



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI - 620 024
B.Sc. COMPUTER SCIENCE
CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED
CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2026 - 2027 onwards)

Sem	Part	Courses	Title	Ins. Hrs.	Credits	Exam. Hours	Maximum Marks		
							Int.	Ext.	Total
I	I	Ability Enhancement Course – I (AEC - I)	(Tamil \$ / Other Languages +, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – II (AEC - II)	English Course - I	6	3	3	30	70	100
	III	Core Course - 1 (CC - 1)	Programming in C and Data Structures	4	4	3	30	70	100
		Core Practical - 1 (CP - 1)	Programming in C and Data Structures Lab	4	4	3	40	60	100
		Allied Course - 1 (AC - 1)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 1 (ACP - 1)	Any one from the list	2	**	**	**	**	**
	IV	Value Education		2	2	3	30	70	100
		Interdisciplinary Course - 1 (IDC - 1) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	22	--	--	--	700
II	I	Ability Enhancement Course – III (AEC - III)	(Tamil \$ / Other Languages +, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – IV (AEC - IV)	English Course - II	6	3	3	30	70	100
	III	Core Course - 2 (CC - 2)	Programming in Java	4	4	3	30	70	100
		Core Practical - 2 (CP - 2)	Object Oriented Programming using Java Lab	4	4	3	40	60	100
		Allied Course - 2 (AC - 2)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 1 (ACP - 1)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 1 (SEC - 1) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course - 2 (IDC - 2) #	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800

III	I	Ability Enhancement Course – V (AEC - V)	(Tamil \$ / Other Languages +, #)	6	3	3	30	70	100
	II	Ability Enhancement Course – VI (AEC - VI)	English Course - III	6	3	3	30	70	100
	III	Core Course - 3 (CC - 3)	Programming in Python	4	4	3	30	70	100
		Core Practical - 3 (CP - 3)	Programming in Python Lab	4	4	3	40	60	100
		Allied Course - 3 (AC - 3)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP - 2)	Any one from the list	2	**	**	**	**	**
	IV	Skill Enhancement Course - 2 (SEC - 2) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course – 3 (IDC - 3) \$\$	One Course from Outside Department	2	2	3	30	70	100
		Health & Wellness @		--	1	--			100
	Total			30	23	--	--	--	800
I	Ability Enhancement Course – VII (AEC - VII)	(Tamil \$ / Other Languages +, #)	6	3	3	30	70	100	
IV	II	Ability Enhancement Course – VIII (AEC - VIII)	English Course - IV	6	3	3	30	70	100
	III	Core Course - 4 (CC - 4)	RDBMS and NoSQL	4	4	3	30	70	100
		Core Practical - 4 (CP - 4)	RDBMS and NoSQL Lab	4	4	3	40	60	100
		Allied Course - 4 (AC - 4)	Any one from the list	4	4	3	30	70	100
		Allied Course Practical - 2 (ACP - 2)	Any one from the list	2	4	3	40	60	100
	IV	Skill Enhancement Course - 3 (SEC - 3) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Interdisciplinary Course - 4 (IDC - 4) \$\$	One Course from Outside Department	2	2	3	30	70	100
	Total			30	26	--	--	--	800
		Summer Internship / Industrial Activity during the Summer Vacation after II Year							

V	III	Core Course - 5 (CC - 5)	Digital Electronics and Microprocessor	4	4	3	30	70	100
		Core Course - 6 (CC - 6)	Fundamentals of Algorithms	5	4	3	30	70	100
		Core Course - 7 (CC - 7)	Programming in PHP	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Software Engineering	5	4	3	30	70	100
		Core Practical - 5 (CP - 5)	Digital Electronics and Microprocessor Lab	5	4	3	40	60	100
	IV	Skill Enhancement Course - 4 (SEC - 4)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 5 (SEC - 5) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Introduction to Disaster Management		2	2	3	30	70	100
		Summer Internship / Industrial Activity @@	(with Viva-Voce)	--	2	-	20	80	100
	Total			30	28	-	--	--	900
VI	III	Core Course - 9 (CC - 9)	Data Communication and Networks	4	4	3	30	70	100
		Core Course - 10 (CC - 10)	Operating Systems	5	4	3	30	70	100
		Core Course - 11 (CC - 11)	Artificial Intelligence and Data Science	5	4	3	30	70	100
		Core Project Work (CPW) @@	Project Work (with Viva-Voce)	6	4	3	20	80	100
	IV	Value Added Course	General Studies for Competitive Examinations	2	1	-	30	70	100
		Skill Enhancement Course - 6 (SEC - 6)	Any one from the list	2	2	3	30	70	100
		Skill Enhancement Course - 7 (SEC - 7) ##	Naan Mudhalvan Course	2	2	3	30	70	100
		Environmental Studies		2	2	3	30	70	100
		Gender Studies		2	1	3	30	70	100
		Extension Activities *		--	1	-	--	--	--
	Total			30	25	-	--	--	900
	Grand Total			180	150	-	--	--	4900

ALLIED COURSE

First Year Students

Mathematics

Second Year Students

Physics / Electronics

SKILL ENHANCEMENT COURSE (SEC)			
Sl. No.	Title of paper	Sl. No.	MANDATORY Naan Mudhalvan Scheme ##
1.	Computer Graphics	1.	2nd Semester:
2.	Big Data Analytics		
3.	Mobile Application Development	2.	3rd Semester:
4.	Software Testing		
5.	Cloud Computing	3.	4th Semester:
6.	Data Mining		
7.	Internet of Things	4.	5th Semester:
--		5.	6th Semester:

INTERDISCIPLINARY COURSE (IDC) FOR WHO HAVE OPT TAMIL AS PART – I (for other Department Students only)	
1 st Semester	Fundamentals of Information Technology
2 nd Semester	Working Principles of Internet
3 rd Semester	Web Design
4 th Semester	Digital Marketing

INTERDISCIPLINARY COURSE (IDC) # FOR WHO HAVE NOT OPT TAMIL AS PART – I		
Those who have studied Tamil upto 10 th +2 but opt for other languages in degree	1 st Semester	Special Tamil – I
	2 nd Semester	Special Tamil - II
Those who have not studied Tamil in school level	1 st Semester	Basic Tamil - I
	2 nd Semester	Basic Tamil – II
Those students who opt for either special Tamil (or) Basic Tamil as IDCs, have to choose 2 more IDCs courses in their 3 rd and 4 th Semester from Outside his/her department.		

