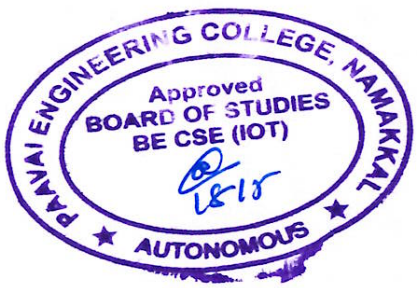
SEMESTER III

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23303	Discrete Mathematics	3	1	0	4
2	PC	CI23301	Introduction to Internet of Things	3	0	0	3
3	PC	CI23302	Data Structures	3	0	0	3
4	PC	CI23303	Object Oriented Programming	3	0	0	3
5	MC	MC23302	Human Values and Gender Equality	2	0	0	0
Theory with Practical							
6	ES	EC23307	Digital Principles and Computer Organization	3	0	2	4
Practical							
7	PC	CI23304	Data Structures Laboratory	0	0	4	2
8	PC	CI23305	Object Oriented Programming Laboratory	0	0	4	2
9	EE	GE23301	Professional Development I	0	0	2	1
			Total	**17**	**1**	**12**	**22**

SEMESTER IV

S. No	Category	Course Code	Course Title	L	T	P	C
Theory							
1	BS	MA23403	Probability and Statistics	3	1	0	4
2	PC	CI23401	Database Management Systems	3	0	0	3
3	PC	CI23402	Operating Systems	3	0	0	3
4	PC	CI23403	Sensors and Devices	3	0	0	3
5	HS	MC23401	Environmental Sciences and Sustainability	2	0	0	0
Theory with Practical							
6	PC	EC23407	Microprocessor and Microcontroller	3	0	2	4
Practical							
7	PC	CI23404	Database Management Systems Laboratory	0	0	4	2
8	PC	CI23405	Operating Systems Laboratory	0	0	4	2
9	EE	GE23401	Professional Development II	0	0	2	1
			Total	**17**	**1**	**12**	**22**



MA23303	DISCRETE MATHEMATICS	3	1	0	4

(Common to CSE, CSE(IOT), CSE(AI&ML), Cyber, AI&DS, IT)

COURSE OBJECTIVES

To enable the students to

1.	interpret the introductory concepts of Logic, which will enable them to model and analyze Physical phenomena involving arguments.
2.	implement the definitions of relevant vocabulary from quantifiers and inference and be able to perform related calculations.
3.	apply the methodologies involved in solving problems related to fundamental principles of sets and implement the mathematical ideas for relations.
4.	understand the concepts of functions and its types.
5.	acquire knowledge and understand the concepts of graphs and its models.

UNIT I	PROPOSITIONAL CALCULUS	12

Propositions - Logical connectives, Compound propositions, Conditional and bi-conditional propositions, Truth tables; Tautologies and contradictions; Contrapositive; Logical equivalences and implications - DeMorgan's Laws, Normal forms, Principal conjunctive and disjunctive normal forms; Rules of inference; Arguments - Validity of arguments.

UNIT II	PREDICATE CALCULUS	12

Predicates - Statement function, Variables, Free and bound variables; Quantifiers; Universe of discourse; Logical equivalences and implications for quantified statements; Theory of inference - The rules of universal specification and generalization; Validity of arguments.

UNIT III	SET THEORY	12

Basic concepts - Notations, Subset, Algebra of sets, The power set; Ordered pairs and Cartesian product; Relations on sets - Types of relations and their properties, Relational matrix and the graph of relation; Partitions; Equivalence relations. Partial ordering - Posets, Lattices as Posets, Properties of lattices.

UNIT IV	FUNCTIONS	12

Definitions of functions, Classification of functions, Type of functions, Examples, Composition of functions, Inverse functions; Binary and n-ary operations; Characteristic function of a set; Hashing functions; Recursive functions; Permutation functions.

UNIT V	GRAPHS	12

Graphs and graph models; Graph terminology and special types of graphs; Matrix representation of graphs and graph isomorphism; Connectivity - Euler and Hamilton paths.

	TOTAL PERIODS	60

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	apply propositional logic to validate the arguments.	Applying (K3)

CO2	apply the rules of inference and methods of proof in predicate calculus to verify the validity of arguments.	Applying (K3)
CO3	explain the knowledge of various set theoretic concepts.	Applying (K3)
CO4	characterize different types of functions and solve recurrence relations.	Understanding(K2)
CO5	apply the concepts of discrete structures such as Euler and Hamilton paths.	Applying (K3)

TEXT BOOKS

1. Trembly, J.P. and Manohar, R., "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw-Hill, 35th Reprint, 2008.
2. Veerarajan T., "Discrete Mathematics with Graph Theory and Combinatorics", Reprint Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.

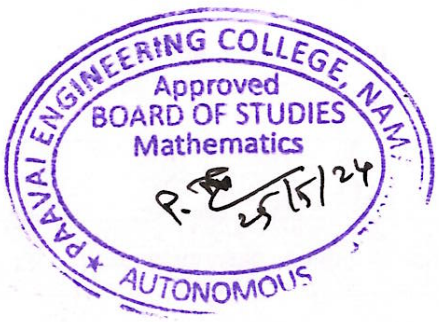
REFERENCES

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 8th Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2012.
2. Tamilarasi, A., and Natarajan, A. M., "Discrete Mathematics and its Applications", 3rd Edition, Khanna Publishers, 2008.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
4. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction ", 4th Edition, Pearson Education, 2002.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	3	-	-	-	-	-	-	-	3	1	2
CO2	3	2	3	3	-	-	-	-	-	-	-	3	1	2
CO3	2	3	3	2	-	-	-	-	-	-	-	2	1	2
CO4	2	2	2	3	-	-	-	-	-	-	-	2	1	2
CO5	3	3	3	3	-	-	-	-	-	-	-	3	1	2



CI23301	INTRODUCTION TO INTERNET OF THINGS	3	0	0	3

COURSE OBJECTIVES	
To enable the students to	
1	acquire the knowledge of IoT network
2	learn about the sensors and actuator characteristics
3	understand the concept of IoT network topologies and IoT connecting technologies
4	study the IoT communication protocols
5	know the various application of IoT and new technologies

UNIT I	INTRODUCTION	9
.Introduction - Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT; Introduction - Wireless Sensor Networks - Machine-to-Machine Communications - Cyber Physical Systems.		
UNIT II	**IOT PROCESSING AND TOPOLOGIES**	**9**
Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading Introduction - IEEE 802.15.4, Zigbee, Thread, ISA100.11A, Wireless HART, RFID, NFC, DASH7, Z-Wave, Weightless, Sigfox, LoRa, NB-IoT, Wi-Fi, Bluetooth		
UNIT III	**IOT COMMUNICATION TECHNOLOGIES AND PROTOCOLS**	**9**
Introduction - Infrastructure Protocols - Discovery Protocols - Data Protocols - Identification Protocols - Device Management - Semantic Protocols		
UNIT IV	**IOT SENSING AND ACTUATION**	**9**
Introduction - Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics; Interoperability – introduction, standards, frameworks		
UNIT V	**IOT CASE STUDIES & FUTURE TRENDS**	**9**
Introduction and Case Studies -Agricultural IoT, Vehicular IoT, Healthcare IoT Paradigms, Challenges, and the Future - Introduction to Arduino Boards - Introduction to Raspberry Pi Boards, IoT Analytics – Introduction		
	TOTAL PERIODS	**45**

