	Manufacturing Technology –I	PC	3	0	0	3	3
5	EE1307	Electrical Drives and Control	ES	3	0	0	3	3
PRACTICAL								
6	ME1311	Computer Aided Machine Drawing	PC	0	0	4	4	2
7	EE1317	Electrical Engineering Laboratory	ES	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**0**	**10**	**25**	**20**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	ME1401	Engineering Management	PC	3	0	0	3	3
2	ME1402	Engineering Metallurgy and Characterization Techniques	PC	3	0	0	3	3
3	ME1403	Manufacturing Technology- II	PC	3	0	0	3	3
4	ME1404	Strength of Materials	PC	3	0	0	3	3
5	ME1405	Thermal Engineering	PC	3	0	0	3	3
6	ME1471	Kinematics of Machinery	PC	3	0	0	3	3
PRACTICAL								
7	ME1411	Manufacturing Technology Laboratory	PC	0	0	4	4	2
8	ME1412	Strength of Materials and Fluid Mechanics Laboratory	PC	0	0	4	4	2
9	HS1421	Introduction to Advanced reading and writing	EEC	0	0	2	2	1
			TOTAL	**18**	**0**	**10**	**28**	**23**

SEMESTER III

MA1303 PRABABILITY, STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	0	0	3

OBJECTIVES

- To introduce the basic concepts of probability and random variables with an objective to estimate solutions for probabilistic models using probability distributions.
- To acquaint the knowledge of testing of hypothesis for small samples.
- To introduce numerical methods with an objective to solve various Engineering problems.
- To make them understand various numerical methods of solving ordinary differential equations.

UNIT I PROBABILITY AND RANDOM VARIABLES 9

Probability – Random variables – Expectation of Random variables – Moments – Moment generating functions – Distributions: Uniform, Exponential and Normal distributions – Demo using Excel.

UNIT II TESTING OF HYPOTHESIS 9

Sampling distributions – Statistical Hypothesis – Type-I and Type-II Errors – Tests for single mean and difference of means of small samples (t-test) – F-test for variance – Chi-square test for goodness of fit – Independence of attributes – Demo using Excel.

UNIT III SOLUTION OF EQUATIONS 9

Solution of algebraic and transcendental equations: Fixed point iteration method –Newton Raphson method – Solution of linear system of equations: Gauss elimination and Gauss Jordan methods – Iterative methods: Gauss Jacobi and Gauss Seidel.

UNIT IV INTERPOLATION AND NUMERICAL INTEGRATION 9

Interpolation – Lagrange's interpolation for unequal intervals – Newton's forward and backward difference interpolation for equal intervals – Numerical Integration: Trapezoidal, Simpson's 1/3rd rule – Gaussian Two point and Three point quadrature.

UNIT V NUMERICAL SOLUTION OF INITIAL VALUE PROBLEMS 9

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge – Kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method for solving first order equations.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the concepts of probability distributions to solve engineering problems.

CO2 Apply the concept of testing of hypothesis for small samples in real life problems.

CO3 Apply the numerical techniques for solving the transcendental equations and system of equations.

CO4 Apply numerical integration to solve engineering problems.

CO5 Obtain the solution of ordinary differential equation with initial condition.

TEXT BOOKS:

1. Grewal, B S, & Grewal, J S 2016, *Numerical Methods in Engineering and Science,* Khanna Publishers, 10th Edition Reprint, New Delhi, India.
2. Johnson, R A, Miller, I, & Freund, J E 2015, *Miller & Freund's Probability and Statistics for Engineers*, Pearson Education, 8th Edition, Asia.

REFERENCES:

1. Gerald, C F, & Wheatley, P O 2007, *Applied Numerical Analysis,* Pearson Education, 7th Edition, Asia, New Delhi.
2. Walpole, R E, Myers, R H, Myers, S L, & Ye, K 2007, *Probability and Statistics for Engineers and Scientists*, Pearson Education, 8th Edition, Asia.
3. Sankar Rao, K 2018, *Numerical Methods for Scientists and Engineers*, Prentice Hall of India Private, 4th Edition.
4. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, S. Chand & Co. Ltd., 3rd Edition Reprint, New Delhi.
5. Gupta, S C, & Kapoor, V K 2020, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, 12th Edition Reprint.

WEB REFERENCES:

1. https://www.vfu.bg/en/e-Learning/Math--Soong_Fundamentals_of_probability_and_statistics_for_engineers.pdf

2. https://www.dcpehvpm.org/E-Content/Stat/FUNDAMENTAL%20OF%20MATHEMATICAL%20STATISTICS-S%20C%20GUPTA%20&%20V%20K%20KAPOOR.pdf
3. https://cds.cern.ch/record/644736/files/3764367156_TOC.pdf

ME1301 ENGINEERING THERMODYNAMICS

L	T	P	C
3	0	0	3

(Use of Standard Steam Table, Mollier Chart and Compressibility chart is permitted)

OBJECTIVES:

- To impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- To impart knowledge on the second law of thermodynamics and availability in analysing the performance of thermal devices.
- To teach the various properties of steam through steam tables and Mollier chart and relate thermodynamic relations.
- To impart knowledge on the performance of steam power cycles.
- To impart knowledge on the macroscopic properties of idea, real gases and gas mixtures.

UNIT I BASICS, ZEROTH AND FIRST LAW OF THERMODYNAMICS 9

Review of Basics – Thermodynamic systems, properties and processes, Thermodynamic Equilibrium – Heat and work transfer, definition and comparison, sign convention – Displacement work – P-v diagram – Thermal equilibrium – Zeroth law – Concept of temperature and Temperature Scales. First law – Application to closed and open systems – Steady and unsteady flow processes.

UNIT II SECOND LAW OF THERMODYNAMICS AND AVAILABILITY 9

Second law statements and its equivalence - Heat Engine, Refrigerator, Heat pump - Carnot cycle and Reversed Carnot cycle, Efficiency and COP – Carnot theorem – Entropy – Concept and causes – Clausius inequality - Change in entropy for reversible and irreversible processes – Principle of increase in entropy. Available (Exergy) and Unavailable energy (Anergy) – Irreversibility – Simple calculations.

UNIT III PROPERTIES OF PURE SUBSTANCES AND THERMODYNAMIC RELATIONS **9**

Steam – Formation and its thermodynamic properties – P-v, P-T, T-v, T-s, h-s diagrams. PVT surface – Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart. Maxwell relations, Tds Equations – Energy equation – Joule-Thomson Coefficient – Clausius Clapeyron equation – Phase Change Processes.

UNIT IV STEAM POWER CYCLES **9**

Ideal and Actual Rankine cycles, Cycle Improvement Methods – Reheat and Regenerative cycles – Performance calculations – Binary and Combined cycles (description only).

UNIT V IDEAL, REAL GASES AND GAS MIXTURES **9**

Properties of Ideal gas – Ideal and real gas comparison – Equations of state for ideal and real gases – Reduced properties. Compressibility factor – Principle of Corresponding states - Generalized Compressibility Chart and its use – Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy and entropy.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to,

CO 1 Apply the zeroth and first law of thermodynamics in calculating the property changes for closed and open engineering systems.

CO 2 Apply the principles of second law of thermodynamics in identifying the performance of thermal devices through energy, entropy and availability calculations.

CO 3 Evaluate the various properties of steam and thermodynamic relations of ideal & real gases.

CO 4 Determine the performance of steam power plant.

CO 5 Evaluate the properties of ideal gases, real gases and gas mixtures.

TEXT BOOKS:

1. R.K.Rajput., 2017, *A Text Book of Engineering Thermodynamics*, Laxmi Publications (P) Limited, Fifth Edition.
2. Yunus A. Cengel and Michael A. Boles., 2015, *Thermodynamics*, Tata McGraw Hill Education Private Limited, 8th edition.

REFERENCES:

1. Nag.P.K., 2013, *Engineering Thermodynamics*, Tata McGraw Hill Education Private Limited, Fifth Edition.
2. Claus Borgnakke and Richard E. Sonntag., 2009, *Fundamentals of Thermodynamics*, Wiley Eastern, 7th Edition.
3. A.Valan Arasu., 2012, *Engineering Thermodynamics*, Vijay Nicole Imprints Private Limited, Chennai,5th Edition.
4. Natarajan, E., 2014, *Engineering Thermodynamics: Fundamentals and Applications*, Anuragam Publications, Chennai, Second Edition.
5. Rathakrishnan, E., 2006, *Fundamentals of Engineering Thermodynamics*, Prentice Hall of India Private Limited, Second Edition.

ME1302 **FLUID MECHANICS AND MACHINERY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about the properties of fluids and concept of control volume.
- To apply the conservation laws in flow through pipes.
- To understand the importance of dimensional analysis.
- To describe the concept and performance of various types of flow in turbines.
- To calculate the performance of various types of flow in pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions – Properties of fluids - mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, surface tension and capillarity. Flow characteristics – Concept of control volume – Application of continuity equation, energy equation and momentum equation – Significance of fluids in Hydraulics and Pneumatics

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient – Laminar flow through circular conduits and circular annuli - Boundary layer concepts – Types of boundary layer thickness – Darcy Weisbach equation - Friction factor – Moody diagram – Commercial pipes – Minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL AND MODEL ANALYSIS 9

Need for dimensional analysis – Methods of dimensional analysis – Similitude – Types of similitude – Dimensionless parameters – Application of dimensionless parameters – Model analysis

UNIT IV TURBINES 9

Introduction to Impact of Jets – Euler's equation – Classification of turbines – heads and efficiencies – Velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines – Working principles – Work done by water on the runner – Draft tube. Specific speed – unit quantities – Performance curves for turbines – Governing of turbines.

UNIT V PUMPS 9

Theory of roto-dynamic machines – Rotary pumps – Classification – Centrifugal pumps – Working principle – Work done by the impeller – performance curves – various efficiencies – velocity components at entry and exit of the rotor – velocity triangles – Reciprocating pump – working principle.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the fundamental properties of fluids and law of conservation of mass, momentum, energy concepts.

CO 2 Apply the boundary layer and Reynolds number concept to flow of fluids.

CO 3 Apply the concept of Dimensional and model analysis to build a prototype.

CO 4 Calculate the efficiencies of Pelton, Francis, Kaplan turbines.

CO 5 Determine the performance of centrifugal pump.

TEXT BOOKS :

1. R.K. Bansal., 2014, *Fluid Mechanics & Hydraulic Machines*, Laxmi Publications Pvt. Ltd.
2. Streeter, V. L. and Wylie E. B., 2010, *Fluid Mechanics*, Tata McGraw Hill.

REFERENCES :

1. R.K.Rajput., 2016, *A Textbook of Fluid Mechanics & Hydraulic Machines* S. Chand Publications.
2. Robert W.Fox, Alan T. McDonald and Philip J.Pritchard., 2016, *Fluid Mechanics,* Wiley Publishers, 9th Edition.

ME1303 MANUFACTURING TECHNOLOGY – I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacturing of plastic components.
- To carry out design calculation/estimate parameters of the processes.

UNIT I METAL CASTING PROCESSES 9

Sand Casting: Sand Mould – Type of patterns - Pattern Materials – Pattern allowances – Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; Melting furnaces: Blast and Cupola Furnaces; Principle of special casting processes: Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting – CO_2 process – Stir casting; Defects in Sand casting. Numerical problems involving calculation of cooling time, fluid flow in the mold.

UNIT II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of: Fusion welding processes: Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; Operating principle and applications of: Resistance welding – Plasma arc welding – Thermit welding – Friction welding and Friction Stir Welding; Brazing and soldering; Weld defects: types, causes and cure. Laser beam welding. Numerical problems involving heat output and power requirement in electric arc/resistance welding.

UNIT III METAL FORMING PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion. Numerical problems involving change in size of forged components, forging force, rolling bite angle, rolling force, draft.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods – special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Introduction to Micro forming**.** Numerical problems on die and punch clearance, shearing force, bending force, drawing blank size calculations.

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – Injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – Introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Apply the knowledge of different metal casting processes for casting simple components by considering its defects, merits and demerits

CO2 Explain the appropriate selection of welding process for the given situation, its construction and working principle.

CO3 Summarize the various hot working and cold working methods of metals.

CO4 Explain various sheet metal making processes.

CO5 Apply the appropriate method of manufacturing simple plastic components.

TEXT BOOKS:

1. Hajra Chouldhary S.K and Hajra Choudhury. AK.,2008, *Elements of workshop Technology,* Volume I and II, Media promoters and Publishers Private Limited, Mumbai.
2. Kalpakjian. S,2018*, Manufacturing Engineering and Technology,* Pearson Education 7th Edition.

REFERENCES:

1. Gowri P. Hariharan, A.Suresh Babu, 2008, *Manufacturing Technology I,* Pearson Education.
2. Paul Degarma E, Black J.T and Ronald A. Kosher, 1997, *Materials and*

Processes, in Manufacturing Eight Edition, Prentice – Hall of India.

3. Rao, P.N, 2019, Manufacturing *Technology Foundry, Forming and Welding,* 5th Edition, TMH.
4. Roy. A. Lindberg, 2006*, Processes and Materials of Manufacture,* PHI / Pearson education.
5. Sharma, P.C.,2019*, A Text book of production Technology , S*.Chand and Co. Ltd.,

EE1307 ELECTICAL DRIVES AND CONTROL

L	T	P	C
3	0	0	3

OBJECTIVES:

- To describe the basic concepts of different types of electrical machines and their performance.
- To explain the different methods of starting D.C motors and induction motors.
- To illustrate the conventional and solid-state speed control of DC/AC drives.

UNIT I INTRODUCTION 9

Basic Elements of a drive – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Torque – Multi quadrant operation – Speed – Torque characteristics of DC motors: Shunt, series and compound – Single Phase and Three Phase Induction Motors(Construction and Working)-Torque Slip Characteristics – Braking – Regenerative, Dynamic and Plugging – H Electric Braking in Electric Vehicles.

UNIT III STARTING METHODS 9

Need for starter-D.C Motor starters – 3point and 4point starter – A.C. Motor starters – DOL starter, Star Delta starter, Autotransformer starter, Primary Resistance starter and Rotor Resistance starter

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 9

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system – Controlled rectifier-based drives – Single Phase half controlled and fully controlled – DC chopper based drive – Class A & Class E Chopper – Applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 9

Speed control of squirrel cage and slip ring induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Inverter based drives (Single phase and Three Phase) and AC voltage regulators based drive (Single Phase).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Explain the various classes of duty and Selection of power rating.

CO2 Summarize the working principle of DC &AC motors, their characteristics and its braking methods.

CO3 Describe the Starting methods of DC &AC.

CO4 Illustrate the various methods of conventional and solid state speed control schemes of DC.

CO5 Illustrate the various methods of conventional and solid state speed control schemes of AC drives

TEXTBOOK :

1. Vedam Subrahmaniam,2010, *Electric Drives (Concepts and Applications),* Tata McGraw-Hill, New Delhi.

REFERENCES :

1. Nagrath .I.J. & Kothari .D.P,2006, *Electrical Machines*, Tata McGraw-Hill. New Delhi
2. Singh. M.D., K.B.Khanchandani, 2006, *Power Electronics ,* Tata McGraw-Hill. New Delhi

ME1311 COMPUTER AIDED MACHINE DRAWING

L	T	P	C
0	0	4	2

OBJECTIVES:

- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages

- To visualize the 2D and 3D conversion.
- To familiarize the students with Indian Standards on drawing practices and standard components
- To sketch the assembly drawing manually as well as Standard CAD Packages

UNIT I DRAWING STANDARDS & FITS AND TOLERANCES 12

Code of practice for Engineering Drawing, BIS specifications – Welding symbols, riveted joints, keys, fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc. - Limits, Fits – Tolerancing of individual dimensions – Specification of Fits – Preparation of production drawings and reading of part and assembly drawings, basic principles of geometric dimensioning & Tolerancing.

UNIT II INTRODUCTION TO 2D DRAFTING 16

Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing - Bearings - Bush bearing, Plummer block - Valves – Safety and non-return valves.

UNIT III 2D GEOMETRIC MODELING AND ASSEMBLY 26

Assembly of Flange Coupling – Assembly of Muff Coupling – Assembly of Knuckle Joint – Assembly of Sleeve and Cotter Joint – Assembly of Stuffing Box – Assembly of Screw Jack - Assembly of Machine vice.

UNIT IV INTRODUCTION TO 3D MODELLING 06

Introduction to Extrude, Revolve, Sweep, Loft, Fillet, Chamfer, Pattern, Mirror in AutoCAD using basic primitives.

Note: 25% of assembly drawings must be done manually and remaining 75% of assembly drawings must be done by using AUTOCAD software.

TOTAL: 60 PERIODS

REFERENCES :

1. Gopalakrishna K.R., 2013, *Machine Drawing*, 22nd Edition, Subhas Stores Books Corner, Bangalore.
2. N. D. Bhatt and V.M. Panchal, 2013, *Machine Drawing*, 48th Edition, Charotar Publishers.
3. N.Siddeshwar, P. Kanniah and V.V.S. Sastri,., 2006, *Machine Drawing*, Tata Mc GrawHill.
4. Rao, S.S., 2005, *Finite Element method in engineering*, Pergamon press.