INTERDISCIPLINARY COURSE (IDC) \$\$ FOR NCC CADETS ONLY	
NCC Course is a Compulsory Course for the NCC Cadets in the 3rd Semester:	NCC Course is a Compulsory Course for the NCC Cadets in the 4th Semester:
Introduction to NCC	1. Special Subject Army (or) 2. Special Subject Navy (or) 3. Special Subject Air force
Those students who opt for NCC Courses as IDCs, have to choose 2 more IDCs courses in their 1 st and 2 nd Semester from Outside his/her department.	

SUMMARY OF CURRICULUM STRUCTURE OF UG PROGRAMMES

Sl. No.	Part	Types of the Courses	No. of Courses	Credits for each Course	Total Credits	Marks
1.	I	Ability Enhancement Course	4	3	12	400
2.	II	Ability Enhancement Course	4	3	12	400
3.	III	Core Course	11	4	44	1100
4.		Core Practical	5	4	20	500
5.		Minor Course (MC)	4	4	16	400
6.		Minor Course Practical (MCP)	2	4	8	200
7.		Core Project Work (CPW)	1	4	4	100
8.	IV	Skill Enhancement Course (SEC)	7	2	14	700
9.		Interdisciplinary Course (IDC)	4	2	8	400
10.		Value Education	1	2	2	100
11.		Health and Wellness	1	1	1	100
12.		Introduction to Disaster Management	1	2	2	100
13.		Summer Internship / Industrial Activity	1	2	2	100
14.		Value Added Course	1	1	1	100
15.		Environmental Studies	1	2	2	100
16.		Gender Studies	1	1	1	100
17.		EXTENSION ACTIVITIES (NCC / NSS / SPORTS / ANTI DRUG CELL / YRC & Any Other Activities	--	1	1	--
Total			49	-	150	4900

\$ For those who have studied Tamil upto 10th+2 (Regular Stream)
+ Syllabus for other Languages should be on par with Tamil at degree level

Those who have studied Tamil upto 10th+2 but opt for other languages in degree level under Part - I should study special Tamil and those who have not studied Tamil in the school level should study Basic Tamil in Part – IV under the Interdisciplinary Course.

** Examination at the end of the next semester

Naan Mudhalvan Scheme: As per the Naan Mudhalvan Scheme instructions, 5 courses from 2nd to 6th semester should be studied under Skill Enhancement Course.

\$\$ NCC Course is one of the Choices in the Interdisciplinary Course. Only the NCC Cadets are eligible to choose this course. However, NCC Course is a Compulsory Course for the NCC Cadets.

@ **Health and Wellness: Assessments:**

- Use self-reflective worksheets to assess their understanding
- submit the worksheets to internal audit / external audit
- Every student's activity report should be documented and the same have to be assessed by the Physical Director with Mentor. The evaluation should be for 100 marks. No examination is required.

Scheme of Evaluation:

Part	Description	Marks
A	Report	40
B	Attendance	20
C	Activities (Observation During Practice)	40
Total		100

@@ **Summer Internship / Industrial Activity**

Internship will be carried out during the summer vacation after the second year. Viva-Voce will be conducted by the college and Marks shall be sent to the University and the same will be included in the 5th semester Mark Statement.

Summer Internship / Industrial Activity & Project Work

Scheme of Evaluation:

Description	Marks
Report	80
Viva-Voce	20
Total	100

* Extension Activities shall be outside instruction hours.

PROGRAMME OUTCOMES:

- PO 1** **Communication Skill:** Mandatory language courses facilitate to become proficient in communication, culturally aware, and more employable in both Indian and global contexts. Improve presentations skill, debates, and professional communication.
- PO 2** **Disciplinary Knowledge:** Learn in-depth complex scientific concepts, demonstrate their ability to explain and apply their knowledge. Consistent in learning by earning extra credits in specialized courses within the science domain and enhance disciplinary knowledge.
- PO 3** **Critical thinking:** Field and academic visits will help students to develop observation skills, grasping ability, collect and interpret data and propose models that will help them to understand hypotheses and conclusions.
- PO 4** **Analytical Reasoning:** Through the interactions, students will develop skills of critical reading of texts, identifying gaps in knowledge, formulating scientific questions, and on will recognizing the synthesis of new ideas.
- PO 5** **Scientific Reasoning:** Skill oriented courses will provide details on principles, conduct of proper calibration and use of scientific instrumentation and appropriate use of scientific techniques in experimental design
- PO 6** **Self-directed Learning:** Preparation of field reports helps them to present their results and discussion in a written format that is typically required for their future professions.
- PO 7** **Reflective Thinking:** All core courses with laboratory components will provide exposure to a wide range of research techniques, therein enhancing their understanding of the application of techniques in their domain.
- PO 8** **Problem Solving:** Students will develop the ability to reason, apply numerical concepts, and equations in their fields of study for interpreting scientific data and drawing relevant scientific conclusions.
- PO 9** **Research-related Skills:** Students undertaking a internship will have the opportunity to design, develop and execute their own research ideas in their experiments, thus expanding their knowledge of research methods and laboratory skills.
- PO 10** **Lifelong Learning:** Ability to understand the gaps in knowledge and skill, adapt to technological change, engage in self-directed learning.

PROGRAMME SPECIFIC OUTCOMES:

PSO 1	To acquire the required knowledge in the Hardware and Software aspects of Computer Science domain and the art of programming.
PSO 2	To understand the development methodologies of software systems and the ability to analyse, design and develop computer applications for real life problems.
PSO 3	To gain knowledge and skills to collaborate and communicate with peers in IT / ITES industries
PSO 4	To understand, adjust and adapt with the dynamic technical environment for the growth of IT industry
PSO 5	To transfer the skills gained, to provide innovative and novel solutions by maintaining ethical norms for the betterment of humane society

UNIT – V: DATA STRUCTURES

Stack: LIFO concept, Stack operations, Array implementation of stack – Queue: FIFO concept, Queue operations, Array implementation of queue – Singly Linked List: concepts, operations – Doubly Linked List: concepts, operations – Trees: General trees, Binary trees.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. E. Balagurusamy, “Programming in ANSI C”, Tata McGraw Hill, New Delhi, Ninth Edition, 2024.
2. Reema Thareja, “Data Structure using C, “Oxford University Press”, New Delhi, Third Edition, 2023

REFERENCES:

1. Byron S. Gottfried, “Programming with C”, Schaum’s Outline Series, Tata-McGraw Hill Edition, New Delhi, 1991.
2. E.Horowitz, S.Sahni and Susan Anderson Freed, “Fundamental Data Structures in C”, 2ed, Orient BlackSwan Publisher, 2009
3. E. Karthikeyan, “A Textbook on C Fundamentals, Data Structures and Problem Solving”, Prentice-Hall of India Private Limited, New Delhi, 2008.
4. Yashavant Kanetkar, “Let us C”, BPB Publications, Tenth Edition, New Delhi, 2010.
5. <https://www.tutorialspoint.com/cprogramming/index.htm>
6. <https://www.w3schools.in/data-structures/intro>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|------------|--|
| CO1 | Demonstrate the ability to construct C programs by correctly utilizing basic building blocks |
| CO2 | Design and implement modular software solutions using functions and recursion and arrays |
| CO3 | Apply pointer arithmetic to manage memory addresses and organize complex information using user-defined data types |
| CO4 | Design and implement modular software solutions using functions and recursion |
| CO5 | Analyze and implement core data structure concepts, including the LIFO/FIFO operations of stacks and queues |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
C01	2	3	2	2	3	2	1	3	3	1	3	3	2	2	2	2.3
C02	3	3	3	2	3	1	2	3	2	3	3	3	2	2	1	2.4
C03	2	3	2	2	2	3	2	2	3	1	3	3	3	2	2	2.3
C04	2	2	1	1	3	1	2	1	2	2	3	3	2	2	2	1.9
C05	3	3	3	3	2	1	3	1	2	3	3	3	3	2	2	2.5
Average	2.4	2.8	2.2	2.0	2.6	1.6	2.0	2.0	2.4	2.0	3.0	3.0	2.4	2.0	1.8	2.4

Mean Co : 2.4

3 - Strong, 2 - Medium, 1- Low

Year: First

CORE PRACTICAL 1

Semester: I

Code : PROGRAMMING IN C AND DATA STRUCTURES
LAB
(Practical)

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify and define core C programming elements and the structural properties of linear data structures like Arrays and Stacks.
- ❖ Demonstrate how to use conditional logic and control structures to solve mathematical logic problems
- ❖ Implement fundamental algorithms for data retrieval and organization, specifically performing Linear Search and Bubble Sort
- ❖ Analyze and compare the operational mechanisms of various data structures,
- ❖ Design and construct modular programs that utilize dynamic memory and pointers to perform complex operations

To develop the C program for the following Exercises

1. Input/Output, Arithmetic, and Conditional Logic:

Concepts: Basic I/O (printf, scanf), operators, expressions, decision-making (if, switch)

Write a C Program to compute grade based on marks

2. Loops and Pattern Printing:

Concepts: for, while, do-while loops, nested loops

Write a C Program to Generate Multiplication Table

3. Arrays and Strings:

Concepts: 1D & 2D arrays, string handling functions

- (a) Write a C Program to Find largest and smallest element in an array
(b) Write a C Program to count vowels and consonants

4. Functions and Recursion:

Concepts: User-defined functions, parameter passing, recursion

Write a C Program to Print Fibonacci Series

5. Structures and File I/O:

Concepts: Structures, unions (basic idea), file handling (fopen, fread, fwrite)

Write a C Program Student record management using structures

6. Dynamic Array Implementation:

Concepts: Dynamic memory allocation (malloc, calloc, realloc, free)

Write a C Program Create dynamic array and perform insertion/deletion

7. Singly Linked List Operations:

Concepts: Linked list creation, traversal, insertion, deletion

Write a C Program to Reverse a linked list and count number of nodes

8. Doubly Linked List Operations:

Concepts: Forward and backward traversal, insertion, deletion

Write a C Program to Create and display doubly linked list, Forward and backward traversal, insertion, deletion

9. Searching and Sorting Techniques:

Concepts: Searching (Linear, Binary) and Sorting Techniques (Bubble, Selection, Insertion, Quick, Merge)

(a) Write a C Program to Implement Linear and Binary Search

(b) Write a C Program to Implement Sorting Techniques

10. Tree Traversals:

Concepts: Binary Trees, traversal techniques

Write a C Program to Create a Binary Tree and Counting leaf nodes

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

CO1	Describe and implement basic control structures to solve mathematical problems
CO2	Apply iterative and conditional logic to perform data validation tasks, such as determining if a number is a palindrome
CO3	Demonstrate the ability to store, traverse, and perform aggregate calculations (sum and average) on data sets using arrays
CO4	Construct and analyze linear data structures by implementing Stack, Queue operations and Singly Linked Lists
CO5	Analyze and execute fundamental algorithms for data organization and retrieval, specifically implementing Linear Search and Bubble Sort

Year: First

INTER DISCIPLINARY COURSE 1

Semester: I

Code :

**FUNDAMENTALS OF INFORMATION
TECHNOLOGY
(Theory)**

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Students will be able to identify the different generations and classifications of digital computers and define the basic anatomical components of a computer system.
- ❖ Students will be able to explain the functions of the CPU, primary memory, and various input/output and secondary storage devices.
- ❖ Students will be able to apply basic knowledge of programming languages, operating systems, and database management systems to interact with computer software.
- ❖ Students will be able to analyze the structure of computer networks, the World Wide Web, and email systems to navigate and design basic web-based interfaces.
- ❖ Students will be able to evaluate the diverse applications of computers in fields like medicine and engineering while constructing basic security strategies to protect against viruses, bombs, and worms.

UNIT – I: INTRODUCTION TO COMPUTER

Introduction to Computers-Generation of Computers - Classification of Digital Computer - Anatomy of Digital Computer.

UNIT – II: COMPUTER HARDWARE

CPU and Memory-Secondary Storage Devices-Input Devices-Output Devices

UNIT – III: COMPUTER SOFTWARE

Introduction to Computer Software – Programming Language-Operating System –Introduction to Database Management System.

UNIT – IV: NETWORK AND INTERNET

Computer Networks - WWW and Internet - Email - Web Design.

