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			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
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/unit3 presentations/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*", 2nd 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