5. S. Trymbaka Murthy, 2007, *A Text Book of Computer Aided Machine Drawing*, CBS Publishers, New Delhi.

EQUIPMENTS NEEDED (For 30 students)

Sl No	Description of Equipment	Quantity
1	Intel core 2 duo or above versions of processor with 2GB RAM	30 Nos
2	AUTOCAD software for Drafting and Modeling	30 Licenses
3	Laser Printer	1 No

COURSE OUTCOMES:

Students will be able to

CO1 Describe the Indian Standards on drawing practices and standard components

CO2 Prepare assembly drawings using manual drafting.

CO3 Create the 2D drawing manually from Isometric view.

CO4 Prepare part drawing using 2D drafting AUTOCAD software.

CO5 Prepare assembly drawing using AUTOCAD software.

EE1317 ELECTRICAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To demonstrate the operation of DC drives, AC drives and transformers and give them experimental skill.
- To study the different types of DC and AC starters.

LIST OF EXPERIMENTS

1) Load test on DC Series motor
2) O.C.C & Load characteristics of DC Shunt and DC Series generator
3) Speed control of DC shunt motor (Armature, Field control)
4) O.C & S.C Test on a single phase transformer
5) Load Test on Single Phase Induction Motor
6) Load Test on Synchronous Motor
7) Load test on three phase squirrel cage Induction motor
8) Speed control of three phase slip ring Induction Motor

9) No-load and Blocked Rotor test on Single Phase Induction Motor
10) Study of DC & AC Starters

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.No.	NAME OF THE EQUIPMENT	Qty.
1	DC Shunt Motor	2 No.
2	DC Series motor	1 No.
3	DC shunt motor-DC Shunt Generator set	1 No.
4	DC Shunt motor-DC Series Generator set	1 No.
5	Single phase transformer	2 No
6	Three phase synchronous motor	1 No.
7	Three phase Squirrel cage Induction motor	1 No.
8	Three phase Slip ring Induction motor	1 No.
9	Single Phase Induction Motor	2 No.

COURSE OUTCOMES:

Students will be able to

CO1 Analyze the various characteristics and testing of DC Machine.
CO2 Analyze the various characteristics and testing of DC Generators.
CO3 Perform load test on Transformers and Induction motors
CO4 Perform load test on Induction motors.
CO5 Illustrate the use of DC and AC starters.

HS1321 INTERPERSONAL SKILLS- LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

The Course will enable learners to

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to

engage in specific academic speaking activities.

- Improve general and academic listening skills
- Make effective presentations.

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification – Improving pronunciation– pronunciation basics –– stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation – taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances – compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer – accept – decline – take leave – listen for and follow the gist- listen for detail

UNIT IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and Interactive communication – group/pair presentations

TOTAL :30 PERIODS

COURSE OUTCOMES:

Students will be able to:

CO1 Develop their communicative competence in English with specific reference to listening

CO2 Prepare conversation with reasonable accuracy

CO3 Apply lexical Chunking for accuracy in speaking
CO4 Demonstrate their ability to communicate effectively in GDs
CO5 Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks, Margret, 2011, Skills for Success. *Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke, 2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin& Mamta Bhatnagar, 2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate, 2014, *Practical English Classroom*, Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack, 2006, *Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter, 2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES:

- https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
- https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
- https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
- https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

ME1401 ENGINEERING MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic roles, skills and functions of management
- To develop the managerial and leadership skills to the students
- To practice the students for industrial environment

UNIT I INTRODUCTION TO MANAGEMENT AND PLANNING 9

Definition of Management – Types of managers - Managerial roles and skills – Evolution of Management – Types of Business organization– Nature and purpose of planning – planning process – Types of planning – Objectives – setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT II ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization Structure – Types – Line and staff authority – Departmentalization – Delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development.

UNIT III DIRECTING AND CONTROLLING 9

Motivation – Motivation theories – Motivational techniques leadership – Types and theories of leadership - System and process of controlling – use of IT in Management control – Productivity & Operation Management – Globalization and Liberalization - International Management –Global Management Theory

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UNIT IV STATISTICAL QUALITY CONTROL 9

Statistical Quality Control – Inspection, Sampling, Sample Size, Sampling Plan, AQL, OC curve, Producer Risk, Consumer Risk, AOQ, AOQL, Control Charts & Control Limits – $\bar{X}$, R & S charts and their application; causes of variations – Assignable & Random- Normal-Distribution curve and concept of Six Sigma.

UNIT V HUMAN RELATIONS AT WORK 9

Dealing Effectively with People, Communication in the Workplace, Motivating and Developing Teamwork; Diversity and Cross-Cultural Competence, Managing Stress and Personal Problems, Developing Career Thrust: Getting Ahead in Your Career, Learning Strategies.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Describe the concept of strategic management, strategic planning process and policies.

CO2 Explain the principles of organizing, staffing and leading.
CO3 Identify the problems in controlling process and recommend solutions.
CO4 Identify the solution for Particular problem through statistical process control tools.
CO5 Prepare the industry ready students and improve public relationship skills.

TEXT BOOKS :

1. Harold Koontz & Heinz Weihrich., 1998, *Essentials of Management*, Tata McGraw Hill.
2. Dubrien, A., 2017, *Human Relations for Career and Personal Success: Concepts, Applications, and Skills*, Pearson.

REFERENCES :

1. Stephen P. Robbins & Mary Coulter., 2009, *Management*, Prentice Hall (India) Pvt.
2. William J. Kolarik, 1995, *Creating Quality*, McGraw Hill, Inc.
3. Greenberg, J. S. 2017, *Comprehensive stress management*, McGraw Hill.

ME1402 **ENGINEERING METALLURGY AND CHARACTERIZATION TECHNIQUES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on the structure, properties and phase changing mechanisms of ferrous metals
- To impart knowledge in heat treatment techniques of ferrous metals
- To explain the mechanical testing and applications of metals to identify and select the suitable materials for various engineering applications
- To impart knowledge on various techniques of material characterization

UNIT I ALLOYS, ELASTIC & PLASTIC BEHAVIOUR OF MATERIALS 9

Constitution of alloys – Solid solutions, substitutional and interstitial, Iron – carbon equilibrium diagram. Microstructure, properties and application. Elasticity in metals and polymers – inelastic & visco elastic behavior – Mechanism of plastic deformation and nonmetallic shear strength of perfect and real crystals, Types of fracture, Griffith theory, stress intensity factor and fracture toughness- Fatigue and creep failure mechanism.

UNIT II HEAT TREATMENT 9

Definition – Full annealing, stress relief, recrystallization and spheroidising – normalizing, hardening and Tempering of steel. Isothermal transformation diagrams – Cooling curves super imposed on I.T. diagram CCR – Hardenability, Jominy end quench test – Austempering, martempering – Case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.

UNIT III FERROUS AND NON-FERROUSMETALS 9

Effect of alloying additions on steel- α and β stabilizers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Types of cast Iron – alloy cast irons, Copper and copper alloys- Brass, Bronze and Cupronickel – Aluminum and Al-Cu – precipitation strengthening – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON METALLIC & CERAMIC MATERIALS 9

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes - Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON – Composites – Classification – Metal Matrix and FRP – Applications of Composites

UNIT V CHARACTERIZATION TECHNIQUES OF MATERIALS 9

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra-Red Spectroscopy (FTIR) – Differential Thermal Analysis – Differential Scanning Calorimetry (DSC) And Thermo gravimetric Analysis (TGA) Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications – Atomic Force Microscopy – Construction & working of AFM – Applications

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Comprehend alloys, elastic and plastic behavior of materials and their mechanism.

CO2 Summarize the concepts of different heat treatment process and hardening methods used in industry.

CO3 Interpret the properties, composition and characteristics of ferrous and nonferrous metals.

CO4 Describe the properties and characteristic of different thermoplastic, thermosetting plastics and ceramics materials

CO5 Explain the various characterization techniques used for testing engineering materials.

TEXT BOOKS:

1. Avner, S.H.,1997, *Introduction to Physical Metallurgy*, McGraw Hill publications.
2. Williams D Callister., 2014, *Material Science and Engineering*., 2014, Wiley India Pvt Ltd, Revised Indian Edition2014.

REFERENCES:

1. Kenneth G.Budinski and Michael K. Budinski ., 2010, *Engineering Materials*, Prentice Hall, New Jersy.
2. Raghavan.V., 2015, *Materials Science and Engineering*, Prentice Hall, New Jersy.
3. U.C.Jindal., 2012, *Engineering Materials and Metallurgy* , First Edition, Dorling Kindersley.
4. Upadhyay. G.S. and Anish Upadhyay, 2006, *Materials Science and Engineering*, Viva Books Pvt. Ltd.
5. Khanna O.P., 2012, *Material science*, Dhanpat Rai publications.
6. George E. Dieter, 1988, *Mechanical Metallurgy*, McGraw -Hill.

ME1403 MANUFACTURING TECHNOLOGY – II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, drilling, milling, grinding, broaching and its allied machines
- To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES AND DRILLING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation – Capstan and turret lathes – tool layout – Drilling machine types, construction of radial drilling machine. Drilling, reaming, boring, tapping operations. Estimation of drilling time.

UNIT III MILLING AND GEAR CUTTING MACHINES 9

Milling machine types, construction of column and knee type machines, operations-types of milling cutter. Estimation of machining time in milling – Gear cutting – forming and generation principle and construction of gear hobbing and gear shaping processes –finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

Numerical Control (NC) of machine tools – CNC types, constructional details, special features, of machining center. Manual part programs for simple milling and turning features involving only external operations – micromachining – wafer machining.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Calculate the tool wear and tool life by applying the fundamentals concepts of theory of metal cutting, chip formation mechanism, various cutting tool materials and cutting fluids

CO2 Demonstrate the metal removal processes using conventional lathe and drilling machines.

CO3 Comprehend the various types milling, and gear cutting machine.

CO4 Illustrate the different types of grinding & broaching machines and their operations.

CO5 Demonstrate the elements of NC machine tools, and write manual part program.

TEXT BOOKS :

1. Hajra Choudhury, 2014, *Elements of Workshop Technology*, Vol.II., Media Promoters.
2. Rao. P.N, 2019*, Manufacturing Technology - Metal Cutting and Machine Tools,* 4thEdition, Tata McGraw-Hill, New Delhi.

REFERENCES :

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White, 1998 *,Machine Tool Practices,* Prentice Hall of India.
2. Geofrey Boothroyd, 1984, *Fundamentals of Metal Machining and Machine Tools,* Mc Graw Hill.
3. HMT, 1998, *Production Technology,* Tata McGraw Hill.
4. Roy. A. Lindberg,2006, *Process and Materials of Manufacture,* Fourth Edition, PHI/Pearson Education.
5. Kalpakjian. S, 2018, *Manufacturing Engineering and Technology,* Pearson Education 7th Edition.

ME1404 STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of stress, strain principal planes and stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion
- To determine the stresses, deformations induced in thin and thick shells.
- To study the concept of shearing force and bending moment due to external loads in Cantilever, Simple supported and Over hanging beams and their effect on stresses.
- To compute slopes and deflections in Cantilever, Simple supported and over hanging beams by various methods and understand the concepts of Euler Column theory.

UNIT I STRESS, STRAIN & DEFORMATION OF SOLIDS AND PRINCIPLE STRESS AND PLANES 10

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation

of simple and compound bars – impact and shock loading – Thermal stresses – Elastic constants – Volumetric strains – Stresses on inclined planes – principal stresses and principal planes - Mohr's circle of stress

UNIT II TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT III THIN, THICK CYLINDER & SPHERES 8

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.

UNIT IV TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams & its types – transverse loading on beams – Shear force and bending moment in beams - Cantilevers – Simply supported beams and over hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity

UNIT V DEFLECTON OF BEAM AND EULER COLUMN THEORY 9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams – Fundamentals of conjugate beam and strain energy - Maxwell's reciprocal theorem – Columns with different end conditions – Slenderness ratio – Euler's and Rankine's column theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Determine the stress and strain for uniform and uniformly varying cross-sectional bar subjected to axial loading condition.

CO2 Calculate the torsional stress developed in circular shafts and springs.

CO3 Determine the stresses induced in thin, thick and spherical shells.

CO4 Draw the shear force, bending moment and induced stresses for the cantilever, simply supported and over hanging beam under the transverse load.

CO5 Determine the deformation behavior of the cantilever, simply supported and over hanging beam under the transverse load and understand the concept of Euler Column theory.

TEXTBOOK :

1. Bansal, R.K., 2016, *Strength of Materials*, Laxmi Publications (P) Ltd.

REFERENCES:

1. Jindal U.C., 2009, *Strength of Materials*, Asian Books Pvt. Ltd., New Delhi.
2. Egor. P. Popov, 2002, *Engineering Mechanics of Solids*, Prentice Hall of India, New Delhi.
3. Ferdinand P. Been, Russell Johnson, J.r.and John J. Dewole, 2005, *Mechanics of Materials*, Tata McGraw Hill Publishing 'co. Ltd., New Delhi.
4. Hibbeler, R.C., 2013, *Mechanics of Materials*, Pearson Education, Low Price Edition.
5. Subramanian R., 2016, *Strength of Materials*, Oxford University Press, Oxford Higher Education.

ME1405 THERMAL ENGINEERING

L	T	P	C
3	0	0	3

(Use of standard Steam table and Psychrometric chart is permitted)

COURSE OBJECTIVES:

- To understand the working of gas power cycles and their applications.
- To understand the construction, operation and performance of IC engines.
- To gain the knowledge about steam turbines and their performance behaviour.
- To acquire the knowledge on working and performance of air compressors.
- To gain the knowledge on refrigeration and air-conditioning systems by understanding the various thermodynamic processes.

UNIT I GAS POWER CYCLES 9

Otto, Diesel, Dual and Brayton cycle - Performance calculation, Improvisations of gas turbines – Intercooling, Reheating and Regeneration (Description only)

UNIT II IC ENGINE AND ITS PERFORMANCE 9

Classification - Components and their function. Valve timing diagram and port timing diagram – Actual and theoretical P-v diagram of four stroke and two stroke engines. Simple and complete Carburettor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System – Principles of Combustion and knocking in SI and CI Engines. Lubrication and

Cooling systems. Performance calculations.

UNIT III STEAM TURBINES 9

Impulse and Reaction principles, compounding, velocity diagrams for simple stage turbines and multi stage turbines, speed regulations – Governors.

UNIT IV AIR COMPRESSOR 9

Classification and working principle of various types of compressors, work of compression with and without clearance – Volumetric efficiency – Isothermal efficiency and Isentropic efficiency of reciprocating compressors – Multistage air compressor and inter cooling – work of multistage air compressor.

UNIT V REFRIGERATION AND AIR CONDITIONING 9

Refrigerants - Vapour compression refrigeration system – Principles and Performance calculations - Working principle of vapour absorption system, Ammonia – Water, Lithium bromide – water systems (Description only). Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – Simple Applications. Air conditioning system - Types and Working Principles. Recent developments in HVAC systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students will be able to

CO 1 Apply the concepts, laws and methodologies of thermodynamics in gas power cycles.

CO 2 Explain the various terminologies of IC engines and their performance.

CO 3 Evaluate the performance of steam turbines.

CO 4 Determine the performance of single stage and multistage air compressor.

CO 5 Calculate the performance parameters in refrigeration and air-conditioning systems.

TEXT BOOKS:

1. Rajput. R. K., 2000, *Thermal Engineering,* S. Chand Publishers.
2. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., 2002, *A course in Thermal Engineering,* Dhanpat Rai & sons, Fifth Edition.

REFERENCES :

1. Sarkar. B.K., 2007, *Thermal Engineering*, Tata McGraw-Hill Publishers.
2. Arora.C.P., 1994, *Refrigeration and Air Conditioning*, Tata McGraw Hill Education Private Limited,
3. Ganesan V., 2007, *Internal Combustion Engines*, Tata McGraw Hill Education Private Limited, Third Edition.
4. Rudramoorthy. R., 2003, *Thermal Engineering*, Tata McGraw Hill Education Private Limited.
5. Ramalingam. K.K., 2009, *Thermal Engineering*, SCITECH Publications (India) Private Limited.

ME1471 **KINEMATICS OF MACHINERY**
(Common to MECH&MTR)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and Cycloidal tooth profiles – Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction in Plate clutches – Axial clutches – Cone Clutches-Internal expanding rim clutches – Electromagnetic clutches. Friction in Band and Block brakes – External shoe brakes – Internal expanding shoe brake

TOTAL: 45 PERIODS

COURSE OUTCOMES :

Students will be able to

CO1 Explain various components of mechanisms and its inversions used in machineries.

CO2 Illustrate the kinematic linkages with respect to displacement, velocity, and acceleration at any point

CO3 Draw the cam profile for specified follower motions

CO4 Demonstrate the basic concepts of toothed gearing and the kinematics of gear trains

CO5 Compute the frictional forces in various power transmission systems such as Clutches and Brakes

TEXT BOOKS:

1. Rattan, S.S, 2014, *Theory of Machines,* 4th Edition, Tata McGraw-Hill.
2. F.B.Sayyad, 2011, *Kinematics of Machinery*. MacMillan Publishers Pvt Ltd., Tech-max educational resources.
3. Uicker J.J., 2014, Pennock G.R and Shigley, J.E., *Theory of Machines and Mechanisms*,4th Edition, Oxford University Press.