UNIT – V: COMPUTER APPLICATIONS AND SECURITY

Computers at Home, Education, Entertainment, Science, Medicine and Engineering - Introduction to Computer Security - Computer Viruses, Bombs, Worms.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. 'Alexis Leon and Mathews Leon, Fundamentals of Information Technology, Vikas Publishing House Pvt. Ltd, 2009
2. Fundamentals of Computers and Information Technology, M.N Doja, 2005

REFERENCES:

1. Ramesh Bangia, "Computer Fundamentals and Information Technology", Laxmi Publications Pvt Limited, 2008.
2. Bharihoke, "Fundamentals of Information Technology", Excel Books, 2009.
3. Ralph Stair, George Reynolds, "Fundamentals of Information Systems" Cengage Learning, 2015

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Describe the historical evolution of computer generations and identify the anatomical components
- CO2 Explain the functional relationship between the CPU, primary memory
- CO3 Differentiate between system software and application software while applying the basic concepts of programming languages
- CO4 Analyze the structure of computer networks and the World Wide Web (WWW)
- CO5 Evaluate the role of computers across diverse fields like medicine and engineering

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
C01	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.9
C02	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.2
C03	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.2
C04	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
C05	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.5
Average	3.0	3.0	2.4	2.4	2.0	1.2	1.0	2.6	1.8	2.0	3.0	2.6	2.2	2.6	1.8	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low

Year: First

CORE COURSE 2

Semester: II

Code :

**PROGRAMMING IN JAVA
(Theory)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Explain the core features of Java and implement essential programming constructs
- ❖ Apply Object-Oriented Programming (OOP) principles by creating classes and objects
- ❖ Analyze and implement complex relationships using inheritance, interfaces, and polymorphism
- ❖ Build resilient applications by implementing comprehensive exception handling (try-catch, custom exceptions)
- ❖ Design and construct professional-grade desktop applications by integrating AWT/Swing.

UNIT – I: OVERVIEW OF JAVA

Object Oriented Programming, Structure of Java program, Control statements, Data types, variables, and Arrays, Operators. Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference. Introducing Methods, Constructors, this Keyword, finalize() class.

UNIT – II: METHODS AND CLASSES

Overloading Methods, Overloading Constructors, Recursion, Introducing final, Nested and Inner Classes, Using Command Line Arguments, Inheritance: Inheritance Basics, Using Super, Method Overriding, Abstract Classes, The Object Class

UNIT – III: PACKAGES AND INTERFACES

Packages, Access Protection, Importing packages, Interfaces, Exception Handling: Fundamentals, Exception Types, Uncaught Exceptions, try and catch, Multiple catch clauses, Nested try statements, Throw, throws, finally. Multithreaded Programming: Thread model, Creating a Thread, Creating Multiple Threads

UNIT – IV: STRING HANDLING

Special String operations, Character extraction and String Comparison, Modifying a String. The Applet Class: Applet Basics, Applet Architecture, Apple Skeleton, Simple Applet Display Methods, Request Repainting, HTML APPLET tag.

UNIT – V: EVENT HANDLING

Event Handling Mechanisms, Event Classes: Action Event Class, Adjustment Event Class, Component Event Class, Container Event Class, Focus Event Class Introducing the AWT: AWT Class, Window Fundamentals, Working with Graphics, Working with Color

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. S. Sagayaraj, R. Denis, P. Karthik & D. Gajalakshmi, "Constructive Java Programming", Universities Press, 2021.
2. E. Balagurusamy, "Programming with JAVA", Tata McGraw Hill, New Delhi, 2019.

REFERENCES:

1. Herbert Schildt, Java: The Complete Reference
2. C. Muthu, "Programming with JAVA", Vijay Nicole Imprints Private Limited, Chennai, Second Edition, 2011.
3. Bruce Eckel, Chuck Allison, "Thinking in Java", Prentice Hall Publications, 2006
4. Malina Pronto, "Java: How To Learn Java Programming: How To Improve Your Java Coding In 2020/2021: 5 Programming Languages To Learn For Beginners In Tech", Independently Published, 2020.
5. Nick Samoylov, "Learn Java 12 Programming: A Step-by-step Guide to Learning Essential Concepts in Java", Packt Publishing, 2019.
6. <https://www.javatpoint.com/java-tutorial>
7. <https://www.geeksforgeeks.org>
8. <https://www.javatpoint.com>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Describe the Java runtime environment and implement fundamental programming constructs
- CO2 Apply Object-Oriented Programming (OOP) principles to design modular code using classes, objects
- CO3 Analyze and manage complex data relationships by implementing multi-dimensional arrays, advanced string handling
- CO4 build fail-safe applications by implementing multi-level exception handling and developing multi-threaded programs
- CO5 Synthesize full-scale Java applications by integrating interactive GUI components (AWT/Swing) with JDBC

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	1	3	1	3	1	1	2	2	2	2	2	2.1
CO2	3	2	1	2	2	2	1	1	3	1	3	3	3	3	2	2.1
CO3	2	3	2	3	1	2	1	1	1	1	2	2	3	2	1	1.8
CO4	3	3	3	2	2	1	3	2	2	1	2	2	2	2	2	2.1
CO5	3	3	3	3	2	2	2	3	1	2	3	3	1	3	2	2.4
Average	2.8	2.8	2.4	2.4	1.6	2.0	1.6	2.0	1.6	1.2	2.4	2.4	2.2	2.4	1.8	2.4

Mean Co : 2.4

3 - Strong, 2 - Medium , 1- Low

Code : **OBJECT ORIENTED PROGRAMMING USING JAVA** Credits: 4
 LAB
 (Practical)

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify and define the syntax required for basic Java programming,
- ❖ Explain and interpret the logic behind iterative and conditional statements used to solve mathematical problems
- ❖ Apply Java control structures to develop algorithms that manipulate data, specifically for reversing numbers and calculating the sum of digits.
- ❖ Analyze the requirements for graphical user interfaces to implement Applets
- ❖ Design and evaluate responsive Java applications that incorporate animation and event handling

To Implement Java Concepts for following exercises

1. Program to check whether a person is eligible to vote or not. If not find how many years he or she has wait to cause their vote.
2. Program to handle **looping and iterative statements**
3. Program to demonstrate **method overloading**.
4. Program to demonstrate **method overriding**
5. Program to handle **Exception Handling**.
6. Program to handle **Multithreading**
7. Program to demonstrate the various **string handling** functions.
8. Program to find area of **triangle and volume of rectangle** using inheritance.
9. Program to implement the concept of **packages**.
10. Program to create **multiple threads** using thread class.
11. JAVA applet to draw **multiple shapes with different colors**.
12. Program to handle a **button click event** and display a message