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	recognize the basics of IoT networks components and models.	Understanding (K2)
CO2	categorize the IoT network types and connecting technologies	Analysing (K4)
CO3	apply the IoT communication protocols	Understanding (K2)
CO4	analyse the various characteristics and process of sensors and actuators.	Applying (K3)
CO5	determine solutions for the real time problems in IoT	Analysing (K4)

TEXT BOOKS

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IOT", Cambridge University Press, 2021.
2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands – on Approach", Orient Blackswan Private Limited, 1st Edition, 2015.

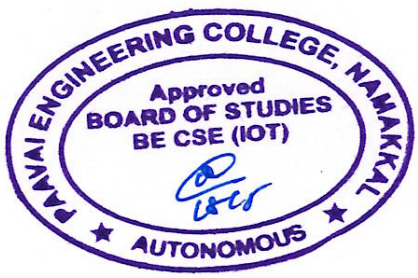
REFERENCES

1. Rajkamal, "Internet of Things: Architecture and Design Principles", McGraw-Hill Education Pvt Ltd., 1st Edition 2018
2. Charalamops Doukas, "Building Internet of Things with the Arduino", Create Space, 2nd Edition, 2013.
3. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From parallel processing to the Internet of Things", Morgan Kaufmann Publishers, 1 Edition, 2012.
4. Marco Schwatrz, "Internet of Things with Arduino Cookbook", Packt Publications, 1st Edition, 2016.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO1	3	3	3	3	-	-	-	-	-	-	-	1	2	1
CO2	3	3	1	2	-	-	-	-	-	-	-	2	2	1
CO3	3	3	3	1	-	-	-	-	-	-	-	3	2	1
CO4	3	3	3	1	-	-	-	-	-	-	-	3	2	1
CO5	2	2	1	1	-	-	-	-	-	-	-	-	2	1



CI23302	DATA STRUCTURES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the concepts of ADTs.
2.	learn linear data structures like lists, stacks.
3.	apply linear data structures for queues.
4.	apply Non-linear data structures for various application.
5.	acquire different types of sorting, searching and hashing algorithms.

UNIT I	ABSTRACT DATA TYPES (ADT)	9

Introduction to Data Structures - Definition, Need of Data Structures, Types of Data Structures; Abstract Data Types (ADT) - List ADT, Operations (Insertion, Deletion), Array Based Implementation, Linked List Implementation, Singly Linked List, Doubly Linked List, Circularly Linked List; Applications of Linked List - Polynomial ADT.

UNIT II	LINEAR DATA STRUCTURES – STACKS	9

Stack ADT – Definition of Stack, Operations, Array based Implementations, Linked List Implementation; Applications of Stack - Conversion of Infix to prefix expression, Conversion of Infix to postfix expression.

UNIT III	LINEAR DATA STRUCTURES – QUEUES	9

Queue ADT – Definition of Queue, Operations, Array based Implementations, Linked List Implementation; Circular Queue; Priority Queue; Applications of Queue.

UNIT IV	NON-LINEAR DATA STRUCTURES – TREES, GRAPHS	9

Tree ADT - Basic Tree Terminologies, Binary Tree ADT, Expression Trees, Tree Traversals, Applications of Trees, Binary Search Tree ADT, AVL Trees; Graph – Definitions, Representation of Graphs, Types of Graphs, Depth-first traversal, Breadth-first traversal, Topological Sort.

UNIT V	SEARCHING, SORTING AND HASHING TECHNIQUES	9

Searching - Linear Search, Binary Search; Sorting - Bubble Sort, Insertion Sort, Shell Sort, Radix Sort, Heap Sort; Hashing - Hash Functions, Separate Chaining, Open Addressing, Rehashing, Extendible Hashing.

TOTAL PERIODS	45

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	understand the different data structures for representation.	Understanding (K2)
CO2	select various linear data structures for problem-solving using stack.	Analyzing (K4)
CO3	solve the computational problems using queue.	Applying (K3)
CO4	examine of various concepts of trees and graphs with real time application.	Applying (K3)
CO5	demonstrate the concept of sorting, searching and hashing techniques.	Analyzing (K4)

TEXT BOOKS

1. Mark Allen Weiss, —Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education,2020.
2. Reema Thareja, —Data Structures Using C, Second Edition, Oxford University Press, 2018.

REFERENCES

1. Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, "Data Structures & Algorithms in Python", An Indian Adaptation, John Wiley & Sons Inc., 2021.
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson Freed, "Fundamentals of Data Structures in C", 2nd Edition,Universities Press, Hyderabad, 2018.
3. R.Venkatesan, S.Lovelyn Rose, "Data Structures", 1st Edition, Wiley, 2019.
4. Seymour Lipschutz, "Data Structures with C", 4th Edition, MCGraw Hill Education, 2017.

CO-PO MAPPING:

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(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	3	3	-	-	-	-	-	1	3	3	2
CO2	3	3	3	-	3	-	-	-	-	-	1	3	3	2
CO3	3	3	3	-	3	-	-	-	-	-	1	3	3	2
CO4	3	3	3	-	3	-	-	-	-	-	1	3	3	2
CO5	3	3	3	-	3	-	-	-	-	-	1	3	3	2

CI23303	OBJECT ORIENTED PROGRAMMING	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1. understand OOP concepts and basics of Java programming language.
2. know the principles of inheritance, packages, and interfaces.
3. develop a java application with threads and generics classes.
4. define exceptions and use I/O streams.
5. understand Graphical User Interface Application using JavaFX.

UNIT I	INTRODUCTION TO OOP AND JAVA	9

Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments.

UNIT II	INHERITANCE, PACKAGES AND INTERFACES	9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III	EXCEPTION HANDLING AND MULTITHREADING	9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model–Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV	I/O, GENERICS, STRING HANDLING	9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files – Streams - Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V	JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS	9

JavaFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, Toggle Button – Radio Buttons – List View – Combo Box – Choice Box – Text Controls – Scroll Pane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu – Menu bars – Menu Item.

	TOTAL PERIODS	45

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	explain the basic OOP and Java concepts.	Understanding (K2)
CO2	demonstrate programs using inheritance, packages and interfaces.	Applying (K3)
CO3	assign exception handling mechanisms and multithreading concepts to solve real-world problems.	Applying (K3)
CO4	customize Java applications with I/O packages, string classes, collections and generics concepts.	Applying (K3)
CO5	apply the concepts of event handling, JavaFX components and controls for developing GUI based applications.	Applying (K3)

TEXT BOOKS

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, New Delhi, 2019.
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1st Edition, McGraw Hill Education, New Delhi, 2015.