REFERENCES :

1. Khurmi, R.S., 2005, *Theory of Machines* ,14th Edition, S Chand Publications.
2. Allen S.Hall Jr., 1961*, Kinematics and Linkage Design*, Prentice Hall.
3. Thomas Bevan, 2005, *Theory of Machines*, 3rd Edition, CBS Publishers and Distributors.
4. Robert L. Norton, 2009, *Kinematics and Dynamics of Machinery*, Tata McGraw-Hill.

ME1411 MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To practice sand molding, arc welding and resistance welding techniques, smith forging, sheet metal forming.
- To acquire knowledge on various basic machining operations in special purpose machines and its applications in real life manufacture of components in the industry.

LIST OF EXPERIMENTS

1. Preparation of green sand mold
2. Joining of plates using arc welding and sheets
3. Making simple sheet metal components involving shearing and bending operation.
4. Turing a component involving features; taper turning, knurling, grooving and thread cutting.
5. Eccentric turning
6. Cutting internal threads
7. Shaping a hexagon and slotting internal keyway
8. Cutting a helical gear using horizontal milling machine.
9. Cutting a slot and measuring cutting force during end milling.
10. Surface grinding square rod
11. Cylindrical grinding
12. Single point tool grinding
13. Hobbing a spur gear
14. Shear angle measurement
15. Manual part program to turn a component
16. Manual part program to mill a component
17. Study on Capstan lathe

18. Demonstration of plastic processing machines (Injection, blow, extrusion, and compression molding)

TOTAL: 60 PERIODS

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

Sl. No.	NAME OF THE EQUIPMENT	Qty.
1	Centre Lathes	7 Nos.
2	Shaper and slotting machine	1 No each
3	Sheet metal forming tools and equipment	2 Nos.
4	Arc welding transformer and resistance welding unit with cables and holders	1 No each
5	Molding table, Molding equipment	2 Nos.
6	Sheet metal forming tools and equipment	2 Nos.
7	Turret and Capstan Lathes	1 No each
8	Horizontal Milling Machine	1 No
9	Vertical Milling Machine	1 No
10	Surface Grinding Machine	1 No.
11	Cylindrical Grinding Machine	1 No.
12	Milling Tool Dynamometer	1 No
13	Gear Hobbing Machine	1 No
14	CNC Lathe	1 No
15	CNC Milling machine	1 No
16	Tool and cutter grinder	1 No

COURSE OUTCOMES:

Students will be able to

CO1 Demonstrate the use of molding tools, welding processes and sheet metal fabrication tools

CO2 Practice making simple components comprising steps, taper, eccentric turning, knurling and thread cutting using lathe

CO3 Utilize shaping machine, milling and other machines to convert round work into other forms like hexagon and cut slot and gears

CO4 Apply various machine tools to grind specimen and tools

CO5 Construct manual part program for machining in CNC

ME1412 **STRENGTH OF MATERIALS AND FLUID MECHANICS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To verify the principles of various flow control and measurements experiment in lab.
- To verify the principle of various turbines and pumps performance.
-

STRENGTH OF MATERIALS **30**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.

EQUIPMENTS NEEDED (FOR 30 STUDENTS)

S.No.	NAME OF THE EQUIPMENT	Qty.
1	Universal Tensile Testing machine with double shear attachment –40 Ton capacity	1
2	Torsion Testing Machine (60 Nm capacity)	1
3	Impact Testing Machine (300 J capacity)	1

4	Brinell Hardness Testing Machine	1
5	Rockwell Hardness Testing Machine	1
6	Spring Testing Machine for tensile and compressive loads (2500 N)	1
7	Muffle Furnace	1
8	Strain Gauge	1

FLUID MECHANICS LABORATORY **30**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ Submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

EQUIPMENTS REQUIRED (FOR 30 STUDENTS)

S. NO.	NAME OF THE EQUIPMENT	Qty.
1	Orifice meter setup	1
2	Venturi meter setup	1
3	Rota meter setup	1
4	Pipe Flow analysis setup	1
5	Centrifugal pump/submergible pump setup	1
6	Reciprocating pump setup	1
7	Gear pump setup	1
8	Pelton wheel setup	1
9	Francis turbine setup	1
10	Kaplan turbine setup	1

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Estimate the mechanical properties of materials when subjected to axial load, transverse load & shear loading.

CO2 Evaluate the properties of material by using various heat treatment processes.

CO3 Calculate the Coefficient of discharge and friction for the given various test rigs.

CO4 Experiment and draw the characteristic curves of various pumps.

CO5 Experiment and draw the characteristic curves of various turbines.

HS1421 INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES :

The Course will enable learners to:

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading – Use glosses and footnotes to aid reading comprehension – Read and recognize different text types – Predicting content using photos and title. Reading-Read for details – Use of graphic organizers to review and aid comprehension

UNIT II CRITICAL READING 6

Reading – Understanding pronoun reference and use of connectors in a passage – speed reading techniques. Reading – Genre and Organization of Ideas – Reading – Critical reading and thinking – understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing – Plan before writing – Develop a paragraph: topic sentence, supporting sentences, concluding sentence – Write a descriptive paragraph Writing – State reasons and examples to support ideas in writing – Write a paragraph with reasons and examples – Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing – Elements of good essay – Types of essays – descriptive-narrative – issue-based-argumentative – analytical.

UNIT V EFFECTIVE WRITING **6**

Writing – letter of recommendation – Email writing – visumes – Job application – project writing-writing convincing proposals.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Students will be able to

CO1 Understand how the text positions the reader.

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011*, Reading and Writing (Level 3)*, Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford

REFERENCES :

1. Davis, Jason & Rhonda LIss, 2006, *Effective Academic Writing (Level 3)*, Oxford University Press: Oxford,
2. E. Suresh Kumar and et al.2012, *Enriching Speaking and Writing Skills. Second Edition.* Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al.2004, *Inspired to Write. Readings and Tasks to develop writing skills*. Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000, *Critical Reading and Writing,* Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004, *the Professional Writing Guide: Knowing Well and Knowing Why,* Business& Professional Publishing: Australia.

WEB RESOURCES:

- http://learnenglishteens.britishcouncil.org/skills/reading
- https://learnenglish.britishcouncil.org/skills/reading
- https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
- https://linguapress.com/advanced.htm

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.E-MECHATRONICS ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Mechatronics Engineering the unique of its kind in the field of Research and Development towards Industrial Automation & Robotics.

MISSION:

To impart highly innovative and technical knowledge in Mechatronics Engineering to the urban and unreachable rural student folks through "Total Quality Education"

PROGRAM EDUCATION OBJECTIVES:

Educational objectives of the course Bachelor of Mechatronics Engineering programme can be divided into

PEO 1: Graduates will be able to apply their multi-disciplinary knowledge to formulate, design, develop and analyse Mechatronics Systems.

PEO 2: Graduates will be able to come up with solution for any real time problems in the field of Mechatronics Engineering and allied areas demanded by the Industry and Society.

PEO 3: Graduates will be able to get familiarized with economical issues in Mechatronics Engineering and work in multi-disciplinary teams with ethical code of conduct.

PROGRAM OUTCOMES:

After going through the four years of study, the Mechatronics Engineering graduates will have the ability to

	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1: Graduates will be able to design and develop cost effective Mechatronics systems by adopting multi-disciplinary skills in Design, Manufacturing, Automation and Electronics.

PSO2: Graduates will be able to apply their knowledge in sensors, drives, actuators, controls, mechanical design and modern software & hardware tools to develop systems for performing specified tasks.

PSO3: Graduates will be able to become Technocrats and Entrepreneurs, build the attitude of developing new concepts on emerging fields and pursuing higher studies.

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BE-MECHATRONICS ENGINEERING

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1373	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2	EC1371	Digital Electronics	PC	3	0	0	3	3
3	MT1301	Analog Devices and Circuits	PC	3	0	0	3	3
4	MT1302	Fluid Mechanics and Thermal Sciences	PC	3	0	0	3	3
5	MT1303	Solid Mechanics	PC	3	0	0	3	3
6	MT1306	Electrical Circuits and Machines	ES	3	0	0	3	3
PRACTICAL								
7	MT1311	Solid and Fluid Mechanics Laboratory	PC	0	0	4	4	2
8	MT1316	Electrical Circuits and Machines Laboratory	ES	0	0	4	4	2
9	HS1321	Interpersonal Skills-Listening and Speaking	EE	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1402	Statistics and Numerical Methods	BS	3	1	0	4	4
2	EE1471	Control Systems Engineering	PC	3	0	0	3	3
3	ME1471	Kinematics of Machinery	PC	3	0	0	3	3
4	MT1401	Manufacturing Technology	PC	3	0	0	3	3
5	MT1402	Microprocessors and its Applications	PC	3	0	0	3	3
6	MT1403	Sensors and Instrumentation	PC	3	0	0	3	3
PRACTICAL								
7	MT1411	Manufacturing Technology and Sensors Laboratory	PC	0	0	4	4	2
8	MT1412	Microprocessors and its Applications Laboratory	PC	0	0	4	4	2
9	HS1421	Introduction to Advanced Reading and Writing	EE	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1373 TRANSFORMATIONS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of PDE used in solving partial differential Equations.
- To introduce Fourier series which plays a vital role in solving boundary value problems.
- To acquaint the students with Fourier transform and Z-transform techniques.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Lagrange's Linear equation – Solution of linear equations of higher order with constant coefficients – Linear non-homogeneous partial differential equations.

UNIT II FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATION 12

Classification of partial differential equations- Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two- dimensional heat equation – Fourier series solutions in cartesian coordinates.

UNIT IV FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z - transform.

TOTAL: 60 PERIODS

COURSE OUTCOMES

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

CO1 Form the partial differential equations and solve them using various techniques.

CO2 Find the Fourier constants and frame the Fourier series of periodic functions.

CO3 Classify and solve the initial and boundary value problems such as wave and heat flow equation

CO4 Compute the Fourier transforms of standard functions and learn the properties.

CO5 Apply the techniques of Z- transform to get the solutions of differential Equations.

TEXTBOOKS

1. Erwin kreyszig, 2015, *Advanced Engineering Mathematics*, John Wiley & Sons, 10th Edition, New Delhi.
2. Grewal B,S, 2017, *Higher Engineering Mathematics*, Khanna Publishers, 44th Edition, New Delhi.

REFERENCES

1. Bali, N, Goyal, M, & Watkins C, 2009, *Advanced Engineering Mathematics,* Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), 7th Edition, New Delhi.
2. Narayanan, S, Manicavachagom Pillay T, K&Ramanaiah, G ,1998, *Advanced Mathematics for Engineering Students*, Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai.
3. Glyn James, 2011, *Advanced Modern Engineering Mathematics*, Pearson Education, 4 th Edition, New Delhi.
4. Peter V, O'Neil, 2012, *Advanced Engineering Mathematics*, Cengage Learning India Pvt., Ltd, 7 th Edition, New Delhi.
5. Ramana, 2010, B,V, *Higher Engineering Mathematics*, Tata McGraw Hill, 11th Reprint, New Delhi.

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2. http://sv.20file.org/up1/692_0.pdf
3. http://www.scribd.com/document/462665493/B-V-Ramana-Higher-Engineering-Mathematics-McGraw-Hill-Education-2018-pdf

EC1371 DIGITAL ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To provide the Digital fundamentals, Boolean algebra and its applications in digital systems
- To familiarize with the design of various combinational digital circuits using logic gates
- To introduce the analysis and design procedures for synchronous and asynchronous sequential circuits
- To explain the various semiconductor memories and related technology
- To introduce the electronic circuits involved in the making of logic gates

UNIT 1 DIGITAL FUNDAMENTALS 9

Review of Number systems - Logic gates - Boolean algebra - Boolean postulates and laws - De-Morgan's Theorem, Principle of Duality - Simplification using Boolean algebra - Canonical forms, Sum of product and Product of sum - Minimization using Karnaugh map - NAND and NOR Implementation.

UNIT 2 COMBINATIONAL CIRCUIT DESIGN 9

Realization of combinational logic using gates - Design of combinational circuits - Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Code converters, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder.

UNIT 3 SEQUENTIAL CIRCUITS 9

Latches - Flip-Flops - SR, JK, D and T, Master Slave Flip Flops - Shift registers - SISO, SIPO, PISO, PIPO - Binary counters – Synchronous and asynchronous up/down counters, mod - N counter, Counters for random sequence - Johnson counter - Ring counter.

UNIT 4 SYNCHRONOUS CIRCUIT DESIGN 9

Design of Synchronous Sequential Circuits - State Table and State Diagram - Design of Mealy and Moore FSM - Overlapping & Non-overlapping Sequence detector - Hazards - Hazard free realization - Case study on Vending Machine FSM.

UNIT 5 LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – RTL, TTL, ECL and CMOS - Basic memory structure – ROM, PROM, EPROM, EEPROM - RAM – Static and dynamic RAM - Programmable Logic Devices – Programmable Logic Array (PLA), Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL - FPGA - Basic Architecture.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Outline the Boolean functions and various minimization techniques.

CO2 Illustrate the combinational circuits used to perform basic digital operations.

CO3 Develop a synchronous/asynchronous counters and shift registers using sequential logic.

CO4 Construct the synchronous sequential circuits with hazard and hazard free conditions.

CO5 Interpret the different types of memories for the implementation of combinational logic circuits and various logic families.

TEXT BOOKS

1. M Morris Mano, M.D.C., 2017. *Digital design: with an introduction to the verilog HDL, VHDL, and system Verilog,* 6th Edition, Pearson Education.

REFERENCES

1. Charles H.Roth, 2013. *Fundamentals of Logic Design*, 6th Edition, Thomson Learning.
2. Wakerly J F, 2002. *Digital Design: Principles and Practices*, 2nd Ed., Prentice Hall.
3. D. D. Givone, 2003. *Digital Principles and Design*, Tata Mc-Graw Hill, New Delhi.
4. Thomas L. Floyd, 2011. *Digital Fundamentals*, 10th Edition, Pearson Education Inc.
5. Stephen Brown & Zvonko Vranesic, 2013, *Fundamentals of Digital Logic with Verilog Design*, Third Edition, McGraw-Hill Higher Education, New Delhi, India.

MT1301 **ANALOG DEVICES AND CIRCUITS**

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To study the basic characteristics of Diodes, Transistors, Rectifiers and oscillators.
- To study characteristics; realize various Circuits using Op-Amp ICs.
- To understand the various functionalities of ICs and Waveform generators.
- To study the internal functional blocks of test and Measuring Instruments.
- To study the characteristics of various electronic display devices.

UNIT I ANALOG ELECTRONICS 9

Semiconductor Diodes –Bipolar Junction Transistor – Characteristics Rectifiers and Filters - Regulated Power Supply –Switching Power Supplies, Thermal Considerations - Feedback and power amplifiers - Oscillators: Colpitts oscillator, Hartley oscillator and Wien bridge oscillator

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS 9

Operational amplifiers – Principles, Specifications, characteristics and applications-. Arithmetic Operations, Integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier, A/D & D/A converters.

UNIT III WAVEFORM GENERATORS AND ICs 9

Triangular, Saw tooth and Sine wave generators - Multivibrators - Function generator ICs – Timer ICs –Voltage regulator ICs: fixed, Adjustable and General purpose - V/F and F/V converters – Optocouplers

UNIT IV TEST AND MEASURING INSTRUMENTS 9

Measurement of voltage, current, frequency and power using Multi meters, oscilloscopes, recorders, data loggers, voltage-controlled oscillators, counters, analyzers and printers.

UNITV DISPLAY DEVICES 9

Introduction, Photo Luminescence, Cathode Luminescence, Electro Luminescence, Injection Luminescence, LED, Plasma Display, Liquid Crystal Displays, Touch Screens, Numeric Displays, Photo transistor, Solar cell, CCD.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Apply the various switching devices in electronic circuits.

CO2 Apply Op-Amp application circuits for signal analysis.

CO3 Design various Signal Generation, Voltage regulation circuits using ICs.

CO4 Analyze various internal functional blocks of test & measurement devices.

CO5 Comprehend the principles of various display devices.

TEXT BOOKS

1. Salivahanan S., Suresh kumar N. and Vallavaraj A.,2012, *Electronic Devices and Circuits*, Tata McGraw Hill publishing company, New Delhi, 3rd edition.
2. Roy Chowdhury D. and Jain Shail B., 2018, *Linear Integrated Circuits*, New Age Int. Pub., 5th edition.

REFERENCES

1. Albert Malvino and Bates J.,2013, *Electronic Principles*, Tata McGraw- Hill Pub. Company Ltd., 7th edition.
2. Millman J., Halkias C.C. and SatyabrataJit., 2010, *Electronic Devices and Circuits,* Tata McGraw Hill, New Delhi, 3rd edition.
3. Thomas L. Floyd.,2010,*Electronic Devices*, Pearson Education Asia, 9th edition.
4. NPTEL Video Lecture Notes on *"Analog Electronic Circuits" and "Integrated Circuits, MOSFETs, Op-Amps and their applications*.
5. Donald A Neaman., 2012 *Semiconductor Physics and Devices*, Fourth Edition, Tata McGraw Hill Inc.2012.