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|---|
| CO1 | Java syntax and control structures to solve fundamental problems |
| CO2 | Construct algorithms to transform and analyze numerical data, specifically by reversing numbers and calculating the sum of digits |
| CO3 | Construct algorithms to transform and analyze numerical data, specifically by reversing numbers and calculating the sum of digits |
| CO4 | Evaluate and implement interactive applet features such as displaying system time, creating moving text animations |
| CO5 | Synthesize event-handling techniques to create responsive programs |

Year: First

INTER DISCIPLINARY COURSE 2

Semester : II

Code :

**WORKING PRINCIPLES OF INTERNET
(Theory)**

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Students will be able to define the fundamental nature of the internet and identify the components of its underlying technical architecture
- ❖ Students will be able to describe the purpose of common internet tools and the role of multimedia in digital communication.
- ❖ Students will be able to apply standard protocols to establish stable internet connectivity and engage in effective online communication.
- ❖ Students will be able to analyze various methods used for safeguarding the internet against external threats and data vulnerabilities.
- ❖ Students will be able to evaluate the effectiveness of different internet security measures to protect both personal and organizational resources

UNIT – I: INTRODUCTION TO THE INTERNET

Introduction to Internet – Internet Basics – History and Evolution of the Internet – Internet Services – Internet Applications – Internet's Underlying Architecture – Client-Server Architecture – Internet Protocols.

UNIT – II: INTERNET CONNECTIVITY AND COMMUNICATION

Connecting to the Internet – Types of Internet Connections – Internet Service Providers (ISP) – Communication on the Internet – E-mail – Instant Messaging – Online Communication Methods – Netiquettes.

UNIT – III: INTERNET COMMUNICATION TOOLS

World Wide Web (WWW) – Working of the World Wide Web – Web Browsers – Search Engines – Web Pages and Websites – Common Internet Tools – E-mail Tools – FTP – Discussion Forums – Social Networking Tools.

UNIT – IV: MULTIMEDIA, INTRANET AND E-COMMERCE

Multimedia on the Internet – Audio and Video Streaming – Multimedia Applications – Intranet – Features and Benefits of Intranet – Electronic Commerce (E-Commerce) – Online Shopping – Digital Payments – Advantages and Limitations of E-Commerce.

UNIT – V: INTERNET SECURITY

Introduction to Internet Security – Safeguarding the Internet – Computer Viruses – Malware and Spyware – Firewalls – Antivirus Software – Password Security – Safe Browsing Practices – Cyber Threats and Protection Measures.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Preston Gralla, "How the Internet Works", Pearson Education, Eighth Edition, 2006.
2. C.Xavier, Fundamentals of Internet and Emerging Technologies, New Age International Private Limited; First Edition, 2021
3. Alexis Leon, Internet for Everyone, S. Chand (G/L) & Company Ltd; Second Edition 2012.
4. Andrea C. Nakaya, "Internet and Social Media Addiction", Reference Point Press, 2015.
5. Richard Fox, Wei Hao, "Internet Infrastructure: Networking, Web Services, and Cloud Computing", CRC Press, 2017.
6. Douglas E. Comer, "The Internet Book: Everything You Need to Know about Computer Networking and How the Internet Works", CRC Press, 2018

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Identify the core components of the internet and describe its underlying technical architecture
- CO2 Explain the functional mechanics of the World Wide Web (WWW)
- CO3 Apply standard protocols to establish internet connectivity, engage in digital communication,
- CO4 Examine contemporary developments in technology and analyze the methods
- CO5 Evaluate the effectiveness of different internet security measures

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
Average	2.8	3.0	2.2	2.2	2.2	2.4	1.4	2.0	1.8	2.0	2.8	2.8	2.4	2.4	1.6	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low

Year: Second

CORE COURSE 3

Semester: III

Code :

**PROGRAMMING IN PYTHON
(Theory)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify core language features including reserved keywords, identifiers, and variables interpret
- ❖ Explain and apply decision-making constructs, nested loops, and various data types.
- ❖ Design modular solutions by defining functions with multiple return values, utilizing recursive logic, and organizing code
- ❖ Analyze and implement Object-Oriented principles such as encapsulation, inheritance, and polymorphism
- ❖ Construct integrated applications that perform sophisticated text processing

UNIT – I: INTRODUCTION TO PYTHON:

Features of Python - How to Run Python - Identifiers - Reserved Keywords - Variables - Comments in Python - Indentation in Python - Multi-Line Statements - Multiple Statement Group (Suite) - Quotes in Python - Input, Output and Import Functions - Operators. Data Types and Operations: Numbers – Strings – List – Tuple – Set – Dictionary – Data type conversion.

UNIT – II: FLOW CONTROL

Decision Making – Loops – Nested Loops – Types of Loops. Functions: Function Definition – Function Calling - Function Arguments - Recursive Functions - Function with more than one return value.

UNIT – III: MODULES AND PACKAGES

Built-in Modules - Creating Modules - import Statement - Locating Modules - Namespaces and Scope - The dir() function - The reload() function - Packages in Python - Date and Time Modules. Python Strings: String operations - Immutable Strings - Built-in String Methods and Functions - String Comparison - File Handling- Directories in Python.

UNIT – IV: OBJECT-ORIENTED PROGRAMMING

Class Definition - Creating Objects - Built-in Attribute Methods - Built-in Class Attributes- Destructors in Python – Encapsulation - Data Hiding – Inheritance - Method Overriding- Polymorphism.

UNIT – V: EXCEPTION HANDLING

Built-in Exceptions-Handling Exceptions- Exception with Arguments - Raising Exception - User-defined Exception - Assertions in Python. Regular Expressions: The match() function - The search() function - Search and Replace - Regular Expression Modifiers: Option Flags-Regular Expression Patterns- Character Classes-Special Character Classes - Repetition Cases - findall() method - compile() method.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities For continuous internal assessment only)
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Reema Thareja, “ PYTHON Programming”, Oxford University Press, New Delhi, Third Edition, 2025
2. Jeeva Jose and P. Sojan Lal, “Introduction to Computing and Problem Solving with PYTHON”, Khanna Book Publishing Co, 2016.