REFERENCES

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018.
2. Deitel & Deitel, "Java: How to Program", Prentice Hall of India, 2010.
3. Allen B. Downey and Chris Mayfield, "Think Java: How to Think Like a Computer Scientist", O'Reilly, California, First Edition, 2016.
4. Joshua Bloch, "Effective Java: A Programming Language Guide", Addison-Wesley Professional, US, Third Edition, 2018.

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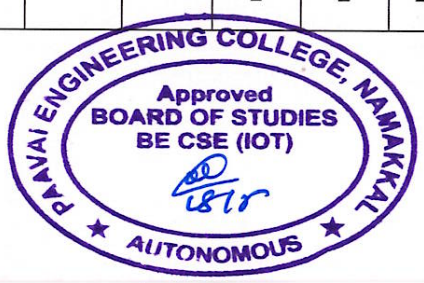
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	3	2	-	-	-	-	-	-	2	2	2
CO2	2	2	3	3	2	-	-	-	-	-	-	2	2	2
CO3	3	3	2	2	2	-	-	-	-	-	-	2	2	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO5	2	2	3	2	2	-	-	-	-	-	-	2	2	2



MC23302	HUMAN VALUES AND GENDER EQUALITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1.	define different types of human values and their impact on individual behaviour and societal norms.
2.	apply principles of personal development such as self-confidence, self-discipline, and resilience to navigate modern challenges effectively.
3.	evaluate the role of values in shaping professional ethics, civic sense and global citizenship.
4.	examine the socio-economic factors influencing gender inequality and explore avenues for empowerment and advocacy.
5.	critically analyze prevalent issues and challenges faced by women, including gender-based violence, discrimination, and cultural biases, and propose measures for their eradication.

UNIT I	HUMAN VALUES	6

Value Education - Definition, Types of values; Human values - Acceptance, Consideration. Appreciation, Listening. Empathy, Sympathy, Honesty, Integrity, Wisdom, Decision making, Self-actualization, Character formation towards positive personality, Contentment; - Religious Values - Humility, Compassion, Gratitude. Peace, Justice, Freedom, Equality.

UNIT II	PERSONALITY DEVELOPMENT	6

Personal Development - Introspection, Self-confidence, Self-discipline; Flexibility -Peer pressure - Sensitization towards Gender Equality; Reliability; Unity; Modern Challenges of Adolescent Emotions and behavior - Comparison and Competition, Positive and Negative attitudes; Family values; Self- improvement - Physical exercises, Meditation ,Yoga.

UNIT III	VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT	6

Professional Values -. Integrity, Responsibility, Punctuality, Dedication - Perseverance - Competence; Civic sense and Responsibility; Global Values - Computer Ethics, Moral Leadership, Code of Conduct; Corporate Social Responsibility; Aesthetic values; National Integration and International understanding of Religious Values – Spirituality, thought process.

UNIT IV	GENDER EQUALITY	6

Gender Equality - Definition, Empowerment, Economic Equality; Condition of Women in India- Education, Healthcare, Political Representation, Gender-based Violence; Challenging Stereotypes: Parental and Caregiving Responsibilities; Legal and Policy Reform; Cultural Shifts; Global Perspective; Male Chauvinism; Sustainable Development..

UNIT V	WOMEN ISSUES AND CHALLENGES	6

Women Issues and Challenges - female feticide, violence against women; Domestic violence- dowry related abuse and deaths, Physical violence, Emotional abuse; Sexual assault; Honour killing; Eve-teasing- Stalking, e-stalking (cyber-crime).

	TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	discuss the concept of human values and their significance in personal and societal development.	Understanding (K2)
CO2	demonstrate introspective skills to enhance personal growth and self-awareness.	Applying (K3)
CO3	recognize the importance of gender equality in promoting a just and equitable society.	Understanding (K2)
CO4	cultivate a sense of social responsibility and ethical conduct towards achieving national and global development.	Analyzing (K4)
CO5	analyse the challenges faced by women in various spheres and identify strategies for addressing them.	Analyzing (K4)

TEXT BOOKS

1. A Foundation Course in Human Values and Professional Ethics: Presenting a Universal Approach to Value Education - Through Self-exploration. New Delhi, 2016.
2. Aurther, John. Personality Development. Lotus Press, 2018.

REFERENCES

1. Joshi, Dhananjay. Value Education in Global Perspective. Lotus Press, 2014.
2. Mahrotra, Mamta. Gender Inequality in India: Challenging Social Norms. Prabhat Books, 2015.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	1	-	1	1	1	2	3	2	1	1	3	1	2
CO2	-	1	-	1	1	1	3	3	2	2	1	1	1	2
CO3	-	1	-	1	1	1	2	3	1	1	1	3	1	2
CO4	-	1	-	1	1	1	2	3	2	2	1	2	1	2
CO5	-	1	-	1	1	1	1	3	2	2	1	3	1	2

EC23307	DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION	3	0	2	4
(Common to CSE (IoT), Cyber Security)					

COURSE OBJECTIVES	
To enable the students to	
1.	learn the fundamentals of digital logic circuits.
2.	be familiar with concepts in combinational logic circuits.
3.	acquire the knowledge in sequential circuits.
4.	understand the instruction set and addressing modes in a computer.
5.	know the concepts of I/O interfacing and memory systems.

UNIT I	BOOLEAN ALGEBRA AND MINIMIZATION	9

Review of binary number systems; Boolean laws and theorems - Boolean functions; Minimization of Boolean functions - Karnaugh map, Tabulation methods; Implementation of Boolean functions using logic gates, NAND, NOR.

UNIT II	COMBINATIONAL LOGIC CIRCUITS	9

Combinational circuits - Analysis and design procedures - Adders, Subtractors, Carry Look Ahead Adder, Code converters, Encoder, Decoder, Multiplexer, Demultiplexer.

UNIT III	SEQUENTIAL LOGIC CIRCUITS	9

Sequential circuits - Flip flops - SR, D, JK, T; Shift registers - SISO, SIPO, PISO, PIPO; Asynchronous and Synchronous Counters; Design of asynchronous sequential circuits - Reduction of state and flow tables; Race-free state assignment; Hazards.

UNIT IV	MACHINE INSTRUCTIONS AND ADDRESSING MODES	9

Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Basic I/O Operations, Stack and Queues, Subroutines, Additional Instruction.

UNIT V	I/O ORGANIZATION AND MEMORY SYSTEMS	9

Interrupts; Direct Memory Access; Standard I/O Interface; Semiconductor Memories - RAM, ROM, Cache, Virtual; Memory Management Requirements; Secondary Storage; Basic Concepts of Pipelining.