L	T	P	C
3	0	0	3

MT1302 FLUID MECHANICS AND THERMAL SCIENCES

OBJECTIVES

This course enables the students to

- To introduce the basic concepts of fluid mechanics.
- To introduce the applications of the conservation laws to flow through pipes.
- To make students understand the working principle of different types of pumps and Hydraulic turbines.
- To make students understand the basic laws of thermodynamics.
- To introduce various mechanisms of heat transfer

UNIT I PROPERTIES OF FLUIDS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – Concept of control volume - Application of continuity equation, Energy equation and Momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – Types of boundary layer thickness – Darcy Weisbach equation – Friction factor- Moody diagram- Commercial pipes- Minor losses – Flow through pipes in series and parallel - Basics of dimensional analysis.

UNIT III HYDRAULIC MACHINES 9

Introduction and classification of hydraulic machines - Reciprocating pump: constructional details, working principle, co-efficient of discharge, slip, power required. Centrifugal pump: classification and working principle, specific speed. Turbines: classification, working principle of impulse and reaction turbine.

UNIT IV LAWS OF THERMODYNAMICS 9

Thermodynamic system and surroundings – Properties of system – State and Equilibrium – Forms of energy – Quasi static process – Zeroth law of thermodynamics – Work and heat transfer – Path and point functions – First law of thermodynamics applied to open systems – SFEE equation and its applications. Second law of thermodynamics applied to Heat engines, Refrigerators & Heat pumps - Carnot's theorem and Clausius inequality – Concept of entropy applied to reversible and irreversible processes – Third law of thermodynamics.

UNIT V HEAT TRANSFER MECHANISMS 9

Heat transfer mechanisms: Conduction – Fourier's Law, thermal resistance. Convection – Newton's law of cooling. Radiation – Wien's law, Kirchhoff's law, Stefan-Boltzmann law. Heat exchangers – LMTD – NTU – Fins.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Describe the properties of fluids and its importance in selection of fluid for suitable application

CO2 Identify the major and minor losses involved in the fluid flow through pipes

CO3 Differentiate the types of hydraulic machines and describe the working principle.

CO4 Apply the basic laws of thermodynamics for different applications.

CO5 Distinguish various modes of heat transfer and determine the heat transfer rate.

TEXT BOOKS

1. Rajput R.K., 2008, *Heat and Mass transfer*, S.Chand and Co Publishing.
2. Modi PN., Seth SM.,2015, *Hydraulics and fluid mechanics including hydraulic machines*", 20th edition, Standard publishers.

REFERENCES

1. Cengel YA., Cimbala J M.,2010, *Fluid Mechanics – Fundamentals and applications*, 2nd Edition, McGraw Hill higher education.
2. Bansal RK., 2011, *Fluid Mechanics and Hydraulics Machines*, 9th edition, Laxmi publications (P) Ltd., New Delhi.
3. Holman, J.P.,2007,*Heat Transfer*, 3rd Edition, McGraw-Hill.
4. White FM., 2011, *Fluid Mechanics*, 7th Edition, Tata McGraw-Hill, New Delhi.
5. Nag P.K.,2005, *Engineering thermodynamics*, Tata McGraw hill.

MT1303 **SOLID MECHANICS**

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS AND STRAIN 9

Stress and strain at a point – Tension, Compression, Shear Stress - Deformation of simple and compound bars – Hooke’s Law – Relationship among elastic constants – Stress Strain Diagram for Mild Steel – Ultimate Stress – Yield Stress – Factor of Safety – Thermal Stresses – Thin Cylinders and Shells – Strain Energy due to Axial Force – Resilience – Stresses due to impact and Suddenly Applied Load – Compound Bars.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – Types transverse loading on beams – Shear force and bending moment in beams– Cantilevers – Simply supported beams and Over – hanging beams - Theory of simple bending–Bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and Deformation in circular and hollow shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double integration method – Macaulay’s methods – Area moment method – Conjugate beam method for computation of slopes and deflections of determinate beams.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and Deformation in thin and thick cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Lame's theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

- CO1 Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- CO2 Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- CO3 Apply basic equation of simple torsion in designing of shafts and helical spring
- CO4 Calculate the slope and deflection in beams using different methods.
- CO5 Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS

1. Bansal, R.K., 2016, *Strength of Materials*, Laxmi Publications (P) Ltd.
2. Jindal U.C., 2009, *Strength of Materials* Asian Books Pvt. Ltd., New Delhi.

REFERENCES

1. Egor. P.Popov, 2002, *Engineering Mechanics of Solids* Prentice Hall of India, New Delhi.
2. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole, 2005, *Mechanics of Materials*, Tata McGraw Hill Publishing 'co. Ltd., New Delhi.
3. Hibbeler, R.C., 2013, *Mechanics of Materials*, Pearson Education, Low Price Edition.
4. Subramanian R., 2010, *Strength of Materials*, Oxford University Press, Oxford Higher Education Series.
5. Timoshenko Timothy., *Strength of Materials,* CBS Publishers & Distributors, 2002.

MT1306 ELECTRICAL CIRCUITS AND MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES

This course will enable the students to

- To discuss electric circuits and provide knowledge on the analysis of circuits using network theorems
- To understand single and three phase circuits, wiring & working principle of transformer
- To describe the working principle, types, characteristics of DC machines
- To describe the working principle of AC machines
- To explain different types of starters and speed control methods of three phase induction motor & Synchronous motor

UNIT I ELECTRICAL CIRCUITS 9

Basic circuit components – Ohms Law - Kirchhoff's Law – Instantaneous Power – Inductors - Capacitors – Independent and Dependent Sources - steady state solution of DC circuits - Nodal analysis, Mesh analysis- Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer theorem- Linearity and Superposition Theorem.

UNIT II AC CIRCUITS 9

Introduction to AC circuits – Waveforms and RMS value – Power and Power factor, Single phase and Three-phase balanced circuits – Three phase loads - House wiring, Industrial wiring, materials of wiring – Principle of Operation of Transformers – EMF Equation of Transformers.

UNIT III DC MACHINES 9

Types - Constructional details – Principle & operation - Emf equation -Methods of excitation of D.C. generators - Characteristics of series, shunt generator - Principle operation of D.C. motor - Back emf and torque equation - Characteristics of series shunt and Compound motors

UNIT IV AC MACHINES 9

Constructional details, principle of operation and performance characteristics Single phase induction motor, Three phase induction motor, Synchronous motors.

UNIT V SPEED CONTROL AND STARTING 9

Speed control of D.C. motors – Three phase induction motors - Synchronous motor – starting methods of D.C. motor, Three phase induction motor and Synchronous motor

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Comprehend the basic laws, mesh current, nodal voltage, voltage and current division for solving circuit problems.

CO2 Solve the networks having DC and AC inputs using network theorems.

CO3 Select DC Machines for a particular application based on its Characteristics.

CO4 Select AC Motor for a particular application based on its Characteristics.

CO5 Differentiate between various types of starting and speed control methods.

TEXTBOOKS

1. D P Kothari and I.J Nagarath, *Electrical Machines Basic Electrical and Electronics Engineering*, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2. Thereja .B.L., *Fundamentals of Electrical Engineering and Electronics*, S. Chand & Co. Ltd., 2008

REFERENCES

1. Del Toro., 2007, *Electrical Engineering Fundamentals*, Pearson Education, New Delhi.
2. John Bird., 2006, *Electrical Circuit Theory and Technology*, Elsevier, First Indian Edition.
3. Allan S Moris., 2006, *Measurement and Instrumentation Principles*, Elsevier, First Indian Edition.
4. Rajendra Prasad., 2006, *Fundamentals of Electrical Engineering*, Prentice Hall of India.
5. A.E.Fitzgerald, David E Higginbotham and Arvin Grabel., 2009, *Basic Electrical Engineering*, McGraw Hill Education(India) Private Limited.
6. N K De, Dipu Sarkar., 2016, *Basic Electrical Engineering*, Universities Press (India) Private Limited

MT1311 SOLID AND FLUID MECHANICS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To study the mechanical properties of materials when subjected to different types of loading.
- To study the effect of hardening and tempering process on materials
- To perform microscopic examination on the hardened and tempered samples
- To verify the principles studied in Fluid Mechanics theory by performing experiments in pumps.
- To verify the principles studied in Fluid Mechanics theory by performing experiments in turbines.

SOLID MECHANICS **30**

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

FLUID MECHANICS **30**

LIST OF EXPERIMENTS

1. Determination of the Coefficient of discharge of given Orifice meter.

2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, Students will be able to

CO1	Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
CO2	Perform shear, impact and deflection test.
CO3	Use the measurement equipments for flow measurement.
CO4	Perform test on different pump.
CO5	Perform test on different turbines.

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Qty.
Universal Tensile Testing machine with double 1 shear attachment – 40 Ton Capacity	1
Torsion Testing Machine (60 NM Capacity)	1
Impact Testing Machine (300 J Capacity)	1
Brinell Hardness Testing Machine	1
Rockwell Hardness Testing Machine	1
Spring Testing Machine for tensile and compressive loads (2500 N)	1
Metallurgical Microscopes	3
Muffle Furnace (800 C)	1
Orifice meter setup	1

Venturi meter setup	1
Rotameter setup	1
Pipe Flow analysis setup	1
Centrifugal pump/submergible pump setup	1
Reciprocating pump setup	1
Gear pump setup	1
Pelton wheel setup	1
Francis turbine setup	1
Kaplan turbine setup	1

MT1316 ELECTRICAL CIRCUITS AND MACHINES LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To understand the basic concepts of electrical circuits and associated theorems.
- To understand the fundamentals of DC shunt motors and induction motors.
- To understand the load test and performance characteristics of DC shunt motor, stepper motor and induction motors.
- To give practical exposure to students on various electrical and electronics components.
- To give hands-on practice on design of simple analog circuits.

LIST OF EXPERIMENTS:

1. Verification of Ohm's Law & Kirchhoff's Laws.
2. Verification of Thevenin theorem
3. Verification of Norton's theorem
4. Load test on D.C. shunt motor.
5. Speed control of D.C. shunt motor.
6. Swinburne's test.
7. Load test on three phase induction motor.
8. No load and blocked rotor tests on three – phase induction motor.

9. Load test on single phase induction motor.
10. No load and blocked rotor tests on single phase induction motor.
11. Load test on Synchronous motors.
12. Performance characteristics of Stepper motor.
13. Performance characteristics of Single phase transformer.
14. Study of Starters

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Compute the performance of the DC machines for varying load.

CO2 Compute the performance of single phase & three phase AC motor for varying load.

CO3 Select suitable speed control method of AC and DC motor.

CO4 Calculate the performance parameters of stepper motor and transformers

CO5 Apply basic electrical laws and network theorems for solution of simple DC & AC circuits.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Quantity
Shunt motor 5HP	3
Single phase Induction Motor 2HP	2
Three phase induction Motor 5HP	2
Single phase transformer 2KVA	1
Three phase auto transformer	2
Single phase auto transformer	2
3 point starter	3
DPST, TPST Each	2
DC source 300v, 100A	1
Ammeter(0-5A),(0-10A)MC Each	2
Ammeter(0-5A),(0-10A)MI Each	2
Voltmeter(0-300V) MC	3
Voltmeter(0-150V),(0-300V),(0-600V)MI Each	2
Wattmeter 150/300V, 5/10A UPF	2

Wattmeter 300/600V,5/10A UPF	2
Wattmeter 150/300V,5/10A LPF	2
Wattmeter 300/600V,5/10A LPF	2
Stepper motor 5Kg	1
Synchronous motor 5KW	1
Rheostat 360 ohm/1.2A	3
Tachometer	5
Rheostat 50 ohm/5A	3
Resistors & Breadboards	-
Dual Regulated power supplies	6
Ammeter A.C and D.C	20
Voltmeters A.C and D.C	20

HS1321 INTERPERSONAL SKILLS- LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES

The course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

Unit I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

Unit II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

Unit III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

Unit IV GROUP DISCUSSION 6

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

Unit V GROUP & PAIR PRESENTATIONS 6

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1	Develop their communicative competence in English with specific reference to listening
CO2	Prepare conversation with reasonable accuracy
CO3	Apply lexical Chunking for accuracy in speaking
CO4	Demonstrate their ability to communicate effectively in GDs
CO5	Explain directions and instructions in academic and business contexts

TEXTBOOKS

1. Brooks, Margret,2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press, Oxford.
2. Richards, C, Jack& David Bholke,2010, *Speak Now Level 3,* Oxford University Press, Oxford.

REFERENCES

1. Bhatnagar, Nitin&MamtaBhatnagar,2010, *Communicative English for Engineers and Professionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate,2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack,2006,*Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter,2014, *Role Play*. Oxford University Press, Oxford.

WEB RESOURCES

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.html

SEMESTER IV

MA1402 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVES

The Course will enable students to

- To make them understand the knowledge of testing of hypothesis for small and large samples.
- To describe the concept of design of experiment to make the judgments in the real life problem.
- To explain the techniques for solving the transcendental equations, system of equations and eigen value problems.
- To introduce the numerical techniques for interpolation in various intervals, differentiation and integration which plays an important role in engineering and technology disciplines.
- To solve the ordinary differential equation with initial conditions.

UNIT I TESTING OF HYPOTHESIS 12

Sampling distributions -Statistical Hypothesis-Tests for single mean and difference of means of large samples (z-test) and Small samples (t-test) – F-test for variance – Chi square test to test the goodness of fit and independence of attributes

UNIT II DESIGN OF EXPERIMENTS 12

Basic principles of experimental deign: Completely randomized design – Randomized block design – Latin square design-2^2 factorial designs.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations : Fixed point iteration method –Newton Raphson method – Solution of linear system of equations: Gauss elimination and Gauss Jordan methods - Iterative methods: Gauss Jacobi and Gauss Seidel – Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 12

Interpolation-Lagrange's and Newton's divided difference interpolations for unequal intervals – Newton's forward and backward difference interpolation for equal intervals– Approximation of derivates using interpolation polynomials – Numerical Solution of single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods : Taylor series method, Euler's method , Modified Euler's method and Fourth order Runge-Kutta method for solving first order equations – Multi step methods : Milne's and Adam –Bashforth predictor corrector methods for solving first order equations.

TOTAL: 60 PERIODS

COURSE OUTCOMES

After completing this course, students will be able to:

CO 1 Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO 2 Apply the basic concepts of classifications of design of experiments.

CO 3 Apply the techniques for solving the transcendental equations, system of equations and eigen value problems.

CO 4 Apply the numerical techniques of differentiation and integration for engineering problems.

CO 5 Solve the ordinary differential equations with initial conditions by various Methods.

TEXT BOOKS

1. Johnson, R A, Miller, I, & Freund, J E 2015, *Miller & Freund's Probability and Statistics for Engineers*, 8th Edition, Pearson Education, Asia.
2. Grewal, B S, & Grewal, J S 2016, *Numerical Methods in Engineering and Science,* 10th Edition Reprint, Khanna Publishers, New Delhi, India.

REFERENCES

1. Walpole, R E, Myers, R H, Myers, S L, & Ye, K 2007, *Probability and Statistics for Engineers and Scientists*, 8th Edition, Pearson Education, Asia.
2. Gupta, S C, & Kapoor, V K 2020, *Fundamentals of Mathematical Statistics*, 12th Edition Reprint, Sultan Chand & Sons.
3. Sankar Rao, K 2018, *Numerical Methods for Scientists and Engineers*, 4th Edition, Prentice Hall of India Private.

4. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.
5. Gerald, C F, & Wheatley, P O 2007, *Applied Numerical Analysis,* 7th Edition, Pearson Education, Asia, New Delhi.

WEB REFERENCES

1. https://fac.ksu.edu.sa/sites/default/files/probability_and_statistics_for_engineering_and_the_sciences.pdf
2. http://www.elcom-hu.com/Mshtrk/Statstics/9th%20txt%20book.pdf
3. https://fac.ksu.edu.sa/sites/default/files/numerical_analysis_9th.pdf

EE1471 CONTROL SYSTEMS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To introduce the components and their representation of control systems
- To learn various methods for analyzing the time response, frequency response and stability of the systems.
- To learn the various approaches for the state variable analysis.

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems-Synchros -Multivariable control system

UNIT II TIME RESPONSE ANALYSIS 9

Standard Inputs - Transient response & Steady state response - Measures of performance of the standard first order and second order system - Effect on an additional zero and an additional pole- Steady error constant and system type number -PID control - Analytical design for PD, PI,PID control systems

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems-Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

CO1 Identify the various control system components and their representations.

CO2 Analyze the various time domain parameters.

CO3 Analysis the various frequency response plots and its system.

CO4 Apply the concepts of various system stability criterions.