REFERENCES:

1. Mark Summerfield. — Programming in Python 3: A Complete introduction to the Python Language, Addison-Wesley Professional, 2009.
2. Martin C. Brown, —PYTHON: The Complete Reference, McGraw- Hill, 2001
3. Wesley J. Chun, “Core Python Programming”, Prentice Hall Publication, 2006.
4. Timothy A Budd, “Exploring Python”, Tata McGraw Hill, New Delhi, 2011
5. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016
6. Guido van Rossum and Fred L. Drake Jr, —An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Describe the core features of Python and utilize fundamental syntax
- CO2 Apply decision-making constructs and various loop types to manipulate collections
- CO3 Design modular applications by implementing recursive functions, custom modules, and hierarchical packages
- CO4 Analyze and implement Object-Oriented principles, including inheritance and polymorphism
- CO5 Synthesize complex programs that perform advanced text processing using regular expressions

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	3	2	1	3	2	3	3	2	2	3	3	2.5
CO2	2	3	2	3	3	3	3	3	2	2	3	3	3	3	2	2.7
CO3	3	2	2	1	3	1	3	3	2	3	3	3	3	3	2	2.3
CO4	3	3	3	2	3	2	2	2	2	2	2	2	3	3	2	2.4
CO5	3	3	3	2	2	1	3	2	1	1	2	3	2	3	1	2.0
Average	2.8	2.8	2.6	2.0	2.8	1.8	2.4	2.6	1.8	2.2	2.6	2.6	2.6	3.0	2.0	2.4

Mean Co : 2.4

3 - Strong, 2 - Medium , 1- Low

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify and define core Python elements, including reserved keywords, identifiers, variables,
- ❖ Explain the mechanics of decision-making statements and iterative loops used to solve computational problems
- ❖ Implement functional programming by creating reusable code blocks and recursive functions
- ❖ Analyze and organize code using Object-Oriented principles—including inheritance and polymorphism.
- ❖ Construct comprehensive applications that integrate file handling for persistent storage with regular expressions

To Implement the PYTHON program for the following Exercises

1. Basic Syntax & Input/Output
2. Flow Controls & Loops
3. Lists & Iterables
4. Functions and Recursive Functions
5. Build in Modules
6. String Operations
7. Lists, Tuples, & Sets
8. Exception Handling
9. Object-Oriented Programming (OOP) – Inheritance, Polymorphism
10. Basic File I/O & Error Handling
11. Regular expression Modifiers
12. Advanced File & Data Handling (Eg. Directory Tree Generator, JSON Configuration Parser)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Apply fundamental control structures to solve simple computational problems
- CO2 Construct algorithms to perform mathematical operations, including calculating the sum of natural numbers
- CO3 Analyze text data to perform pattern-based checks, such as identifying palindromes and categorizing characters into vowels or consonants
- CO4 Design and implement recursive functions to solve complex mathematical problems
- CO5 Synthesize file-handling techniques to process external data, specifically calculating metrics

COURSE OBJECTIVES:

This course aims to:

- ❖ Learn HTML basics and design simple web pages.
- ❖ Understand frames, framesets, and HTML forms for web design.
- ❖ Learn DHTML and CSS for dynamic and styled web pages.
- ❖ Study Chemical Markup Language (CML) and its web representation.
- ❖ Learn Mathematical Markup Language (MathML) for displaying equations on web pages.

UNIT – I: HTML BASICS AND WEB PAGE DESIGN

Designing a Home Page - HTML Document - Anchor Tag – Hyperlinks - Head and Body Sections - Header Section - Title - Prologue - Links - Colorful Pages – Comments - Body Section - Heading - Horizontal Ruler - Paragraph - Tabs – Images and Pictures - Lists and their Types - Nested Lists - Table Handling.

UNIT – II: FRAMES AND FORMS IN HTML

Frames: Frameset Definition - Frame Definition - Nested Framesets - Forms: Forms and their Elements.

UNIT – III: DHTML AND STYLE SHEETS

Defining Styles - Elements of Styles - Linking a Style Sheet to a HTML Document - Inline Styles - External Style Sheets - Internal Style Sheets - Multiple Styles - Web Page Designing.

UNIT – IV: CHEMICAL MARKUP LANGUAGE (CML)

Introduction to Chemical Markup Language (CML) – Importance of CML – Basic structure of a CML document – Representation of chemical elements, atoms, and molecules – Simple CML tags and attributes – Displaying chemical information on web pages.

UNIT – V: MATHEMATICAL MARKUP LANGUAGE (MATHML)

Introduction of Math ML – Importance of MathML in web design – Basic structure of a MathML document – Presentation MathML and Content MathML – Representing numbers, variables, and mathematical expressions – Simple MathML tags and attributes – Displaying mathematical equations on web pages .

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Xavier, "World Wide Web Designing", Tata McGraw Hill, 2000.
2. Somnath Tagore, "Markup languages in Biology Studies in CML, BSML, SBML", LAP Lambert Academic Publishing, 2012.
3. Michael Kohlhase, "OMDoc -- An Open Markup Format for Mathematical Documents", Springer-Verlag Berlin and Heidelberg GmbH & Co. K, 2006.

REFERENCES:

1. N.P. Gopalan and J. Akilandeswari, Web Technology – A Developer's Perspective, Prentice Hall of India Private Ltd, New Delhi, Second Edition, 2016.
2. Thomas Powell, "HTML & CSS: The Complete Reference", McGraw Hill Education, 2017.
3. Shruti Dalela, "Web Designing with Practical Implementation", Shripriti Publications, 2024.
4. Prem Kumar, "Web Design With HTML & CSS : HTML & CSS Complete Beginner's Guide", Notion Press, 2021.
5. Robert W. Sebesta, "Programming the World Wide Web", Pearson Education, Third Edition, 2007.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Create and design basic HTML web pages.
CO2 Design web layouts using frames and develop HTML forms.
CO3 Develop well-structured and user-friendly web interfaces using CSS.
CO4 Represent chemical data using CML in web applications.
CO5 Display mathematical expressions using MathML in web pages.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	3	2	2.1
CO2	3	3	3	2	2	1	1	3	2	2	3	3	2	3	2	2.3
CO3	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
CO4	3	3	3	3	2	1	1	3	2	2	3	3	3	3	2	2.5
CO5	2	3	3	3	3	2	1	2	2	2	2	3	3	3	2	2.4
Average	2.8	3.0	2.8	2.6	2.2	1.2	1.0	2.6	1.8	2.0	2.8	2.8	2.4	3.0	2.0	2.4

Mean Co : 2.4

3 - Strong, 2 - Medium, 1- Low

Year: Second

CORE COURSE 4

Semester: IV

Code:

**RDBMS AND NoSQL
(Theory)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Recall the limitations of relational databases and identify the primary types of NoSQL databases
- ❖ Explain the principles of the ER model, including entities, attributes, and relationship sets.
- ❖ Apply SQL commands and aggregate functions to perform complex data queries and set operations.
- ❖ Analyze relational schemas to identify redundancies using functional dependencies and perform decomposition through normal forms
- ❖ Design comprehensive database systems for real-world applications such as E-commerce or Big Data systems

UNIT – I: DATABASE SYSTEMS & ER MODEL

Overview of Database Systems- Managing Data – File System vs DBMS – Structure of DBMS – Schema and Instances. Database Design and ER Model: Entities, Attributes, Entity Sets Relationships and Relationship Sets – ER Diagrams – Extended ER Features. Introduction to NoSQL: Need for NoSQL – Limitations of Relational Databases – Types of NoSQL Databases.