LIST OF EXPERIMENTS

1. Design and implementation of Adders and Subtractors using logic gates.
2. Design and implementation of Binary to Gray code and Gray to Binary code Code converters using logic gates.
3. Design and implementation of Multiplexer, De-multiplexer, Encoder and decoder.
4. Implementation of 4-bit shift registers using Flip flops. (SISO/ SIPO/PISO/PIPO).

Programming using 8086	
1. Basic arithmetic and Logical operations.	
2. Sorting and searching	
TOTAL PERIODS	**75**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	apply the fundamentals of digital logic circuits.	Applying (K3)
CO2	design combinational logic circuits.	Applying (K3)
CO3	analyze and design Sequential circuits.	Applying (K3)
CO4	identify the instruction set and addressing modes in a computer.	Analyzing (K4)
CO5	recall the concepts of I/O interfacing and memory systems.	Understanding (K2)

TEXT BOOKS

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", Pearson, 6th Edition, 2018.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", 5th Edition, Elsevier, 2014.

REFERENCES

1. H. Charles Roth Jr, "Digital System Design using VHDL", Thomson/ Brooks cole, 2015.
2. S. Salivahanan and S. Arivazhagan, "Digital Circuits and Design", 4th Edition, Vikas Publishing House Pvt.Ltd, New Delhi, 2012.
3. Carl Hamacher, "Computer Organization", 6th Edition, McGraw Hill, 2023.
4. John P. Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hill, 2012.

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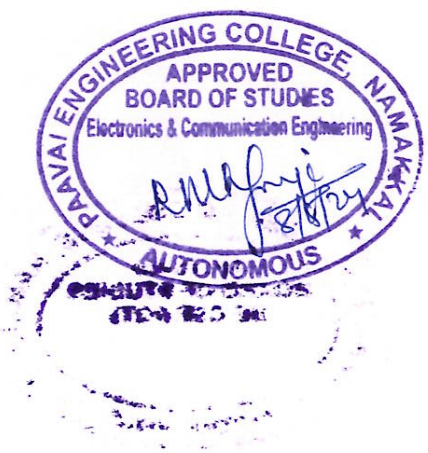
COs	PO's												PSO's	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	-	1	-	-	-	1	1	-	2	2	2
CO2	3	2	2	-	1	-	-	-	1	1	-	2	2	2
CO3	3	2	2	-	1	-	-	-	1	1	-	2	2	2
CO4	3	2	2	-	1	-	-	-	1	1	-	2	2	2
CO5	3	1	2	-	1	-	-	-	1	1	-	2	2	2



CI23304	DATA STRUCTURES LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	implement basic data structure using an array.
2.	implement linear data structures.
3.	apply various operations on non-linear data structures.
4.	get familiarized to sorting and searching algorithms.

LIST OF EXPERIMENTS

1. Array implementation of List ADT.
2. Linked List Implementation of Singly and Doubly Linked List.
3. Array Implementation of Stack ADTs.
4. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion.
5. Array Implementation of Queue ADTs.
6. Applications of Queue ADTs.
7. Implementation of Binary Search Trees.
8. Implementation of AVL Trees.
9. Implementation of Graph Traversal algorithms.
10. Implementation of Linear Search and Binary Search.
11. Implementation of Insertion Sort and Bubble Sort.
12. Implementation of Hashing–any one collision techniques.

TOTAL PERIODS	**60**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	develop a basic data structure using an array.	Applying (K3)
CO2	perform various operations in stacks, queues, linked list.	Applying (K3)
CO3	implement various operations on non-linear data structures.	Applying (K3)
CO4	apply searching and sorting techniques for given data.	Applying (K3)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	-	-	-	2	-	1	3	3	1
CO2	3	3	3	-	3	-	-	-	2	-	1	3	3	1
CO3	3	3	3	-	3	-	-	-	2	-	1	3	3	1
CO4	3	3	3	-	3	-	-	-	2	-	1	3	3	1

CI23305	OBJECT ORIENTED PROGRAMMING LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	build software development skills using java programming for real-world applications.
2.	understand and apply the concepts of classes, packages, and interfaces.
3.	implement exception handling and perform file processing.
4.	develop applications using generic programming and event handling.

LIST OF EXPERIMENTS

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion).
2. Develop stack and queue data structures using classes and objects.
3. Write a Java program to demonstrate the concept of package.
4. Solve the above problem using an interface.
5. Implement exception handling and creation of user defined exceptions.
6. Write a Java program that implements a multi-thread application.
7. Write a program to perform file operations.
8. Write a Java program to handle all mouse events and key events using Adapter classes.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Create a Java application for Student Information System. It is used to store, administer and manage all aspects of student information such as student details, subjects, semesters, enrollment details, grades of students, etc.
12. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for digits and for the + - * / % operations. Add a text field to display the result.

	TOTAL PERIODS	**60**

COURSE OUTCOMES		**BT MAPPED**
At the end of this course, the students will be able to		(Highest Level)
CO1	analyze software development skills for real-world applications.	Applying (K3)
CO2	investigate different methodologies to create application using classes, packages, and interfaces.	Applying (K3)
CO3	explore exception handling and perform file processing.	Applying (K3)
CO4	create applications using generic programming and event handling.	Applying (K3)

CO-PO MAPPING:

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COs	PO's												PSO's	
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CO1	3	3	3	-	3	-	-	-	2	-	1	3	3	-
CO2	3	3	3	-	3	-	-	-	2	-	1	3	3	-
CO3	3	3	3	-	3	-	-	-	2	-	1	3	3	-
CO4	3	3	3	-	3	-	-	-	2	-	1	3	3	-

GE23301	PROFESSIONAL DEVELOPMENT I	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1.	enhance and evaluate the student's professional skills and introduce the function of corporate world.
2.	enhance and develop the students behavioral, speaking and listening skills to face the interview.
3.	solve advance level verbal aptitude tests to get placed in Tier I companies.
4.	improve their reasoning skills to get placed in reputed companies.

UNIT I	SELF - UNDERSTANDING AND PERSONALITY ENHANCEMENT SKILLS	7

Introduction self-exploration; SWOT analysis - Types and barriers; Effective communication in workplace; Leadership skills; Decision making - Problem solving; Goal setting - Critical, strategic and lateral thinking; JAM level- I; Basic resume building level- I.

UNIT II	BEHAVIOURAL SKILLS, LISTENING AND SPEAKING SKILLS	7

Behavioural skills; Time management; Emotional intelligence; Analytical thinking- Listening; Listening and hearing; Self-introduction; Group discussion - Types and importance, evaluation criteria, do's and don'ts of GD; GD Level-1.

UNIT III	QUANTITATIVE APTITUDE	8

Number System; LCM and HCF; Simple interest and compound interest; Average; Pipes and cisterns; Area; Profit and loss.

UNIT IV	LOGICAL REASONING	8

Logical sequence; Analogy; Classification; Causes and effect; Making judgment; Directions.

	TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	define and analyze soft skills to improve the leadership skills.	Analyzing (K4)
CO2	demonstrate the behavioral skills through various activities.	Applying (K3)
CO3	develop the problem solving skills through quantitative aptitude.	Applying (K3)
CO4	illustrate the logical reasoning Skills to solve real world problems.	Analyzing (K4)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill, 2023.
2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

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CO3	3	2	2	2	-	1	-	-	-	-	2	-	2	2
CO4	2	1	3	2	-	3	3	1	-	1	2	-	2	2

PAVAI ENGINEERING COLLEGE, NAMAKKAL
Approved
BOARD OF STUDIES
English
25/5/24
AUTONOMOUS

MA23403	PROBABILITY AND STATISTICS	3	1	0	4

(Common to Agri, Biotech, Cyber, CSE, CSE(IOT), CSE(AI&ML), AI&DS, IT, Food, Pharma)

COURSE OBJECTIVES

To enable the students to

1. analyse the concept of random variables and probability distribution in designing processes.
2. differentiate the discrete and continuous two dimensional random variables.
3. determine the concepts of hypotheses testing, its need and applications.
4. equip with statistical techniques for designing experiments, analyzing, interpreting and presenting research data.
5. emphasize the aspects of control charts in quality control.

UNIT I **RANDOM VARIABLES** **12**

Discrete and continuous random variables – Moments, Moment generating functions; Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions; Functions of random variables.

UNIT II **TWO - DIMENSIONAL RANDOM VARIABLES** **12**

Joint distributions; Marginal and conditional distributions; Covariance, Correlation and Linear regression; Transformation of random variables; Applications of Central limit theorem (for independent and identically distributed random variables).

UNIT III **TESTING OF HYPOTHESIS** **12**

Sampling distributions - Estimation of parameters; Statistical hypothesis; Large sample test for single mean and difference of means; Small samples - Tests based on t, Chi-square and F distributions for mean, variance and proportion; Contingency table (test for independent), Goodness of fit.

UNIT IV **DESIGN OF EXPERIMENTS** **12**

Completely randomized design; Randomized block design; One way and two way classifications- Latin square design - 2^2 factorial design.

UNIT V **STATISTICAL QUALITY CONTROL** **12**

Control charts for measurements (X and R charts) - Control charts for attributes (P, C and NP charts), Tolerance limits, Acceptance sampling - U-test and Sign test.

TOTAL PERIODS **60**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	assign suitable probability distributions in engineering problems.	Understanding (K2)
CO2	apply the concept of discrete and continuous two dimensional random variables.	Analyzing (K4)
CO3	apply the concept of testing of hypothesis for small and large samples in real life problems	Applying (K3)
CO4	analyse the principles to be adopted for designing the experiments.	Applying (K3)
CO5	examine statistical data using control chart in quality control	Analyzing (K4)

TEXT BOOKS

1. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4thEdition, 2007.
2. Johnson. R.A. and Gupta. C.B., Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7thEdition, 2007.

REFERENCES

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8thEdition, 2012.
2. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education Asia, 8thEdition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.

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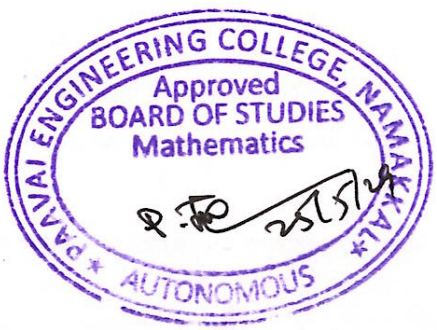
CO2	3	2	3	3	-	-	-	-	-	-	-	3	1	2
CO3	3	3	3	2	-	-	-	-	-	-	-	2	1	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	1	2
CO5	3	3	2	3	-	-	-	-	-	-	-	2	1	2



CI23401	DATABASE MANAGEMENT SYSTEMS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	explore the fundamentals of DBMS and Relational Model.
2.	acquire the knowledge about basic, intermediate and advanced SQL.
3.	design the database with Query Languages and E-R model.
4.	apply the normalization and understand the storage and File structure.
5.	implement the query processing, optimization and Transaction.

UNIT I	INTRODUCTION	9

Introduction- Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Database Users and Administrators; Relational Model - Structure of Relational Databases, Database Schema, Keys, Schema Diagrams, Relational Query Languages-Relational Operations.

UNIT II	INTRODUCTION TO SQL AND INTERMEDIATE AND ADVANCED SQL	9

Introduction to SQL- Overview of the SQL Query Language, Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions, Nested Sub queries; Intermediate & Advanced SQL - Join Expressions, Views, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization, Functions and Procedures, Triggers.

UNIT III	DATABASE DESIGN	9

Relational Query Languages - The Relational Algebra, The Tuple Relational Calculus, The Domain Relational Calculus; E-R Model - The Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Entity-Relationship Design Issues.

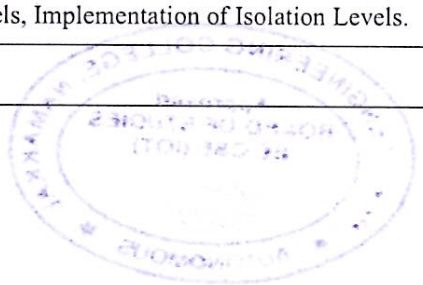
UNIT IV	RELATIONAL DATABASE DESIGN AND STORAGE AND FILE STRUCTURE	9

Relational Database Design - Features of good relational designs, Functional dependency, Decomposition using functional dependencies, Normal Forms, 1NF, 2NF, 3NF, BCNF, 4NF, 5NF; Storage and File Structure - Physical Storage Media, Magnetic Disk and Flash Storage, RAID, Tertiary Storage, File Organization, Organization of Records in Files, Data-Dictionary Storage.

UNIT V	QUERY PROCESSING, QUERY OPTIMIZATION AND TRANSACTIONS	9

Query Processing and Query Optimization - Selection Operation, Sorting, Join Operation, Heuristic optimization, Cost based optimization; Transaction - Transaction concept, Transaction Atomicity and Durability, Transaction Isolation Serializability, Transaction Isolation and Atomicity, Transaction Isolation levels, Implementation of Isolation Levels.

	TOTAL PERIODS	45



COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	describe the database architecture and schema diagrams.	Understanding (K2)
CO2	explore Structured Query Language for creating databases.	Applying (K3)
CO3	design a database using Relational Query Languages and E-R model	Applying (K3)
CO4	choose the appropriate normal form for the given database.	Analysing (K4)
CO5	make use of query processing, optimization and Transaction for finding best performance.	Analysing (K4)

TEXT BOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.

REFERENCES

1. Ramakrishna R. & Gehrke J, Database Management Systems, third edition, Mc-Graw Hill,2022.
2. Elmasri Ramez and Navathe Shamkant B., "Fundamental Database Systems", 7th Edition, Pearson Education, New Delhi, 2017.
3. Majumdar, A. K., and Bhattacharyya, P. Database Management Systems. McGraw-Hill, 2017.
4. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, New Delhi, 2013.