CO5 Design various transfer functions of digital control system using state variable models

TEXT BOOK

1. M.Gopal., 2012, *Control System – Principles and Design*, Tata McGraw Hill, 4th Edition.

REFERENCES

1. J.Nagrath and M.Gopal, 2007, *Control System Engineering*, New Age International Publishers, 5 th Edition.
2. K. Ogata., 2012 , *Modern Control Engineering*, 5th edition, PHI.
3. S.K.Bhattacharya.,2013, *Control System Engineering*, 3rd Edition, Pearson.
4. Benjamin.C.Kuo.,1995, *Automatic control systems‖,* Prentice Hall of India, 7th Edition

ME1471 KINEMATICS OF MACHINERY

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
- To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – Kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams – Uniform velocity, parabolic, simple harmonic and Cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and Cycloidal tooth profiles – Spur Gear terminology and definitions –Gear tooth action – Contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction in Plate clutches – Axial clutches – Cone Clutches-Internal expanding rim clutches – Electromagnetic clutches. Friction in Band and Block brakes – External shoe brakes – Internal expanding shoe brake

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

- CO1 Define various components of mechanisms and explain the various inversions of a mechanism
- CO2 Illustrate the kinematic linkages with respect to displacement, velocity, and acceleration at any point
- CO3 Design cam profile for specified follower motions
- CO4 Demonstrate the basic concepts of toothed gearing and the kinematics of gear trains
- CO5 Compute the frictional forces in various power transmission systems such as Clutches and Brakes

TEXT BOOKS

1. Rattan, S.S, 2014, *Theory of Machines*,4thEdition, Tata McGraw-Hill.
2. F.B.Sayyad, 2011, *Kinematics of Machinery*. MacMillan Publichers Pvt Ltd., Tech-max Educational resources.
3. Uicker J.J., 2014, Pennock G.R and Shigley, J.E., *Theory of Machines and Mechanisms*,4th Edition, Oxford University Press.

REFERENCES

1. Khurmi, R.S., 2005, *Theory of Machines*,14 Edition, S Chand Publications.
2. Allen S.Hall Jr., 1961, *Kinematics and Linkage design*, Prentice Hall.
3. Thomas Bevan, 2005, *Theory of Machines*, 3rd Edition, CBS Publishers and Distributors.
4. Robert L. Norton, 2009, *Kinematics and Dynamics of Machinery*, Tata McGraw-Hill

MT1401	MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the basic concepts of sand-casting technique and special casting technique.
- To know the principles, equipment's of different welding techniques.
- To understand the basic concepts and working of Traditional machining process.
- To know the basic concepts and working of Non-traditional machining process.
- To understand the working principles of different types of Metal forming and Plastic manufacturing methods.

UNIT I METAL CASTING PROCESSES 9

Casting types, procedure to make sand mould, types of core making, moulding tools, machine moulding - melting furnaces: Blast and Cupola Furnaces;
Special moulding processes – CO_2 moulding, Shell moulding, Investment moulding, Permanent mould casting, Pressure die-casting, Centrifugal casting, Continuous casting – Stir casting – Casting defects.

UNIT II METAL JOINING PROCESSES 9

Classification of Welding processes- Principles of Oxy-acetylene gas welding - A.C metal arc welding, Resistance welding, Submerged arc welding, Tungsten inert gas welding, Metal inert gas welding - Plasma arc welding - Thermit welding- Electron beam welding- Laser beam welding- Friction welding and friction stir welding -Soldering and brazing- Defects in welding.

UNIT III CONVENTIONAL MACHINING PROCESSES 9

General principles, working and operations of: Lathe, Shaper, Planer, Milling machines, Drilling machine - Gear generation methods - Broaching machines – Cylindrical grinding, Surface grinding, Centreless grinding and Internal grinding – Introduction to CNC Machining.

UNIT IV UNCONVENTIONAL MACHINING PROCESSES 9

General principles, working and applications of: Water jet machining, Abrasive jet machining, Ultrasonic machining, Electric discharge machining, Electro chemical machining, Plasma arc machining, Electron beam machining, Laser beam machining, Chemo-mechanical polishing, Magneto rheological finishing. Comparison of Conventional & Unconventional machining processes.

UNIT V **METAL FORMING AND MANUFACTURING OF PLASTIC COMPONENTS** **9**

Principles and applications: Forging, Rolling, Extrusion, Wire drawing, Spinning, HERF Process - Powder metallurgy

Types of plastics – Moulding of Thermoplastics – Injection moulding– Blow moulding – Rotational moulding – Film blowing – Extrusion – Thermoforming – Processing of Thermosets –Compression moulding – Transfer moulding – Bonding of Thermoplastics.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to

- CO 1 Identify and Select suitable casting process for a specific component
- CO 2 Explain the working principles and applications of different arc welding processes, special welding process and defects associated with it
- CO 3 Select the suitable process for manufacturing of components using suitable conventional machining
- CO 4 Select the suitable process for manufacturing of components using suitable unconventional machining
- CO 5 Understand various metal forming process and manufacturing methods of plastic components

TEXT BOOKS

1. Hajra Choudhary. S.K and Hajra Choudhary. A.K., 2010, *Elements of Workshop Technology*, volume I and II, Media Promoters and Publishers Private Limited, Mumbai.
2. Kalpakjian. S, 2018, *Manufacturing Engineering and Technology*, 7th Edition, Pearson Education India Edition.

REFERENCES

1. *H.M.T. Production Technology – Handbook*, Tata McGraw-Hill, 2000.
2. Roy A. Lindberg, 2006, *Processes and Materials of Manufacture*, PHI / Pearson education.
3. Black J.T and Ronald A. Kosher, 2017, *Degarmos Materials and Processes, in Manufacturing* 12th Edition, Wiley Publishers.

4. Sharma, P.C., 2006, *A Text book of production Technology*, S.Chand and Co. Ltd.
5. Adithan. M and Gupta. A.B., 2006, *Manufacturing Technology*, New Age.

MT1402 MICROPROCESSORS AND ITS APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES

- Understand fundamental operating concepts behind microprocessors and microcontrollers.
- Emphasis on the hardware features of Microprocessor 8085 and Microcontroller 8051 with their functions
- To apply instructions and addressing modes and write programs using 8085
- Understand commonly used peripheral / interfacing
- To apply instructions and algorithms write programs using 8051.

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction - format and addressing modes – Assembly language format – Data transfer, data manipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Serial Communication – Interrupts-Introduction to Arduino & Raspberry pi.

UNIT IV PERIPHERAL INTERFACING 9

Introduction on Architecture, configuration and interfacing, with ICs: 8255, 8259, 8254,8237,8251, 8279 - A/D and D/A converters.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises-key board and display interface – Closed loop control of servo motor- stepper motor control – Washing Machine Control.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Krishna Kant., 2013, *Microprocessor and Microcontrollers*, Eastern Company Edition, Prentice Hall of India, New Delhi.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely., 2007, *The 8051 Micro Controller and Embedded Systems*, PHI Pearson Education, 5th Indian reprint.

REFERENCES

1. N.Senthil Kumar, M.Saravanan, S.Jeevananthan., 2016, *Microprocessors and Microcontrollers*, Oxford.
2. Soumitra Kumar Mandal., 2013, *Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085,8086,8051*,McGraw Hill Edu.
3. Valder – Perez., 2013, *Microcontroller – Fundamentals and Applications with Pic,* Yeesdee Publishers, Tayler & Francis.
4. R.S. Gaonkar., 2013, *Microprocessor Architecture Programming and Application, with 8085*, Wiley Eastern Ltd., New Delhi.

MT1403 **SENSORS AND INSTRUMENTATION**

L	T	P	C
3	0	0	3

OBJECTIVES

This course enables the students to

- To understand the concepts of measurement technology and various transducers, sensors.
- To know about the different motion, proximity, ranging sensors.
- To learn the various sensors used to measure various physical and optical parameters.

- To acquire knowledge on various Pressure, Temperature and advanced sensors.
- To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

UNIT I INTRODUCTION 9

Basics of Measurement Units and Standards– Classification of sensors –Contact and Non Contact Sensors- Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors —Sensor calibration techniques – Sensor Output Signal Types –Wiring Techniques- specifications and manufacturer of sensors

UNIT II MOTION, PROXIMITY AND RANGING SENSORS 9

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III FORCE, MAGNETIC, HEADING AND OPTICAL SENSORS 9

Strain Gage, Load Cell, and Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers - Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors

UNIT IV PRESSURE TEMPERATURE AND ADVANCED SENSORS 9

Pressure –Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.

UNIT V SIGNAL CONDITIONING AND DAQ SYSTEMS 9

Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multichannel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After successful completion of the course, the students will be able to

CO1	Outline the various calibration techniques and types of sensors and transducers
CO2	Summarize the various sensors used in the Motion and Ranging applications
CO3	Describe the working principle and characteristics of force, magnetic , heading and optical sensors
CO4	Understand the basic principles of various pressure and temperature, smart sensors
CO5	Ability to implement the DAQ systems with different sensors for real time applications

TEXT BOOKS

1. Ernest O Doebelin., 2009, *Measurement Systems – Applications and Design*, Tata McGraw-Hill.
2. Sawney A K and Puneet Sawney., 2013, *A Course in Mechanical Measurements and Instrumentation and Control*, 12th edition, Dhanpat Rai & Co, New Delhi.

REFERENCES

1. C. Sujatha Dyer, S.A., 2001, *Survey of Instrumentation and Measurement*, John Wiley & Sons, Canada.
2. Hans Kurt Tönshoff (Editor), Ichiro., 2001, *Sensors in Manufacturing Volume 1*, Wiley-VCH April.
3. John Turner and Martyn Hill., 1999, *Instrumentation for Engineers and Scientists*, Oxford Science Publications.
4. Patranabis D., 2011, *Sensors and Transducers*, 2nd Edition, PHI, New Delhi.
5. Richard Zurawski., 2015, *Industrial Communication Technology Handbook* 2nd edition, CRC Press.

MT1411 **MANUFACTURING TECHNOLOGY AND SENSORS LABORATORY**

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To demonstrate and study about various machines
- To understand the machine capabilities and processes
- To provide knowledge about sensors.
- To provide knowledge about actuators.
- To provide hands on experience to measure different signal using sensor and processing them in required form.

LIST OF EXPERIMENTS

MANUFACTURING TECHNOLOGY LABORATORY **(30 Hours)**

1. LATHE PRACTICE

a. Plain Turning
b. Taper Turning
c. Thread Cutting

Estimation of machining time for the above turning processes.

2. DRILLING PRACTICE

a. Drilling
b. Tapping
c. Reaming.

3. MILLING

a. Surface Milling.
b. Gear Cutting.
c. Contour Milling.

4. PLANNING AND SHAPING

a. Cutting Key Ways.
b. Dovetail machining.

SENSORS LABORATORY **(30 Hours)**

1. Design and testing of Digital Comparator
2. Design and testing of Voltage to frequency converter and frequency to voltage converter.

3. Design and testing of sample and hold circuit.
4. Design and testing of Flash type Analog to Digital Converters.
5. Design and testing of instrumentation amplifier using OP-AMP.
6. Displacement measurement using potentiometer and LVDT and plotting the characteristic curves.
7. Study of Characteristics and calibration of strain gauge and Load Cell
8. Temperature measurement using Thermocouple, Thermistor and RTD and comparing the characteristics.
9. Temperature Measurement using MultiSIM Live Software
10. Measurement of sound using microphones and sound level meter.
11. Conversation of time domain audio signal into frequency domain signal (FFT).
12. Study of Temperature & Pressure Transmitter

TOTAL: 60 PERIODS

COURSE OUTCOMES

After successful completion of the course, the students will be able to:

CO1 Utilize different machine tools for manufacturing gears

CO2 Utilize different machine tools for finishing operations.

CO3 Generate appropriate design procedure, suitable for signal conversion to interface with computer.

CO4 Design appropriate circuits by using conventional formulas used in signal conditioning and conversion.

CO5 Generate appropriate design procedure to obtain a required measurement data for temperature, force, humidity, displacement and sound.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

NAME OF THE EQUIPMENT	Qty.
Lathe	15 No.
Drilling Machine	1 No.
Milling Machine	2 No.
Planning Machine	1 No.
Shaping Machine	2 No.
Digital Signal Oscilloscope	6 No.

Function Generator	5 No.
Breadboard	10 No.
Regulated Power supply	6 No.
LVDT	1 No.
Thermistor	1 No.
Thermocouple	1 No.
RTD	1 No.
Load cell setup	1 No.
4 Channel data acquisition system for strain gauge	1 No.
Sound level meter	1 No.
Computer with LABVIEW/ MATLAB/SCILAB	1 No.
Prony brake dynamometer	1 No.
Hygrometer	1 No.

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MT1412 MICROPROCESSORS AND ITS APPLICATIONS LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES

This course enables the students to

- To focus on the implementation of arithmetic operations using microprocessors
- To focus on the implementation of arithmetic operations using microcontrollers
- To simulate assembly language programs.
- To implement various on-chip and off-chip interfacing and algorithms
- To develop mini projects using processors

LIST OF EXPERIMENTS

1. Simple arithmetic operations: addition / subtraction / multiplication / division.
2. Programming with control instructions
   i. Ascending / Descending order, Maximum / Minimum of numbers
   ii. Programs using Rotate instructions.
   iii. Hex / ASCII / BCD code conversions
3. Interface Experiments: with 8085
   i. A/D Interfacing & (ii) D/A Interfacing.
4. Traffic light controller

5. I/O Port / Serial communication
6. Programming Practices with Simulators/Emulators/open source
7. Read a key interface display
8. Demonstration of basic instructions with 8051 Micro controller execution, including:
    i. Conditional jumps, looping ii) Calling subroutines
9. Programming I/O Port 8051
    i. study on interface with A/D & D/A
    ii. study on interface with DC & AC motor
10. Mini project development with processors

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Apply the concepts of partial derivatives to find the higher derivatives of multi variable functions.
CO2	Apply the techniques of multi variable calculus to compute the gradients, directional derivative and extreme values
CO3	Test the given system of equation is linearly dependent or independent.
CO4	Apply the concept of eigen values and eigenvectors for Diagonalization of a matrix
CO5	Apply the inner product techniques for finding the orthonormal vector and minimal solution to the system of linear equation

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

Description of Equipment	**Quantity required**
8085 Microprocessor Trainer with Power Supply	15nos
8051 Micro Controller Trainer Kit with power supply	15nos
8255 Interface board	5nos
8251 Interface board	5nos
8259 Interface board	5nos
8279 Keyboard / Display Interface board	5nos
8254 timer counter	5nos
ADC and DAC card	5nos
AC & DC motor with Controller	5nos
Traffic Light Control System	5nos

HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES

The Course will enable learners to:

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence. Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES

CO1	Understand how the text positions the reader
CO2	Develop critical thinking while reading a text
CO3	Develop a descriptive paragraph
CO4	Make use of sentence structures effectively when creating an essay
CO5	Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCES

1. Davis, Jason & Rhonda LIss. *Effective Academic Writing (Level 3)* Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. *Enriching Speaking and Writing Skills*. Second Edition. 2012, Orient Black swan:Hyderabad.
3. Withrow, Jeans and et al. *Inspired to Write. Readings and Tasks to develop writing skills*. 2004, Cambridge University Press: Cambridge.
4. Goatly, Andrew. *Critical Reading and Writing*, 2000, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, *The Professional Writing Guide: Knowing Well and Knowing Why*, 2004,Business & Professional Publishing: Australia.

WEB RESOURCES

1. http://learnenglishteens.britishcouncil.org/skills/reading
2. https://learnenglish.britishcouncil.org/skills/reading
3. https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
4. https://linguapress.com/advanced.html

KAMARAJ COLLEGE OF ENGINEERING & TECHNOLOGY

(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. POLYMER TECHNOLOGY

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

VISION:

To make the Department of Polymer Technology of this Institution the unique of its kind in the field of Research and Development activities in this part of the world.

Mission of the Department:

To impart highly innovative and technical knowledge in the field of Polymer Technology to the urban and unreachable rural student folks through Total Quality Education.

Program Educational Objectives (PEOs):

PEO 1:

Graduates will be technically proficient in Polymer Technology with a commitment to quality, timeliness and compete with confidence in their career.

PEO 2:.

Graduates will contribute towards research and Professional development and entrepreneurship.

PEO 3:

Graduates will engage in lifelong learning or continuous education opportunities.

PROGRAM OUTCOMES:

After going through the four years of study, the Polymer Technology graduates will have the ability to

S. No.	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
5	Modern tool usage	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
7	Environment and sustainability	Understand the impact of the professional engineering solutions in societal and environmental contexts, and

		demonstrate the knowledge of, and need for sustainable development.
8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1:

Polymer industry oriented preparedness: Reveal an ability to identify careers in polymer technology's domains like, synthesis of polymers, processing and quality with adept skills required to work in polymer technology laboratory or manufacturing facility.

PSO2:

Higher Education Preparedness: Demonstrate an ability to appear for competitive examinations to pursue higher studies.