UNIT – II: RELATIONAL MODEL & DESIGN

Relational Model: Structure of Relational Databases – Keys – Integrity Constraints – Relational Algebra – Relational Calculus. ER to Relational Mapping – Views – Schema Design – Materialized Views. Aggregate Models – Column-family concept – Schemaless Databases.

UNIT – III: SQL & TRANSACTION MANAGEMENT

SQL Queries: Basic SQL Queries – INSERT, UPDATE, DELETE – SELECT – Set Operations – Nested Queries – Aggregate Functions – NULL Values- Constraints – Triggers – Views – Active Databases.- ACID Properties – Transactions and Schedules – Lock-based Protocols – Crash Recovery.

UNIT – IV: NORMALIZATION, SECURITY & APPLICATIONS

Schema Refinement and Normal Forms: Functional Dependencies – Normal Forms (1NF, 2NF, 3NF, BCNF) – Decomposition – Normalization in Database Design. Security and Authorization: Database Security – Access Control. Applications: Big Data Systems – E-commerce – Content Management Systems – Real-time Analytics.

UNIT – V: NoSQL DATABASES & DISTRIBUTED CONCEPTS

No SQL Data Models- Key-Value Stores – Document Databases – Column-Family Stores – Graph Databases – Features and Use Cases. Examples of No SQL Systems: Mongo DB, Cassandra

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities For continuous internal assessment only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Database System Concepts, Sixth edition, Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill-2010.
2. Jagdish Chandra Patni, Hitesh Kumar Sharma, Ravi Tomar, Avita Katal., "Database Management System: An Evolutionary Approach", CRC Press, 2022.

REFERENCES:

1. Abraham Silberschatz, Hendry F. Korth, S Sudharshan," Database System Concepts", 6th Edition, McGraw Hill International, 2019.
2. Blokdyk, Gerardus, and Blokdyk, Gerardus, "RDBMS Relational Database Management System a Complete Guide", 2020 Edition, Emereo Pty Limited, 2019.
3. Wilfried Lemahieu, SeppevandenBroucke, Bart Baesens, "Principles of Database Management: The Practical Guide to Storing, Managing and Analyzing Big and Small Data", Cambridge University Press, 2018.
4. C.J. Date, "An Introduction to Database Systems" Addison Wesley, 2000.
5. NoSQL Distilled by Pramod J. Sadalage

e- BOOKS :

1. <https://tutorialspoint.dev/computer-science/dbms>
2. <https://tutorialspoint.dev/computer-science/NoSQL>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|---|
| CO1 | Distinguish between traditional file systems and DBMS structures, while identifying the core necessity and types of NoSQL databases |
| CO2 | Construct comprehensive Entity-Relationship (ER) diagrams and map them into relational schemas |
| CO3 | Perform complex data manipulations using SQL queries, set operations, and aggregate functions |
| CO4 | Analyze and refine database schemas by applying normalization techniques (1NF through BCNF) to eliminate redundancies |
| CO5 | Design secure, scalable data solutions by integrating NoSQL models (like MongoDB and Cassandra) with distributed concepts |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	2	2	2	2	2	3	3	3	2	2	2	2.4
CO2	2	2	3	3	1	1	2	2	1	1	3	3	3	3	1	2.1
CO3	2	3	3	3	2	3	2	1	2	1	3	3	3	1	3	2.3
CO4	3	3	2	2	2	2	2	3	3	2	3	3	3	2	1	2.4
CO5	2	3	3	3	3	2	1	1	2	2	3	3	3	3	2	2.4
Average	2.4	2.8	2.8	2.6	2.0	2.0	1.8	1.8	2.0	1.8	3.0	3.0	2.8	2.2	1.8	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium , 1- Low

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify and define the foundational components of database management systems,
- ❖ Explain the core principles of data modeling through ER diagrams and interpret the significance of ACID properties
- ❖ Implement practical data solutions by mapping ER models to relational schemas and performing CRUD operations
- ❖ Analyze and refine database structures using normalization (1NF to BCNF) and extract complex insights from datasets
- ❖ Design and construct integrated, secure data-driven applications that utilize views, indexes, and distributed concepts

LIST OF EXERCISES:

1. Create a table STUDENT with the following fields: ID (Primary Key), NAME, AGE, DEPARTMENT
Perform the following operations:
 - a) Insert at least 5 records
 - b) Display all records
 - c) Update age of a student
 - d) Delete a record
 - e) Display students whose age is greater than 18
2. Create two tables EMPLOYEE and DEPARTMENT and perform:
 - a) Insert records
 - b) Apply INNER JOIN
 - c) Use GROUP BY to count employees in each department
 - d) Find maximum salary
 - e) Create a VIEW for employee details
3. Write SQL queries for the following:
 - a) Use aggregate functions (SUM, AVG)
 - b) Write a subquery to find highest value
 - c) Use ORDER BY
 - d) Apply constraints (PRIMARY KEY, UNIQUE)
 - e) Create and drop a table
4. Using MongoDB:
 - a) Create a database and collection
 - b) Insert 5 documents
 - c) Display all documents
 - d) Update a document
 - e) Delete a document
5. Perform the following operations in MongoDB:
 - a) Use query operators (\$gt, \$lt)
 - b) Retrieve specific records