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(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
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CO1	3	2	2	1	2	-	-	-	-	-	-	-	2	1
CO2	3	3	2	1	2	-	-	-	-	-	-	-	3	2
CO3	3	3	3	2	3	-	-	-	-	-	2	2	3	3
CO4	3	3	2	3	2	-	-	-	-	-	1	-	3	2
CO5	3	3	3	3	3	-	-	-	-	-	2	2	3	3

CI23402	OPERATING SYSTEMS	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1.	understand the basic concepts and functions of operating systems.
2.	acquire knowledge about processes, threads, scheduling algorithms and concept of deadlocks.
3.	analyze various memory management schemes.
4.	learn file system interfaces and implementation process.
5.	be familiar with virtual machines , clouds and IOT Operating Systems.

UNIT I	INTRODUCTION TO OPERATING SYSTEMS	9

Introduction - Computer system organization, Operating Systems and types, Operating system structures, Services, System calls, System programs; Processes - Process concept, Process scheduling, Operations on Processes, Cooperating processes, Inter process communication; Threads - Overview, Multi-threading models - Threading issues.

UNIT II	PROCESS MANAGEMENT AND DEADLOCK	9

CPU Scheduling - Concepts-scheduling criteria, Scheduling algorithms, Algorithm Evaluation; Process Synchronization - The critical-section problem, Synchronization hardware; Semaphores, Classic problems of synchronization - Monitors; Deadlock-System model - Deadlock Characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III	MEMORY MANAGEMENT	9

Main Memory – Background, Swapping, Contiguous memory allocation, Paging Segmentation, Segmentation with paging; Virtual Memory – Background, Demand paging, Page replacement, Allocation of frames, Thrashing.

UNIT IV	FILE SYSTEMS	9

File-System Interface - File concept, Access methods, Directory structure, File system mounting, File sharing, Protection; File-System Implementation - Directory implementation, Allocation methods, Free-space management, efficiency and performance, recovery, Network file systems.

UNIT V	I/O SYSTEMS	9

I/O Systems - I/O Hardware - Application I/O interface - kernel I/O subsystem - streams - Performance; Disk attachment - Disk scheduling - Disk management - Storage Device Management - Swap-space management - RAID - stable storage.

	TOTAL PERIODS	45

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	identify appropriate system calls for a given service using various OS services and structure.	Understanding (K2)
CO2	apply different methods for process synchronization and handling deadlock.	Apply (K3)
CO3	make use of memory management strategies and page replacement policies to address demand paging.	Analyze (K4)
CO4	apply various file system concepts for memory management.	Apply (K3)
CO5	make use of memory management strategies for storing data.	Understanding (K2)

TEXT BOOKS

1. Silberschatz, Galvin, and Gagne, "Operating System Concepts", Tenth Edition, Wiley India Pvt Ltd, 2018.
2. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition Prentice Hall of India, 2018.

REFERENCES

1. Andrew S. Tanenbaum, "Modern Operating Systems", Fourth Edition, Pearson Education, 2014.
2. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2007.
3. Andrew S. Tannenbaum & Albert S. Woodhull, "Operating System Design and Implementation", Prentice Hall, 3rd Edition, 2006.
4. Gary J.Nutt, "Operating Systems", Pearson/Addison Wesley, 3rd Edition, 2004.

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COs	PO's												PSO's	
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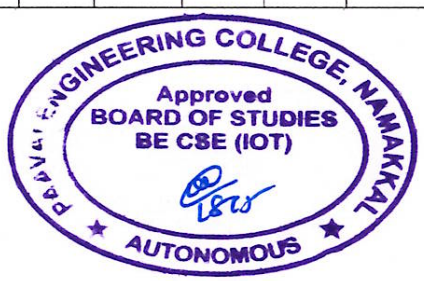
CO1	1	3	-	-		-	-	-	1	-	-	-	2	1
CO2	3	3	3	-	3	-	-	-	1	-	-	1	2	1
CO3	2	3	3	-	3	-	-	-	1	-	1	2	2	1
CO4	2	3	3	-	3	-	-	-	1	-	2	3	2	1
CO5	3	3	-	-	-	-	-	-	3	3	2	3	1	3



CI23403	SENSORS AND DEVICES	3	0	0	3

COURSE OBJECTIVES

To enable the students to

1	learn sensor fundamentals, its characteristics also the fundamentals and basics of vibration sensors.
2	know the concepts of practical sensors which includes bio, chemical and mechanical type
3	study about the applications of optical, radiation and temperature sensors
4	find the smart sensor basics and applications
5	acquire the knowledge of physical device interfaces

UNIT I INTRODUCTION TO SENSORS — **9**

Sensor Fundamentals – Basic sensor technology, sensor systems; Application considerations – sensor characteristics, system characteristics, instrument selection, data acquisition and readout; Acceleration, Shock and Vibration Sensors – Technology Fundamentals, Piezoresistive Accelerometers, Capacitive Accelerometers, Servo or (Force Balance) Accelerometers, Applicable Standards, Interfacing and Designs

UNIT II BIO, CHEMICAL AND MECHANIAL SENSORS — **9**

Biosensors – overview of bio sensors – applications of bio sensors – origin of biosensors – application range of biosensor; Chemical sensors– technology fundamentals – applications; capacitive sensors – inductive sensors - Capacitive and Inductive Sensor Types; Flow and level sensor – Methods for Measuring Flow, Selecting Flow Sensors, Recent Advances in Flow Sensors, Level Sensors force; Load and weight sensor - Quartz Sensors, Strain Gage Sensors; humidity sensor

UNIT III OPTICAL, RADIATION AND TEPERATURE SENSORS — **9**

Optical and Radiation Sensors – Photo sensors, Thermal Infrared Detectors; Position and Motion Sensors - Contact and Non-contact Position Sensors; pressure sensor –Piezoresistive Pressure Sensing; Piezoelectric Pressure Sensors; Temperature sensor - Sensor Types and Technologies; Nanotechnology-Enabled Sensors - Wireless Sensor Networks: Principles and Applications

UNIT IV SMART SENSORS AND APPLICATIONS — **9**

Smart Sensors - Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, the Automation; Recent Trends in Sensor Technologies –Film sensors, micro electromechanical systems; Sensors Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Medical Diagnostic Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring

UNIT V IOT PHYSICAL DEVICES AND ENDPOINTS — **9**

Introduction to Arduino and Raspberry Pi- Installation, Interfaces (serial, SPI, I2C); Controlling Hardware-Connecting LED, 7-Segment LED Display, Optocoupler, unipolar and bipolar Stepper motors, Relay, Piezo Buzzer, Push Button Switch, Keyboard, Controlling servo motor, speed control of DC Motor