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S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

B.TECH. POLYMER TECHNOLOGY

Regulation - 2020

AUTONOMOUS SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI

(III & IV)

SEMESTER III

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1304	Statistics and Partial Differential Equations	BS	3	1	0	4	4
2	PT1301	Fundamentals of Polymer Science	PC	3	0	0	3	3
3	PT1302	Plastics Materials- I	PC	3	0	0	3	3
4	PT1303	Polymer Physics	PC	3	0	0	3	3
5	PT1306	Introduction to Chemical Engineering	ES	3	0	0	3	3
PRACTICAL								
6	PT1311	Polymer Identification and Analysis Laboratory	PC	0	0	4	4	2
7	PT1316	Chemical Engineering Laboratory	ES	0	0	4	4	2
8	HS1321	Interpersonal Skills- Listening and Speaking	EEC	0	0	2	2	1
			TOTAL	**15**	**1**	**10**	**26**	**21**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA1471	Numerical Methods	BS	3	1	0	4	4
2	PT1401	Mould Manufacturing Technology	PC	3	0	0	3	3
3	PT1402	Plastic Processing Technology-I	PC	3	0	0	3	3
4	PT1403	Plastics Materials II	PC	3	0	0	3	3
5	PT1404	Polymer Rheology	PC	3	0	0	3	3
6	PT1405	Rubber Materials	PC	3	0	0	3	3
PRACTICAL								
7	PT1411	Mould Manufacturing Technology Laboratory	PC	0	0	4	4	2
8	PT1412	Polymer Preparation Laboratory	PC	0	0	4	4	2
9	HS1421	An Introduction to Reading and Writing	EEC	0	0	2	2	1
			TOTAL	**18**	**1**	**10**	**29**	**24**

SEMESTER III

MA1304 STATISTICS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

OBJECTIVES:

- To make the students understand the concept of testing of hypothesis for small and large samples.
- To describe the concept of design of experiments to make the scientific judgements in the Engineering problem.
- To introduce the basic concepts of statistical quality control in the field of Engineering and Technology.
- To introduce the basic concepts of PDE for solving standard partial differential equations.

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems

UNIT I TESTING OF HYPOTHESIS **12**

Sampling distributions – Statistical Hypothesis – Type I and Type II errors – Tests for single mean and difference of means of large samples (z-test) and Small samples (t-test) – F-test for variance – chi-square test for goodness of fit – independence of attributes – Demo using Excel.

UNIT II DESIGN OF EXPERIMENTS 12

Basic Principles of Experimental Design – Completely randomized design – Randomized block design – Latin square design – 2^2 factorial design – Demo using Excel

UNIT III STATISTICAL QUALITY CONTROL **12**

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits – Demo using Excel.

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT V APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS **12**

Dirichlet's conditions – General Fourier series – Half range sine series – Half range cosine series – Classification of PDE – Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Apply the concept of testing of hypothesis for small and large samples
CO2	Apply the basic concepts of classifications of design of experiments in the field of Engineering and Technology
CO3	Apply the techniques of Statistical quality control in Engineering problems

CO4 Solve various types of partial differential equations

CO5 Apply the Fourier series techniques in solving heat flow and wave equations

TEXT BOOKS:

1. Devore, J L 2017, *Probability and Statistics for Engineering and the Sciences*, Cengage Learning, 9th Edition, Boston
2. Johnson, R A, 2017, *Miller and Freund's Probability and Statistics for Engineers*, Pearson India Education, Asia, 9th Edition, New Delhi.
3. Grewal, B, S, 2014, *Higher Engineering Mathematics*, Khanna Publishers, 43rd Edition New Delhi.

REFERENCES:

1. Milton, J S & Arnold, J C, 2008 *Introduction to Probability and Statistics*, Tata McGraw Hill, 4th Edition, New Delhi.
2. Ross, S M, 2014 *Introduction to Probability and Statistics for Engineers and Scientists*, Elsevier, 5th Edition, New Delhi
3. Spiegel, M R, 2017 Schiller, J, Srinivasan, R A & Goswami, D, *Schaum's Outline of Theory and Problems for Probability and Statistics*, McGraw Hill Education, 3rd Edition, New Delhi.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., 2004 "*Schaum's Outline of Theory and Problems of Probability and Statistics*", Tata McGraw Hill Edition
5. Erwin Kreyszig, 2016 "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India.

PT1301 FUNDAMENTALS OF POLYMER SCIENCE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the students to understand the basic concept of polymer, mechanism and various techniques of polymerization, characterization of polymers by molecular weight, reactions and degradation of polymers

UNIT I BASIC CONCEPTS OF POLYMER 9

Basic concepts of macromolecules – Monomers - Functionality - Classification and Nomenclature of polymers - Types of polymers. Polymer Architectures – Linear- Branched – cross linked Macromolecules. Isomerism in Polymers –structural - stereo-conformational isomerism. Copolymers – statistical - alternating - block and graft copolymers.Step growth polymerization - Mechanism - Kinetics - Bi-functional systems - Poly functional systems.

UNIT II POLYMERIZATION MECHANISMS 9

Introduction-Addition polymerization Mechanism and kinetics of free radical – Cationic – Anionic Polymerisation - Initiator systems - Chain length and degree of Polymerization – Control of molecular weight - Chain transfer - Inhibition Coordination polymerization - Mechanism –Kinetics - Ring opening polymerization-Atom transfer radical-polymerization. Reversible Addition Fragmentation Termination (RAFT).

UNIT III COPOLYMERIZATION MECHANISM 9

Copolymerization –Types of copolymerization- Mechanism and Kinetics of free radical - Ionic copolymerization. Chemistry of copolymerization-monomer and radical reactivity –streric effects-Alteration –polar effects-Q-e scheme.
Determination of Monomer reactivity ratios. Polymerization techniques - Bulk polymerization-Solution polymerization - Suspension polymerization - Emulsion polymerization – Interfacial condensation.

UNIT IV POLYMER MOLECULARWEIGHT 9

Molecular weight- Molecular weight averages - Molecular weight distribution - Unidispersity, polydispersity, Degree of polymerization.
Molecular weight determination – Absolute methods: Basic concepts of end group analysis, colligative properties, membrane osmometry, vapour pressure osmometry-light scattering, and Relative methods: Viscometry -gel permeation chromatography

UNIT V REACTIONS OF POLYMERS 9

Chemical reactions of polymers – Addition and substitution reactions - Hydrolysis – Acidolysis –Aminolysis –– cross linking reactions. Polymer degradation – Mechanical degradation – Oxidative degradation – Hydrolytic degradation – Photo degradation

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Develop the knowledge in the basic concepts of polymers, their classifications and nomenclature.
CO2	Evaluate the mechanism and kinetics of free radical cationic and anionic polymerization
CO3	Appraise the mechanism and kinetics of copolymer free radical the synthesis techniques for polymer
CO4	Determine the molecular weight of the polymer and understand the techniques used for determination.
CO5	Acquire knowledge about degradation mechanism of polymers and chemical reaction of polymers

TEXT BOOKS:

1. Billmeyer,F.W3rdEdition, 2008.*"Textbook of Polymer Science*", Wiley international publishers.
2. Gowariker, V.R, Viswanathan,N.V, JayadevSreedhar, 2nd edition 2015"*Polymer Science"* – New AgeInternational (P) Ltd, Publishers.
3. Anil kumar and GuptaR K , 2003 *Fundamentals of polymer engineering* Marcel Dekker, Inc

REFERENCES:

1. George Odian, 4thEdition,2004."*Principles of polymerisation*", Wiley international publishers.
2. CowieJM.G., 1991"*Polymers: Chemistry and Physics of Modern Materials*", Blackie, and London
3. Young R.J and .Lovell,P 2nd ed 1991 *"Introduction to Polymers*", Chapman & Hall,.
4. PremamoyGhosh1990, *"Polymer Science and Technology of Plastics and Rubbers*", Tata McGraw- Hill, New Delhi.
5. Painter PC, Coleman MM 2009*Essentials of polymer science and engineering*. DeStech Publications, Lancaster, PA.
6. PremamoyGhosh2011'*Polymer Science and Technology'* Tata McGraw – Hill.
7. Charles E. Carraher Jr. Fourth Edition 2017*Introduction to Polymer Chemistry*, CRC Press.
8. Joel R. Fried, 2014 "*Polymer Science and Technology*", Prentice Hall.
9. Ravve,2012 *A Principles of Polymer Chemistry*, Springer- Verlag New York,.

10. Andrew J. Peacock and Allison Calhoun, 2012*Polymer Chemistry: Properties and Application,* Carl Hanser Verlag GmbH & Company.

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PT1302 PLASTICS MATERIALS I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the general methods of preparation of individual class of plastics Materials
- To study about the general properties, processing behavior and applications of different class of plastics materials
- To understand about the structure- property relation of different class of plastics materials.

UNIT I INTRODUCTION 9

Basic chemistry of polymers-nomenclature of polymers sources for raw materials. Methods of manufacturing –properties and applications of Natural Polymers - Shellac resin and natural rubber-Cellulosics - Cellulose nitrate, cellulose acetate, cellulose acetate butyrate, Ethyl cellulose and others.

UNIT II COMMODITY THERMOPLASTICS-I 9

Preparation- properties - and applications of Polyolefine-Polyethylene- LDPE -LLDPE-HDPE, HMWHDPE- UHMWHDPE - Crosslinked polyethylene- Chlorinated polyethylene –Polypropylene – Homo & Co polymer

UNIT III COMMODITY THERMOPLASTICS-II 9

Preparation - properties - and applications of Vinyl plastics - Polyvinyl chloride, C-PVC, Polyvinyl Acetate, Polyvinylidene chloride, Polyvinyl alcohol. Polystyrene

UNIT IV GENERAL PURPOSE THERMOSETS 9

Preparation - properties - and applications of: Phenol formaldehyde (PF), Amino plastics: Urea formaldehyde (UF) - Melamine formaldehyde (MF), Unsaturated polyesters, Alkyd resins.

UNIT V ENGINEERING AND SPECIALITY THERMOSETS 9

Preparation - properties - and applications of: Epoxy Plastics, Polyurethane (PU) Silicones

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of this course, Students will be able to

CO1	Acquire knowledge on manufacturing, properties and applications of Natural polymers
CO2	Correlate the Olefin polymers manufacturing methods, properties and applications
CO3	Correlate the vinyl polymers manufacturing methods, properties and applications
CO4	Describe the manufacturing methods, properties and applications of general purpose themoset polymers
CO5	Explain the methods of preparation , properties and applications of engineering and speciality polymers

TEXT BOOKS:

1. Brydson, J.A., 1999. *Plastics materials*. Elsevier.
2. Feldman, D. and Barbalata, A., 1996. *Synthetic polymers: technology, properties, applications*. Springer Science & Business Media.

REFERENCES:

1. Olabisi, O. and Adewale, K. eds., 2016. *Handbook of thermoplastics* (Vol. 41). CRC press.
2. Saunders, K.J., 2012. *Organic polymer chemistry: an introduction to the organic chemistry of adhesives, fibres, paints, plastics and rubbers*. Springer Science & Business Media.
3. Rubin, I.I. ed., 1990. *Handbook of plastic materials and technology* (p. 1745). New York: Wiley.
4. Gebelein, C.G., 1993. *Biotechnological Polymers*. Technomic Publishing Co., Lancaster, Pa.

PT1303 POLYMER PHYSICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the students understand physical and conformational properties of polymeric materials.
- To know the molecular arrangement in polymers and their orientation under the influence of stress.
- To know the solubility behavior of polymers.

UNIT I FUNDAMENTALS OF POLYMER PHYSICS 9

Potential energy and conformational energy of molecules - conformations and configurations, Tacticity, isomeric states and isomerism in polymers, stereoisomerism, geometric isomerism

Freely jointed and freely rotating chain models -Random coils and average end to end distance - (Derivation only)

UNIT II THERMODYNAMIC PROPERTIES 9

Laws of Thermodynamics - Freely jointed and freely rotating chain models - Entropy and enthalpy- Energy driven and entropy driven elasticity - Thermo elasticity -Thermodynamic treatment - entropic and energetic contributions (Derivation only)

UNIT III POLYMER CRYSTAL FORMATION 9

Amorphous State - Transition temperatures- Glass transition temperature Theory- Factors influencing glass transition Temperature- Crystalline State - polymorphism – Polymer single crystals, lamellae, spherulites – Crystallinity -factors affecting crystallinity -X-ray diffraction.

UNIT IV CHAIN ORIENTATION 9

Chain orientation - Concept of chain orientation - orientation in amorphous and crystalline polymers - Uniaxial and biaxial orientation practical significance – Orientation processes: spinning Process – Optical Properties of polymers – Birefringence, Haze, Transparency.

UNIT V POLYMER SOLUTIONS 9

Polymer solutions - Terms and definitions, types of solutions - Hilderbrand approach, Flory Huggins theory - Thermodynamic view of miscibility, upper critical solution temperature (UCST), lower critical solution temperature (LCST) - solubility parameter, determination of solubility parameter of polymers - theta conditions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of this course, Students will be able to

CO1	Understand the relationship between structure and properties of polymers and will be familiar with various techniques for the study of the size of polymers
CO2	Interpret the response of polymer towards temperature and understand the theories that support their behavior
CO3	Understand the amorphous and crystalline nature of polymers, their influence on properties and methods of determining them
CO4	Acquire knowledge of polymers behavior under orientation and various methods of orientation for the improvement in properties of polymers
CO5	Describe the various theories of polymers in solution and that importance in various applications

TEXT BOOKS:

1. Lewis, D. and Glasstone, S., 1960. *Elements of physical chemistry*. Macmillan.
2. Gedde, U.L.F., 1995. *Polymer physics*. Springer Science & Business Media.

REFERENCES:

1. Ulf W. Gedde, 2001. *Polymer Physics*, Springer – Science Business Media, B.V. 1st Edition.

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PT 1306 INTRODUCTION TO CHEMICAL ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide the basic fundamentals in the field of chemical engineering.
- To impart the thorough knowledge in fluid flow behavior.
- To gain the ideas in the field of heat transfer operation
- To learn the principles in Mass transfer operations

UNIT I Fluid Flow **9**

Newtonian and Non-Newtonian fluids – Continuity Equation - Bernoulli's theorem-Hagen Poisuille equation, Measurement of fluid flow- Orificemeter, Venturimeter and Pitot tube.

UNIT II MECHANICAL OPERATIONS 9

Properties of solids - Laws of crushing, Crushers - Grinders – Screen Analysis - Equipment for screening, Cyclones and Hydro cyclones.

(Basic principles and equipment description only. Mathematical consideration not required)

UNIT III HEAT TRANSFER 9

Modes of heat transfer; Heat transfer by conduction - Fourier's law, conduction across composite walls. Heat transfer by natural & forced convection – Heat Exchangers - Co current, Counter current, Shell & tube heat exchangers.

(Basic principles and equipment description only. Mathematical consideration not required)

UNIT IV MASS TRANSFER 9

Principles of diffusion, theory of diffusion, Two film theory and mass transfer coefficients Humidification – operation, Equipment's - cooling towers and spray chambers - Drying - Principles and definitions. Rate of batch drying- Equipment for drying.

(Basic principles and equipment description only. Mathematical consideration not required)

UNIT V UNIT OPERATIONS 9

Absorption - Principle and equipment (packed towers and plate columns). Distillation – flash distillation, and Binary distillation. Industrial equipment for distillation Adsorption - Principle and equipment for adsorption.

(Basic principles and equipment description only. Mathematical consideration not required)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Demonstrate the flow meters used in process industries and apply fluid flow behavior in polymer processing.
CO2	Operate different size reduction equipments and screening Operations
CO3	Compare the conduction, convection and Radiation modes of heat transfer.
CO4	Apply the theories behind the mass transfer operations.
CO5	Demonstrate the concept of distillation equipment in Polymer industries.

TEXT BOOKS:

1. Shri Gavhane, K.A., 2015. *"Unit Operations I & II",* NiraliPrakashan Publication.
2. McCabe, W.L., Smith, J.C. and Harriott, P., 2014. *Unit operations of chemical engineering* (Vol. 7). New York: McGraw-hill.
3. Richardson, J.F. and Harker, J.H., 2020. *Coulson and Richardsons Chemical Engineering*.

REFERENCES:

1. Badger, W.L, Banchero, J.T., 2002. *"Introduction to Chemical Engineering"*, McGraw-Hill, UK, 1st Edition.
2. Felder, R.M., Rousseau, R.W. and Bullard, L.G., 2020. *Elementary principles of chemical processes*. John Wiley & Sons.
3. Serth, R.W. and Lestina, T., 2014. *Process heat transfer: Principles, applications and rules of thumb*. Academic press.
4. Bergman, T.L., Incropera, F.P., DeWitt, D.P. and Lavine, A.S., 2011. *Fundamentals of heat and mass transfer*. John Wiley & Sons.
5. Welty, J., Rorrer, G.L. and Foster, D.G., 2020. *Fundamentals of momentum, heat, and mass transfer*. John Wiley & Sons.

PT1311 POLYMER IDENTIFICATION AND ANALYSIS LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To identify and analyze a polymer by chemical analysis

LIST OF EXPERIMENTS

Part –A Identification

1. Identification of Rubbers: NR, SBR, BR, IR, IIR, EPDM, CR, NBR, Hypalon, Thiokol,Silicone.
2. Identification of Plastics: PE, PP, PS, PVC, PVA, PF, UF, MF, Polyester
3. Identification of Thermoplastic Elastomers: SIS, SBS, SEBS, Hytrel

(Any six polymer samples in Part –A)

Part –B Determination / Analysis

1. Quantitative estimation of the following monomers: Aniline, Phenol, Acetone, Ethyl Acetate, Formaldehyde, Acrylonitrile, Urea, Glycol, Methyl methacrylate
2. Determination of molecular weight by viscosity method and end group analysis.
3. Estimation of Polymers: Acrylonitrile content of NBR, Chlorine content of CR, Rubber hydrocarbon content of NR.
4. Analysis of Polymer Compounds: Iodine value of rubber compounds, Carbon black content, Free sulphur content, Total inorganic content, Silica content
5. Determination of physical properties - boiling point using standards techniques,
6. Determination of physical properties - melting point, refractive index, specific gravity of polymer materials
7. Determination of Melt flow index of polymer materials.
8. Determination of water soluble matter in given pigment.
9. Determination of solubility of a given polymer in different solvents
10. Determination of viscosity of a resin by Ford Cup or Brook field viscometer.
11. Determination of gel time of a thermoset materials at a given temperature

(Any four experiments in Part –B)

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Identify a polymer by chemical analysis
CO2	Analyze a physical properties of polymer.
CO3	Estimate the quantity of monomers
CO4	Determine the solubility of polymers
CO5	Determine the gel time of thermoset materials

REFERENCES:

1. Sandler, S.R ,Karo, W,BonesteelJ and Pearce E.M, 1998 *Polymer Synthesis andCharacterization: A Laboratory Manual,* Elsevier.
2. Braun, D ,CherdonH and Ritter,H, 2013*Polymer Synthesis: Theory and Practice*, Springer Science.
3. Kuruvilla Joseph and Gem Mathew,2004,*Advanced Practical Polymer Chemistry*, Polymer Publications.
4. Dietrich Braun. 5th edition, 2005*Simple Methods for Identification of Plastics,*Hanser Publications.
5. Siddaramaiah, 2007 "*Practicals in Polymer Science*", CBS Publishers & Distributors, New Delhi.
6. Crompton T R, Vol. 1, 2008, *Characterisation of Polymers.* vol.1, SmithersRapra Technology Limited.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Bunsen Burner	15
2.	Electronic Balance	1
3.	Thermostatic Water bath	2
4.	Melting Point Apparatus	1
5.	Retort Stand	15
6.	Polymer Samples and Glassware	15
7.	Burette	15
8.	Pipette	15
9.	Funnel	15

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PT1316 CHEMICAL ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To impart knowledge in the field of flow measuring instruments
- To learn the fundamental flow analysis of heat exchanger.
- To understand the knowledge in different size reduction equipments.

LIST OF EXPERIMETS

1. To determine the pipe friction using Flow through rough and smooth pipes.
2. To determine the efficiency of pump using Centrifugal pump.
3. To determine the coefficient of discharge of orifice meter.
4. To find the efficiency of Air compressor
5. To Calibrate the rotameter
6. To find the Pressure drop in packed bed
7. To study the concept of Fluidization by using fluidized bed
8. To determine the coefficient of discharge of Venturi meter
9. To find the Thermal conductivity of solids.
10. To find overall heat transfer coefficient of the Heat exchanger
11. To find the Stefan-Boltzman constant
12. To find the new surface area created by Jaw crusher
13. To find the critical speed of Ball Mill
14. To find the Screening efficiency.
15. To separate the component by Simple distillation
16. To separate the component by using steam distillation
17. To find the Particle size and Surface area of filler particles.

(Any Nine Experiments)

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Demonstrate the different flow meters used in process industries.

CO2 Operate the different size reduction equipments such as Jaw crusher and ball mill.

CO3 Apply the knowledge in the field of various screens used in process industries.

CO4 Demonstrate the parallel and counter flow arrangements of Heat exchanger.

CO5 Apply the knowledge in mass transfer operations like simple and steam distillation.

REFERENCES:

1. Shri Gavhane, K.A., 2015. *"Unit Operations I & II",* NiraliPrakashan Publication.
2. McCabe, W.L., Smith, J.C. and Harriott, P., 2014. *Unit operations of chemical engineering* (Vol. 7). New York: McGraw-hill.
3. Richardson, J.F. and Harker, J.H., 2020. *Coulson and Richardsons Chemical Engineering*.

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HS1321 INTERPERSONAL SKILLS - LISTENING AND SPEAKING

L	T	P	C
0	0	2	1

OBJECTIVES:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations..

UNIT I LISTENING AS A KEY SKILL 6

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversationstarters: small talk

UNIT II LISTEN TO A PROCESS INFORMATION 6

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate acomplete idea as opposed to producing fragmented utterances - compare andcontrast information and ideas from multiple sources- converse with reasonable accuracy overa wide range of everyday topics.

UNIT III LEXICAL CHUNKING 6

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minuteinformal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail.

UNIT IV GROUP DISCUSSION **6**

Being an active listener: giving verbal and non-verbal feedback – participating in a groupdiscussion – summarizing academic readings and lectures conversational speech listening toand participating in conversations – persuade- negotiate disagreement in group work.

UNIT V GROUP & PAIR PRESENTATIONS **6**

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

TOTAL: 30 PERIODS

COURSE OUTCOMES:

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

CO1	Develop their communicative competence in English with specific reference to listening
CO2	Prepare conversation with reasonable accuracy
CO3	Apply lexical Chunking for accuracy in speaking
CO4	Demonstrate their ability to communicate effectively in GDs
CO5	Explain directions and instructions in academic and business contexts

TEXT BOOKS:

1. Brooks,Margret,2011, *Skills for Success. Listening and Speaking. Level 4,* Oxford University Press,Oxford.
2. Richards, C, Jack& David Bholke,2010, *Speak Now Level 3,*Oxford University Press, Oxford.

REFERENCES:

1. Bhatnagar, Nitin&MamtaBhatnagar,2010, *Communicative English for Engineers andProfessionals,* Pearson, New Delhi.
2. Hughes, Glyn & Josephine Moate,2014, *Practical English Classroom,* Oxford University Press, Oxford.
3. Vargo, Mari,2013, *Speak Now Level 4*, Oxford University Press, Oxford.
4. Richards, C, Jack,2006,*Person to Person (Starter)*, Oxford University Press, Oxford.
5. Ladousse, Gillian Porter,2014, *Role Play*. Oxford University Press, Oxford.

WEBSOURCES:

1. https://www.cambridge.org/elt/blog/wp-content/uploads/2019/10/Learning-Language-in-Chunks.pdf
2. https://english.eagetutor.com/english/628-how-to-greet-your-boss-people-in-office.html
3. https://www.groupdiscussionideas.com/group-discussion-topics-with-answers/
4. https://www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness/unit3presentations/1opening.shtml

SEMESTER IV

MA1471 **NUMERICAL METHODS**

L	T	P	C
3	1	0	4

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life situations.
- To impart the knowledge of various techniques of differentiation and integration.
- To compute the solution of differential equation with initial and boundary conditions.
- To understand the knowledge of finding the solution for the boundary value problems in Partial Differential Equations using finite difference methods.

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 12

Solution of algebraic and transcendental equations: Fixed point iteration method – Newton Raphson method – Solution of linear system of equations: Gauss elimination method – Pivoting – Gauss Jordan method – Inverse of a matrix by Jordan Method – Iterative methods of Gauss Jacobi and Gauss Seidel – Dominant Eigen value of a matrix by Power method.

UNIT II INTERPOLATION AND APPROXIMATION 12

Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Difference operators and relations – Interpolation with equal intervals: Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 12

Approximation of derivatives using interpolation polynomials – Numerical integration: Trapezoidal rule – Simpson's 1/3 rule – Simpson's 3/8 rule – Romberg's Method – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 12

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods: Milne's and Adam's predictor and corrector methods for solving first order equations

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 12

Finite difference methods for solving second order two-point linear boundary value problems – Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 60 PERIODS

OUTCOMES:

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

- CO1 Compute numerical solutions to system of linear equations, algebraic, transcendental equations and Eigen value problems.
- CO2 Construct approximate polynomial to represent the data and find the intermediate values of unknown function using interpolation

CO3	Apply numerical methods to find the values of differentiation and integration.
CO4	Solve the partial and ordinary differential equations with initial and boundary conditions by using numerical techniques.
CO5	Solve using finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain and one dimensional heat and wave equation.

TEXT BOOKS:

1. Burden, R.L and Faires, J.D 2016, *Numerical Analysis*, 9th Edition, Cengage Learning.
2. Grewal, B.S., and Grewal, J.S. 2015, *Numerical Methods in Engineering and Science*, Khanna Publishers, 10th Edition, New Delhi.

REFERENCES:

1. Brian Bradie, 2007, *A Friendly Introduction to Numerical Analysis*, Pearson Education, Asia, New Delhi.
2. Gerald. C. F. and Wheatley. P. O. 2006, *Applied Numerical Analysis*, Pearson Education, Asia, 6th Edition, New Delhi.
3. Kandasamy, P, Thilagavathy, K, & Gunavathy, K 2014, *Numerical Methods*, 3rd Edition Reprint, S. Chand & Co. Ltd., New Delhi.
4. Mathews, J.H. 1992, *Numerical Methods for Mathematics, Science and Engineering*, 2nd Edition, Prentice Hall.
5. Sankara Rao. K. 2007, *Numerical Methods for Scientists and Engineers*, Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi.
6. Sastry, S.S 2015, *Introductory Methods of Numerical Analysis*, PHI Learning Pvt. Ltd, 5th Edition, New Delhi.

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PT1401 MOULD MANUFACTURING TECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the students to acquire knowledge in basic machining operations
- To impart knowledge in EDM and Electroforming process
- To make the students to acquire knowledge in measuring instruments

UNIT I FUNDAMENTALS OF MOLD MAKING 9

Mold Making: selection of materials for mold making, Mechanism of metal cutting, types of tools, influence of tool angles, Cutting fluids. Applications of basic machining operations Turning, Cylindrical Grinding, Surface Grinding & Vertical Milling in mould making

UNIT II ELECTRICAL DISCHARGE MECHINING 9

Electrical discharge machining – Principle, Types of EDM - Die Sinking & Wire Cut EDM, Machining Process, Requirements of dielectric fluid, Applications of EDM in mold making.

UNIT III ELECTRO FORMING PROCESS 9

Electroforming for mold manufacturing - discussion of the process, materials for electroforming, design & materials for models, machining for electroformed mold cavities, Advantages, Disadvantages & Applications.

UNIT IV HOBBING AND CHEMICAL TEXTURING 9

Hobbing for mold cavity making - Discussion of the hobbing process, elements of hobbing, materials used for cavity, lubrication, and depth of hobbing, advantages and disadvantages. Surface Texturing of molds – Chemical Texturing, Process description, Advantages-Limitations of chemical texturing.

UNIT V METOROLOGY AND INSPECTION 9

Metrology and inspection: Vernier caliper, Micrometer, Vernier height gauges, Surface plate, Slip gauges, Sine Bar, Rockwell Hardness, Optical profile projectors and Optical flat-Applications of measuring instruments in mould making

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- CO1 Apply the basic machining operations to make mould parts
- CO2 Demonstrate the working principles and applications of EDM
- CO3 Apply Electroforming principle for making mould cavities
- CO4 Apply hobbing and surface texturing principles to make mold parts
- CO5 Demonstrate the applications of measuring instruments in mould making

TEXT BOOKS:

1. KlusStokhert (Edt.), *Mold making handbook for Plastic Engineers*, Hanser Publishers, 2nd edition, 1998.
2. Hmt, H.M.T., 2001. *Production technology*. Tata McGraw-Hill Education.
3. Donaldson, C., LeCain, G.H., Goold, V.C. and Ghose, J., 2012. *Tool design*. Tata McGraw-Hill Education.

REFERENCES:

1. Chang, T.C. and Wysk, R.A., 1997. *Computer-aided manufacturing*. Prentice Hall PTR
2. R.G.W.Pye, *Injection Mold Design*, East West Press Pvt. Ltd., New Delhi.3rd Edition, 1983.
3. Stoeckhert&Menning, *Mold making handbook*, 2nd edition, Carl HanserVerlag GmbH & Company KG, 2013.
4. W.A.J Chapman, *Workshop Technology Part 2*, Taylor & Francis Group, 2016.
5 Menges, G., Michaeli, W. and Mohren, P., 2013. *How to make injection molds*. Carl HanserVerlag GmbH Co KG.

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PT1402 PLASTIC PROCESSING TECHNOLOGY-I

L	T	P	C
3	0	0	3

OBJECTIVES:

- To make the students to acquire knowledge in injection moulding techniques
- To impart knowledge in blow moulding and thermoforming process
- To make the students to acquire knowledge in ancillary equipments

UNIT I INJECTION MOULDING - I 9

Introduction to polymer processing - Plastics processing techniques - Injection moulding Process description- Theory of injection moulding - moulding cycle.
Injection unit: Construction of Injection unit - Types of Injection unit –Plunger type, Two stage preplasticating type & Reciprocating screw type- Barrel-Nozzle-Non return valve.
Design features of screw - Screw design & Nomenclature – Feed zone, Compression zone and Metering zone Types of screw- General purpose screw-PVC screw.

UNIT II INJECTION MOULDING - II **9**

Injection molding Clamping unit - Classification–Toggle type- Hydraulic type-Hybrid clamping- Tie Barless clamping- All electric injection moulding machine-Merits and Demerits- Classification and functions of moulds - Microprocess control.

Calculation of clamping tonnage - Shot capacity – Injection rate - Plasticizing capacity. Moulding defects causes and Remedies

UNIT III BLOW MOULDING **9**

Blow moulding – Fundamentals of the process, complete blow moulding operation, Extrusion blow moulding – Classification - Intermittent type: Reciprocating screw & Accumulator head EBM - Continuous type: Shuttle, Rotary & Vertical type EBM.

Injection blow molding, Injection stretch blow moulding, start-up and shut-down procedures, parison programming, parison swell, cutting devices, moulding defects - causes and remedy.

UNIT IV THERMOFORMING **9**

Thermoforming – Basic process, thermoforming materials, stretching and wall thickness distribution, Methods of forming: simple vacuum forming, drape forming, pressure forming, free forming, snap back forming, matched mold forming and plug assist forming.

Classification of thermoforming machines –Sheet fed –Roll fed- Shuttle type-Rotary type-Ferris wheel type-Inline theromoformer-Advantages-Disadvantages-Trouble shooting

UNIT V ANCILLARY EQUIPMENTS FOR PROCESSING **9**

Ancillary equipments for processing – Need of predrying - moisture content- Dryer - Types of Dryers - Tray Dryer–– Hopper dryer – Hopper loader – Vacuum hopper loader - Granulator - 3 blade, 4 blade granulator - Mould temperature controller – Chilling plant – Colour blender - Magnetic grills.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Illustrate injection moulding principles and screw designs for making of plastic products

CO2 Demonstrate the different types of clamping unit in injection molding machine

CO3 Apply blow molding principles to make plastic bottles and containers

CO4 Apply thermoforming principles to make thermoplastic products

CO5 Illustrate the ancillary equipments used for plastics processing

TEXT BOOKS:

1. Muccio, E.A., 1994. *Plastics processing technology*. ASM international.
2. Rosato, D.V. and Rosato, M.G., 2012. *Injection molding handbook*. Springer Science & Business Media.
3. Crawford, R.J. and Martin, P.J., 2020. *Plastics engineering*. Butterworth-Heinemann.

REFERENCES:

1. Agassant, J.F., Avenas, P., Carreau, P.J., Vergnes, B. and Vincent, M., 2017. *Polymer processing: principles and modeling*. Carl HanserVerlag GmbH Co KG.
2. Baird, D.G. and Collias, D.I., 2014. *Polymer processing: principles and design*. John Wiley & Sons.
3. Lafleur, P.G. and Vergnes, B. eds., 2014. *Polymer extrusion*. John Wiley & Sons.
4. Thomas, S. and Yang, W. eds., 2009. *Advances in polymer processing: from macro-to nano-scales*. Elsevier.
5. Tadmor, Z. and Gogos, C.G., 2013. *Principles of polymer processing*. John Wiley & Sons.
6. Cheremisinoff, N.P. and Cheremisinoff, P.N., 1996. *Handbook of applied polymer processing technology* (Vol. 31). CRC Press.

PT1403 PLASTICS MATERIALS II

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the general methods of preparation of individual class of plastic materials
- To study the general properties, processing behavior of plastics materials.

- To provide the knowledge in applications of different class of plastics materials.

UNIT I ENGINEERING PLASTICS & ITS APPLICATIONS - I 9

Preparation- properties - and applications: Styrene copolymers – High Impact Polystyrene (HIPS), Acrylonitrile Butadiene Styrene (ABS), Styrene acrylonitrile (SAN), Acrylic plastics – Polymethyl Methacrylate, Polyacrylonitrile , Ethylene Vinyl Alcohol (EVA).

UNIT II ENGINEERING PLASTICS & ITS APPLICATIONS – II 9

Preparation- properties - and applications: **Polyamides** - Nylons 6, (6,6), (6,10), 11, 12, **Polyesters** – Polyethylene terephthalate, polybutylene terephthalate, Polycarbonate, Polyacetals.