TOTAL PERIODS — **45**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	understand the characteristics of sensors and fundamentals of vibration sensors	Understanding (K2)
CO2	apply the mechanical and chemical applications.	Applying (K3)
CO3	recognize the implementation of sensor networks with optical and radiation sensors.	Understanding (K2)

CO4	design and implementation of smart sensors	Analysing (K4)
CO5	analyze the appropriate IoT endpoint devices and its interfaces.	Analysing (K4)

TEXT BOOKS

1. Jon S. Wilson, "Sensor Technology", Newnes is an imprint of Elsevier, 2005
2. D. Patranabis,"Sensors and Transducers", PHI, 2013

REFERENCES

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things, A Hands on Approach", Orient Blackswan Private Limited, 1st Edition, 2015.
2. Nathan Ida, "Sensors, Actuators and their Interfaces, A multidisciplinary Introduction", Scitech Publishing, 2014.
3. Sabrie Soloman, "Sensors Handbook", second edition, McGraw Hill, 2010.
4. Ambika Nagaraj, "Introduction to Sensors in IoT and Cloud Computing Applications", Bentham Science Publishers Pte. Ltd, 2021

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CO4	3	2	2	1	2	-	-	-	1	-	2	2	2	1
CO5	3	2	2	1	2		-	-	1	-	2	2	2	1

MC23401	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0

COURSE OBJECTIVES

To enable the students to

1.	establish the knowledge of precious resources of the environment and their various impacts.
2.	create awareness on ecosystem and biodiversity preserve.
3.	learn scientific and technological solutions to current day pollution issues.
4.	analyze climate changes, concept of carbon credit and the challenges of environmental management.
5.	understand green materials, energy cycles and the role of sustainable urbanization.

UNIT I	ENVIRONMENT AND NATURAL RESOURCES	6

Definition, scope and importance of Environment. Forest resources: Use and over-exploitation, deforestation, - mining, dams and their effects on forests and tribal people. Water resources: Use and over- utilization of surface and ground water, dams-benefits and problems. Food resources: effects of modern agriculture, fertilizer-pesticide problems. Role of an individual in conservation of natural resources.

UNIT II	ECOSYSTEMS AND BIODIVERSITY	6

. Concept of an ecosystem: Structure and function of an ecosystem - ecological succession - food chains and food webs. Ecosystems- Types of ecosystem: Introduction - forest ecosystem and lake ecosystems. Biodiversity: Introduction - definition (genetic - species - ecosystem). Diversity - Value of biodiversity - Hotspots of biodiversity - Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT III	ENVIRONMENTAL POLLUTION	6

Pollution: Définition - air pollution - water pollution - marine pollution - noise pollution. Solid waste management: Causes - effects - control measures of urban and industrial wastes. Role of an individual in prevention of pollution - Electronic waste -Sources-Causes and its effects- Pollution case studies-Field study of local polluted site – Industrial/Agricultural

UNIT IV	SUSTAINABILITY AND ENVIRONMENT	6

Sustainability - from unsustainability to sustainability-millennium development goals, and protocols. Sustainable development goals-targets, indicators and intervention areas. Climate change— acid rain - ozone layer depletion. Regional and local environmental issues and possible solutions-case studies. Concept of carbon credit, carbon footprint. Environmental management in industry-A case study.

UNIT V	SUSTAINABILITY PRACTICES	6

Zero waste and R concept, Circular economy, ISO 14000 Series, Environmental Impact Assessment - Sustainable energy: Non-conventional Sources, Green materials, Energy Cycles - carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economical and technological change.

	TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	find the method of conservation of natural resources.	Understanding(K2)
CO2	understand ecosystem and the conservation of biodiversity.	Understanding(K2)
CO3	aware of environmental pollution and interpret its effects.	Understanding(K2)
CO4	apply sustainable development for technological advancement and societal development.	Applying(K3)
CO5	measure the sustainability practices for green energy cycles.	Analyzing(K4)

TEXT BOOKS

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw Hill, 1st edition, 2017.
2. Gilbert M. Masters, Wendell P. Ela " Introduction to Environmental Engineering and Science", 3rd edition, Pearson, 2022.

REFERENCES

1. William P. Cunningham and Mary Ann Cunningham, "Environmental Science: A Global Concern", McGraw Hill, 16th edition, 2023.
2. C. S. Rao, Environmental Pollution and Control engineering, New Age International (P) ltd Publication, New Delhi, 4th edition, 2021.
3. Erach Bharucha, "Textbook of Environmental Studies", Universities Press Pvt. Ltd., edition,2020.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 4th Edition, 2015.

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	1	-	-	-	2	-	-	1	1	-	-	-	-
CO2	-	2	-	-	1	1	-	1	-	-	-	-	-	-
CO3	2	-	1	1	-	-	-	2	-	-	-	2	-	-
CO4	-	2	-	-	1	-	3	1	1	-	1	1	-	-
CO5	2	2	-	1	-	-	2	1	-	-	-	1	-	-

EC23407	MICROPROCESSOR AND MICROCONTROLLER	3	0	2	4

COURSE OBJECTIVES	
To enable the students to	
1.	understand the architecture and programming of 8086 microprocessor.
2.	acquire knowledge on bus structures and various configurations of 8086 microprocessor.
3.	learn the design aspects of I/O and memory interfacing circuits.
4.	be familiar with the architecture of 8051 microcontroller.
5.	design a microcontroller-based system.

UNIT I	8086 MICROPROCESSOR	9
8086 Microprocessor - Pin Configuration, Architecture, Addressing modes, Instruction set, Assembler directives, Assembly language programming.		
UNIT II	**8086 SYSTEM BUS STRUCTURE**	**9**
8086 signals - Basic configuration, System bus timing; System design using 8086 I/O programming; Introduction to Multiprogramming - System Bus Structure, Multiprocessor configurations - Coprocessor, closely coupled and loosely Coupled configurations; Introduction to advanced processors.		
UNIT III	**INTERFACING WITH 8086 MICROPROCESSOR**	**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; Case studies -Traffic Light control, LED display, LCD display.		
UNIT IV	**8051 MICROCONTROLLER**	**9**
Comparison of microprocessor and microcontroller; 8051 - Architecture, Special Function Registers (SFRs), I/O Ports and circuits, Instruction set, Addressing modes, Assembly language programming; PIC and ARM processors.		
UNIT V	**INTERFACING WITH 8051 MICROCONTROLLER**	**9**
Interfacing 8051 - Timers, Serial Port, Interrupts, LCD, Keyboard / Display controller, ADC, DAC, Sensor Interfacing, Stepper Motor controller and Waveform generator.		

LIST OF EXPERIMENTS

1. Basic arithmetic and Logical operations using 8086 Microprocessor.
2. Move a data block without overlap using 8086 Microprocessor.
3. String manipulations using 8086 Microprocessor.
4. Sorting and searching using 8086 Microprocessor.