UNIT III HIGH PERFORMANCE PLASTICS - I 9

Preparation - properties - and applications: Aromatic ether - Polypheneylene oxide (PPO), Aromatic thioether - Polyphenylenesulphide (PPS), Polysulfone, Aromatic polyamides

UNIT IV HIGH PERFORMANCE PLASTICS - II 9

Preparation - properties - and applications: Polyimides (PI) Polyamideimide (PAI), Polyimidazoles, Fluoropolymers – Polyvinyl fluoride (PVF), Polyvinylidene fluoride (PVDF), Polytetrafluoroethylene (PTFE), Polychlorotrifluoroethylene (PCTFE).

UNIT V WATER SOLUBLE POLYMERS AND BIO DEGRADABLE POLYMERS 9

Preparation- properties and applications of Biodegradable polymers - poly ξ–caprolactone - polylactic acid- Bacterial polyhydroxyalkonates.– polyvinylpyrrolidone – polyacrylic acid and its homolog's – polyacrylamide –polyethylene oxide – polyethylene amine-Polyvinyl alcohol

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of this course, Students will be able to

CO1 Acquire knowledge on manufacturing, properties and applications of special purpose polymers

CO2 Correlate the structure and properties of engineering polymers

CO3 Acquire skill in selection of suitable polymers for specific applications based on its properties

CO4 Describe the manufacturing methods, properties and applications of high performance polymers

CO5 Acquire knowledge on methods of preparation , properties and applications of water soluble and biodegradable polymers

TEXT BOOKS:

1. Brydson, J.A., 1999. *Plastics materials*. Elsevier
2. Rubin, I.I. ed., 1990. *Handbook of plastic materials and technology* (p. 1745). New York: Wiley.
3. Manas Chanda, Salil.K.Roy, 1993 *"Plastics Technology Hand book",* 2nd edition, Marcel Dekker, New York.
4. Matrin.T.Goosey, 1985. "*Plastics for Electronics",* Elsevier, Applied Science
5. R.W. Dyson, 1998 *"Specialty Polymers*", Chapman & Hall, 2nd edition.

REFERENCES:

1. Rosato, D.V. and Rosato, D.V., 2004. *Reinforced plastics handbook*. Elsevier.
2. De Carvalho, A.J.F., Curvelo, A.A.S. and Agnelli, J.A.M., 2001. A first insight on composites of thermoplastic starch and kaolin. *Carbohydrate Polymers*, *45*(2), pp.189-194.
3. Birley, A.W., 2012. *Plastics materials: properties and applications*. Springer Science & Business Media
4. Harper, C.A. and Petrie, E.M., 2003. *Plastics materials and processes* (pp. 557-559). John Wiley & Sons.
5. Birley, A.W., 2012. *Plastics materials: properties and applications*. Springer Science & Business Media.
6. Hebbert, M., 1982. The Gospel According to FJO. *Built Environment (1978-)*, *8*(4), pp.219-223.
7. Biron, M., 2018. *Thermoplastics and thermoplastic composites*. William Andrew.

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PT 1404 **POLYMER RHEOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide understanding about the mechanical behavior of polymeric materials.
- To impart knowledge in rheological behavior of polymer melts.

- To equip with the knowledge about the function of various rheometers.
- To apply the fundamentals of polymer rheology in different processing applications.

UNIT I MECHANICAL BEHAVIOUR OF POLYMERIC MATERIALS 9

Introduction to Rheology – Types of mechanical deformation – Elastic materials – Viscous materials – Viscoelasticity – effect of rate of strain, temperature and time on mechanical behaviour of polymeric materials – creep – stress relaxation

UNIT II FLOW PROPERTIES OF POLYMER MELT 9

Fluid flow – types of fluid flow –Newtonian and Non Newtonian fluids – laminar flow of Newtonian fluids - viscosity of polymer melts – shear thinning and shear thickening – zero-shear rate viscosity — power law – die-swell and melt fracture – Weissenberg effect.

UNIT III VISCO ELASTIC BEHAVIOUR 9

Introduction - Static Test – Dynamic Test – Boltzmann superposition principle – Applications of Boltzmann superposition principle – Mechanical models of Viscoelastic systems – Maxwell Model – Voigt-Kelvin Model

UNIT IV MEASUREMENT OF RHEOLOGICAL PROPERTIES 9

Measurements of rheological properties – capillary rheometers – melt flow index – cone and plate viscometrer – torque rheometers – Mooney viscometer – curemeters – Rheo – optical methods – birefringence

UNIT V APPLICATION OF POLYMER RHEOLOGY TO PROCESSING 9

Rheological behaviour of thermoplastics PE, PVC, PS, PP, nylons and PC – Applications of rheology to polymer processing - injection moulding, extrusion and blow moulding.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Demonstrate the rheological behavior of thermoplastic materials

CO2 Analyze the flow properties of polymer melts.

CO3 Critique the influence of rheology on different properties of polymer.

CO4	Explain the function of various rheological instruments and optimize its parameters.
CO5	Apply the theory of rheology in the applications of polymer processing

TEXT BOOKS:

1. Shaw, M.T., 2012. *Introduction to polymer Rheology*. Hoboken, NJ: Wiley.
2. Gupta, B.R., 2005. *Applied Rheology in Polymer Processing*. Asian Books Private.
3. Rudolph, N. and Osswald, T.A., 2014. *Polymer Rheology: Fundamentals and applications*. Carl Hanser Verlag GmbH Co KG.

REFERENCES:

1. Griskey, R., 1995. *Polymer process engineering*. Springer Science & Business Media.
2. Han, C.D., 2007. *Rheology and processing of polymeric materials: Volume 1: Polymer Rheology* (Vol. 1). Oxford University Press on Demand..
3. Gupta, B.R., 2008. *Polymer Processing Technology*. Asian Books.
4. Han, C.D., 2007. *Rheology and processing of polymeric materials: Volume 1: Polymer Rheology* (Vol. 1). Oxford University Press on Demand.
5. MALKIN, A.Y., 2012. Rheology: concepts, methods and applications. prof. dr. Alexander Ya. Malkin, prof. dr. Avraam I. Isayev. 2nd edition: *Toronto:* ChemTec Publishing.

PT1405 **RUBBER MATERIALS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gather basic knowledge on structure and properties of natural rubber, synthetic rubber.
- To acquire the knowledge on structure and properties and thermoplastic elastomers.
- To define the reclaim rubber, properties and its applications.

UNIT I NATURAL RUBBER 12

Natural Rubber: Origin – Natural Rubber Latex, tapping, processing, properties and applications – Conversion of Latex into dry rubber – smoked sheet, air dried sheet, crepe rubber -Modifications of Natural Rubber–Applications

UNIT II GENERAL PURPOSE ELASTOMERS 7

Manufacturing, structure, properties, curing and applications of- Polyisoprene, Polybutadiene, SBR, EPDM, Nitrile rubber.

UNIT III SPECIAL PURPOSE ELASTOMERS -I 9

Manufacturing, structure, properties, curing and applications of- Butyl rubber, Halobutyl, Neoprene,CSM, Fluoro elastomer (FKM), Epichlorohydrin, Polysulphide.

UNIT IV SPECIAL PURPOSE ELASTOMERS-II 9

Manufacturing, structure, properties, curing, and applications of-Polyurethane Elastomers, Acrylic rubber, Ethylene Vinyl Acetate, Silicone rubber

UNIT V THERMOPLASTIC ELASTOMERS AND RECLAIMED RUBBERS 9

Basic structure, Manufacture, Morphology, Commercial grades and Applications – Thermoplastic styrene block copolymers, Polyester thermoplastic elastomers, polyamide thermoplastic elastomer, Polyurethane thermoplastic elastomers. Reclaimed rubber - process of reclamation – applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1	Relate the structure and properties of natural rubber,
CO2	Describe the structure manufacturing, curing , properties and application of synthetic rubbers
CO3	Discuss the structure manufacturing, curing , properties and application of synthetic rubbers
CO4	Explore the structure manufacturing, curing , properties and application of synthetic elastomers.
CO5	Explain the process of reclamation and morphological behaviour of thermoplastic elastomers

TEXT BOOKS:

1. Morton, M., 1999. *Introduction to polymer science*. In Rubber Technology (pp. 1-19). Springer, Dordrecht.
2. Blow, C.M., 1971. *Rubber technology and manufacture*.
3. Hoffman, W., 1989. *Rubber technology handbook*, Hanser. *New York*, p.239.

REFERENCES:

1. Brydson, J.A., 1978. *Rubber chemistry*.
2. Bhowmick, A.K. and Stephens, H. eds., 2000. *Handbook of elastomers*. CRC Press.
3. De, S.K. and White, J.R. eds., 2001. *Rubber technologist's handbook* (Vol. 1). iSmithers Rapra Publishing.
4. Roland, C., 2007. *Rubber technologist's handbook*, vol. 2. Rapra, Shrewsbury, UK.
5. White, J., De, S.K. and Naskar, K., 2009. *Rubber Technologist's Handbook*, Vol. 2. Smithers Rapra, Shawbury, Shrewsbury, Shropshire, p.452.
6. Thomas, S., Chan, C.H., Pothen, L.A., Rajisha, K.R. and Maria, H. eds., 2013. *Natural Rubber Materials: Volume 1: Blends and IPNs* (Vol. 7). Royal society of Chemistry.
7. Gelling, I.R., 1985. *Modification of natural rubber latex with peracetic acid*. Rubber Chemistry and Technology, *58*(1), pp.86-96.
8. Warner, W.C., 1994. *Methods of devulcanization*. Rubber Chemistry and Technology, *67*(3), pp.559-566.
9. Manuel, H.J. and Dierkes, W., 1997. *Recycling of rubber* (Vol. 99). iSmithers Rapra Publishing.

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PT1411 MOULD MANUFACTURING TECHNOLOGY LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

To enable the students to,

- Perform basic machining operations using lathe and shaping machine
- Demonstrate the basic machining operations of milling machine

- Measure dimensions of parts using measuring instruments

LIST OF EXERCISES

1. Exercise on Shaping machine - making stepped block
2. Exercise on Shaping machine - making beveled block
3. Exercise on Horizontal Milling-Gear cutting
4. Exercise on Vertical Milling
5. Exercise on lathe - external thread
6. Exercise on lathe- taper turning
7. Exercise on Surface Grinding.
8. Exercise on Slotting Machine.
9. Grinding of Cutting tools.
10. Study of different types of Cutting tools
11. Measurements using Micrometer, Vernier caliper and Vernier Height gauge and Slip gauge.
12. Measurement of angle using Sine Bar.
13. Application of Dial gauge.
14. DEMOMSTRATION EXPERIMENT: To make a simple mould for hand injection molding machine

(Any 10 experiments from above)

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Perform turning operations using lathe

CO2 Make stepped block and bevelled block using shaping machine

CO3 Perform basic machining operations using milling machine

CO4 Make finishing operations using grinding machine

CO5 Measure dimensions of parts using measuring instruments

TEXT BOOKS:

1. KlusStokhert (Edt.), *Mold making handbook for Plastic Engineers*, Hanser

Publishers, 2nd edition, 1998.

2. Hmt, H.M.T., 2001. *Production technology*. Tata McGraw-Hill Education.
3. Donaldson, C., LeCain, G.H., Goold, V.C. and Ghose, J., 2012. *Tool design*. Tata McGraw-Hill Education.

REFERENCES:

1. Chang, T.C. and Wysk, R.A., 1997. *Computer-aided manufacturing*. Prentice Hall PTR
2. R.G.W.Pye, *Injection Mold Design*, East West Press Pvt. Ltd., New Delhi.3rd Edition, 1983.
3. Stoeckhert&Menning, *Mold making handbook*, 2nd edition, Carl HanserVerlag GmbH & Company KG, 2013.
4. W.A.J Chapman, *Workshop Technology Part 2*, Taylor & Francis Group, 2016.
5. Menges, G., Michaeli, W. and Mohren, P., 2013. *How to make injection molds*. Carl HanserVerlag GmbH Co KG.

LIST OF EQUIPMENT FOR A BATCH OF 60 STUDENTS:

S. No.	Description of Equipment	Quantity Required
1.	Shaping machine	1 No
2.	Vertical milling machine	1 No
3.	Horizontal milling machine	1 No
4.	Lathe	5 No
5.	Surface grinding machine	1 No
6.	Vernier caliper	1 No
7.	Vernier height gauge	1 No
8.	Vernier Depth Gauge	1 No
9.	Bench grinder	1 No
10.	Micrometer	1 No

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PT1412 POLYMER PREPARATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To impart practical skills in synthesizing various polymers using different polymerization techniques.
- To impart knowledge in identifying suitable method for polymerization of polymer..

LIST OF EXPERIMENTS

1. Preparation of phenol - formaldehyde (Novalac) resin.
2. Preparation of phenol - formaldehyde (Resol) resin.
3. Preparation of Urea formaldehyde resin by condensation method.
4. Preparation of Bisphenol - An epoxy resin.
5. Preparation of polystyrene by bulk polymerization method
6. Preparation of polystyrene by emulsion polymerization method
7. Preparation of acrylonitrile by Solution Polymerization method.
8. Preparation of styrene and methyl methacrylate by copolymerization method.
9. Preparation of Caprolactone by Ring opening polymerization method
10. Preparation of Vinyl acetate by Solution Polymerization method.
11. Sheet casting using methyl methacrylate
    (any 9 experiments)

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1	Apply the knowledge on synthesis the polymer by condensation technique
CO2	Apply the polymerization techniques like solution and emulsion, interfacial in polymer preparation
CO3	Synthesize industrially used polymers like polystyrene, PMMA and epoxy resin
CO4	Synthesize a copolymer by applying copolymerization technique
CO5	Apply the knowledge on preparation of biodegradable polymer

REFERENCES:

1. Siddaramaiah., 2007., *Practical's in Polymer Science*, CBS Publishers & Distributors.
2. Dietrich Braun., Harald Cherdron., Matthias Rehahn, et al., 2012 "*Polymer Synthesis: Theory and Practice: Fundamentals, Methods, Experiments*", springer ,5th edition.
3. Wayne, R.Sorenson., and Campbell, T.W. *2001*. *Preparative Methods of Polymer Chemistry* 3rd edition, Wiley – Interscience, New York.
4. McCaffery E.M. 1970, *Laboratory Preparation for Macromolecular Chemistry*, McGraw Hill,Kogakush.
5. Collins, E.A., Bares, J. and Billmeyer, F.W., 1973. *Experiments in polymer science.*

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HS1421 AN INTRODUCTION TO ADVANCED READING AND WRITING

L	T	P	C
0	0	2	1

OBJECTIVES:

The course will enable learners to

- To strengthen the reading skills of students of engineering.
- To enhance their writing skills with specific reference to technical writing
- To develop their critical thinking skills.
- To provide more opportunities to develop their project and proposal writing skills

UNIT I EFFECTIVE READING 6

Reading – Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title. Reading-Read for details-Use of graphic organizers to review and aid comprehension.

UNIT II CRITICAL READING 6

Reading– Understanding pronoun reference and use of connectors in a passage- speed reading techniques. Reading– Genre and Organization of Ideas- Reading– Critical reading and thinking- understanding how the text positions the reader.

UNIT III PARAGRAPH WRITING 6

Writing-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence.-Write a descriptive paragraph Writing-State reasons and examples to support ideas in writing– Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT IV ESSAY WRITING 6

Writing– Elements of a good essay - Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT V EFFECTIVE WRITING 6

Writing– Email writing- visumes – Job application- Report Writing - Project writing-Writing convincing proposals

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1 Understand how the text positions the reader

CO2 Develop critical thinking while reading a text

CO3 Develop a descriptive paragraph

CO4 Make use of sentence structures effectively when creating an essay

CO5 Demonstrate proper usage of grammar in writing E-Mails, Job application and project proposals

TEXT BOOKS:

1. Gramer, F, Margot & Colin, S, Ward, 2011, *Reading and Writing (Level 3)* Oxford University Press, Oxford.
2. Debra Daise, CharlNorloff, and Paul Carne, 2011, *Reading and Writing (Level 4)* Oxford University Press: Oxford.

REFERENCE BOOKS:

1. Davis, Jason & Rhonda LIss. 2006 *Effective Academic Writing (Level 3)* Oxford University Press: Oxford.
2. E. Suresh Kumar and et al. 2012, *Enriching Speaking and Writing Skills*, Second Edition, Orient Black swan: Hyderabad.
3. Withrow, Jeans and et al. 2004 *Inspired to Write. Readings and Tasks to develop writing skills*, Cambridge University Press: Cambridge.
4. Goatly, Andrew, 2000 *Critical Reading and Writing*, Routledge: United States of America.
5. Petelin, Roslyn & Marsh Durham, 2004 *The Professional Writing Guide: Knowing Well and Knowing Why, Business & Professional* Publishing: Australia.

WEB RESOURCES:

1. http://learnenglishteens.britishcouncil.org/skills/reading
2. https://learnenglish.britishcouncil.org/skills/reading
3. https://www.readingrockets.org/article/25-activities-reading-and-writing-fun
4. https://linguapress.com/advanced.htm