5. Interfacing Key board and Display with 8086 Microprocessor.	
6. Basic arithmetic and Logical operations using 8051 Microcontroller.	
7. Interfacing ADC and DAC with 8051 Microcontroller.	
TOTAL PERIODS	**75**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	infer the operations of 8086 microprocessor architecture and 8086 programs.	Understanding (K2)
CO2	execute programs based on 8086 microprocessor.	Understanding (K2)
CO3	interface I/O circuits for real time applications.	Applying (K3)
CO4	analyse different microcontroller operations and programs.	Analyzing (K4)
CO5	design and implement 8051 microcontroller-based systems.	Applying (K3)

TEXT BOOKS

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", 2nd Edition, Prentice Hall of India, 2015.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", 2nd Edition, Pearson education, 2011.

REFERENCES

1. Ramesh S. Gaonkar, "Microprocessor Architecture, Programming and Applications with 8085", Penram International Publishing reprint, 6th Edition, 2017.
2. Krishna Kant, "Microprocessor and Microcontroller Architecture, programming and system design using 8085, 8086, 8051 and 8096, PHI, 2007, Seventh Reprint, 2013.
3. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012.
4. Kenneth J. Ayala, The 8051 Microcontroller, 3rd Edition, Thompson Delmar Learning, 2012.

CO-PO MAPPING :

Mapping of Course Outcomes (CO's) with Programme Outcomes (PO's) and Program Specific Outcomes (PSO's) (1/2/3 indicates the strength of correlation) 3 – Strong , 2 – Medium , 1 – Weak

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

CI23404	DATABASE MANAGEMENT SYSTEMS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	explore and implement important commands in SQL with key and constraints.
2.	learn the usage of nested and joint queries.
3.	acquire the knowledge of Triggers, Views and Cursor.
4.	familiar with the use of a database Connectivity

LIST OF EXPERIMENTS

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Database Programming: Implicit and Explicit Cursors.
11. Database Connectivity with Front End Tools.

TOTAL PERIODS	**60**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	create SQL databases table with various key constraints	Applying (K3)
CO2	construct simple and advanced Query Techniques and Join operations	Applying (K3)
CO3	implement the Transaction Management and Trigger Implementation	Applying (K3)
CO4	develop program with Integration and Database Programming	Applying (K3)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	1	2	-	-	-	-	-	-	-	3	2
CO2	3	3	2	2	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	3	3	-	-	-	1	1	-	-	3	3
CO4	3	3	3	3	3	2	-	-	2	2	1	2	3	3

CI23405	OPERATING SYSTEMS LABORATORY	0	0	4	2

COURSE OBJECTIVES

To enable the students to

1.	execute shell programming and the use of filters in the UNIX environment.
2.	perform programming in c using system calls and to process creation and inter process communication, demonstrate scheduling algorithms.
3.	implement file system related system calls.
4.	be familiar with implementation of CPU scheduling algorithms, page replacement algorithms and deadlock avoidance.

LIST OF EXPERIMENTS

1. Basics of UNIX commands.
2. Shell Programming.
3. Implement the following CPU scheduling algorithms.
   a) FCFS b) SJF c) Priority d) Round Robin
4. Implement the following file allocation strategies.
   b) Sequential b) Indexed c) Linked
5. Implement Semaphores.
6. Implement Bankers Algorithm for Dead Lock Avoidance and Deadlock Detection.
7. Implement the following page replacement algorithms.
   c) FIFO b) LRU c) Optimal
8. Implement Paging Technique of memory management.
9. Implement Shared memory and IPC.
10. Implement Thread and Synchronization

TOTAL PERIODS	**60**

COURSE OUTCOMES At the end of this course, the students will be able to		**BT MAPPED** (Highest Level)
CO1	compare the performance of various CPU scheduling algorithms for a given applications.	Applying (K3)
CO2	implement the file allocation strategy.	Applying (K3)
CO3	implement deadlock avoidance and detection algorithms.	Applying (K3)
CO4	analyse different paging techniques for efficient memory allocation.	Applying (K3)

CO-PO MAPPING:

Mapping of Course Outcome (CO's) with Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)
(1/2/3 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	PO's												PSO's	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	3	-	-	-	-	2	1	3	2	1
CO2	3	3	3	1	2	-	-	-	-	2	2	3	2	1
CO3	3	2	3	2	3			2	2	2	2	3	2	1
CO4	3	3	3	1	2	-	-	-	-	2	2	3	2	1

GE23401	PROFESSIONAL DEVELOPMENT II	0	0	2	1

COURSE OBJECTIVES

To enable the students to

1.	enhance their own behavioural skills to survive in corporate world.
2.	evaluate their listening and speaking skills to face the interviews in a successful way.
3.	solve advance level verbal aptitude tests to get placed in Tier I companies.
4.	improve their reasoning skills to get placed in reputed companies.

UNIT I	WRITING SKILLS	7

Email writing; Fixing and cancelling appointments; Paper submission for seminars and conferences; Business communication; Stress management; Body language; Dress code; Self-introduction II; Update resume building II; JAM level -3.

UNIT II	PRESENTATION SKILLS	7

Presentation skills - Types and methods of delivering presentation, ways and methods to improve presentation skills; Mini presentation in smaller groups; Situational role play; Face to face interview; Group discussion level IL; JAM Level-4.

UNIT III	QUANTITATIVE APTITUDE - I	8

Simplification; Time, speed and distance; Trains; Boats and streams; Ratio and proportion; Partnership; Percentage.

UNIT IV	LOGICAL REASONING	8

Seating arrangement; Arithmetic reasoning; Character puzzle; Syllogisms; Matching definitions; Statements and arguments.

	TOTAL PERIODS	30

COURSE OUTCOMES At the end of this course, the students will be able to		BT MAPPED (Highest Level)
CO1	interpret the personality development through various activities.	Understanding (K2)
CO2	examine speaking and listening skills to excel in their jobs.	Analyzing (K4)
CO3	develop the quantitative skills and analytical skills to face the interview.	Applying (K3)
CO4	extend the reasoning abilities by scoring exceeded percentage to get placed in reputed companies.	Understanding (K2)

TEXT BOOKS

1. Agarwal, R.S. "Objective General English", S.Chand & Co.2021.
2. Agarwal, R.S. "Quantitative Aptitude", S.Chand & Co.2021.

REFERENCES

1. Abhijit Guha, "Quantitative Aptitude ", Tata-Mcgraw Hill, 2023.
2. Agarwal, R.S." a modern approach to Verbal & Non Verbal Reasoning", S.Chand & Co Ltd, New Delhi.2021.
3. Word Power Made Easy By Norman Lewis, Wr.Goyal Publications, 2021.

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COs	PO's												PSO's	
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CO1	-	-	-	-	-	-	3	3	2	3	-	3	1	2
CO2	-	-	-	-	-	-	2	3	2	3	-	3	1	2
CO3	3	2	2	-	-	1	-	-	-	-	2	-	2	2
CO4	2	3	3	2	-	3	3	1	-	1	2	-	2	2

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