- c) Perform aggregation using group
 - d) Create index
 - e) Display sorted output
6. Design a simple application using NoSQL:
- a) Create collection (Product/Student)
 - b) Insert multiple records
 - c) Perform update and delete
 - d) Use aggregation
 - e) Compare with RDBMS (write 3 points)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|--|
| CO1 | Distinguish between file systems and DBMS, identifying the core necessity of NoSQL structures |
| CO2 | Design comprehensive Entity-Relationship (ER) diagrams and implement them as structured SQL tables |
| CO3 | Perform complex data retrieval and modification using SQL (Joins, Subqueries) and NoSQL |
| CO4 | Refine database schemas through normalization (1NF to BCNF) and analyze data distributions using aggregate functions |
| CO5 | Construct integrated data-driven applications that utilize database views, security access controls |

Year: First

INTER DISCIPLINARY COURSE 4

Semester : IV

Code :

**DIGITAL MARKETING
(Theory)**

Credits: 2

COURSE OBJECTIVES:

Students will be able to :

- ❖ Students will be able to identify the historical transition from traditional to digital marketing and define core e-concepts essential for modern e-business
- ❖ Students will be able to explain the components of the online marketing mix (e-product, e-promotion, e-price, and e-place) and interpret the meaning and benefits of digital branding
- ❖ Students will be able to apply various digital media channels, including search engine marketing (SEM), ePR, affiliate marketing, and interactive display advertising to reach target audiences
- ❖ Students will be able to analyze online consumer behavior and the cultural implications of website characteristics to optimize digital engagement
- ❖ Students will be able to design and evaluate a digital brand analysis that incorporates brand share dimensions and audience insights to formulate a competitive market position

UNIT – I: INTRODUCTION TO DIGITAL MARKETING

Digital Marketing – Transition from traditional to digital marketing – Growth of e-concepts – Growth of e-business.

UNIT – II: ONLINE MARKETING MIX

Online marketing mix – E-product – E-promotion – E-price – E-place

UNIT – III :DIGITAL MARKETING CHANNELS

Digital media channels – Search engine marketing – ePR – Affiliate marketing – Interactive display advertising

UNIT – IV: CONSUMER BEHAVIOR IN DIGITAL MARKETING

Online consumer behavior – Cultural implications of key website characteristics.

UNIT – V: DIGITAL BRANDING AND ANALYSIS

Digital brand analysis – Meaning – Benefits – Components – Brand share dimensions – Brand audience dimensions

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Puneet Singh Bhatia, (2019) "Fundamentals of Digital Marketing", 2nd Edition, Pearson Education Pvt Ltd, Noida.
2. Dave Chaffey, Fiona Ellis-Chadwick, (2019) "Digital Marketing", Pearson Education Pvt Ltd, Noida.

REFERENCES:

1. Chuck Hemann & Ken Burbary, (2019) "Digital Marketing Analytics", Pearson Education Pvt Ltd, Noida.
2. Seema Gupta, (2022) "Digital Marketing" 3rd Edition, McGraw Hill Publications Noida.
3. Kailash Chandra Upadhyay, (2021) "Digital Marketing: Complete Digital Marketing Tutorial", Notion Press, Chennai.
4. Michael Branding, (2021) "Digital Marketing", Empire Publications India Private Ltd, New Delhi.
5. <https://www.digitalmarketer.com/digital-marketing/assets/pdf/ultimate-guide-to-digital-marketing.pdf>
6. <https://uwaterloo.ca/centre-for-teaching-excellence/teaching-resources/teaching-tips/educational-technologies/all/gamification-and-game-based-learning>

COURSE OUTCOMES:

Upon successful completion of this course the students would be able to:

- CO1 Describe the transition from traditional to digital marketing and explain the growth of e- business
- CO2 Students will be able to implement the four pillars of online marketing (e-product, e-promotion, e-price, eplace)
- CO3 Students will be able to apply various digital media channels, including search engine marketing (SEM), ePR, affiliate marketing, and interactive display advertising to reach target audiences.
- CO4 Examine online consumer behavior and evaluate how cultural implications
- CO5 Design comprehensive brand analyses by synthesizing brand share and audience dimensions to measure

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	3	2	2	2	2	1	1	1	1	2	3	2	2	1	1.8
CO2	3	3	2	2	2	2	1	1	2	2	3	3	3	3	2	2.3
CO3	3	3	3	1	2	3	2	3	3	2	3	2	2	2	1	2.3
CO4	3	3	3	3	3	2	2	3	1	2	3	3	3	3	2	2.6
CO5	3	3	1	3	2	3	1	2	2	3	3	3	2	2	2	2.3
Average	2.8	3.0	2.2	2.2	2.2	2.4	1.4	2.0	1.8	2.0	2.8	2.8	2.4	2.4	1.6	2.3

Mean Co : 2.3

3 – Strong, 2 - Medium, 1- Low

Year: Third

CORE COURSE 5

Semester: V

Code :

**DIGITAL ELECTRONICS AND
MICROPROCESSOR
(Theory)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Identify the characteristics of digital systems and define various number base systems, including binary, octal, hexadecimal, and their respective complements.
- ❖ Explain the basic theorems and properties of Boolean algebra and interpret how digital logic gates function within integrated circuits.
- ❖ Design procedures to construct essential combinational circuits, such as binary adders, subtractors, multipliers, and magnitude comparators.
- ❖ Analyze the internal architecture of the Intel 8085 microprocessor, including its buses and memory addressing capacity.
- ❖ Design functional programs by synthesizing the Intel 8085 instruction set, data formats, and addressing modes.

UNIT - I: NUMBER SYSTEMS

Digital Systems and Binary Numbers - Digital Systems - Binary Numbers - Number Base Conversions - Octal and Hexadecimal Numbers - Complements of Numbers. Signed Binary Numbers - Binary Codes - Binary Storage and Registers- Binary Logic

UNIT - II: BOOLEAN ALGEBRA AND LOGIC GATES

Introduction - Basic Definitions - Axiomatic Definition of Boolean Algebra - Basic Theorems and Properties of Boolean Algebra. Boolean Functions - Canonical and Standard Forms - Other Logic Operations - Digital Logic Gates - Integrated Circuits.

UNIT - III: COMBINATIONAL LOGIC

Introduction - Combinational Circuits - Analysis of Combinational Circuits - Design Procedure - Binary Adder - Subtractor - Decimal Adder - Binary Multiplier - Magnitude Comparator - Decoders - Encoders - Multiplexers - HDL Models of Combinational Circuits.

UNIT - IV: INTRODUCTION TO MICROPROCESSOR

Evolution of Microprocessor – Single chip Microcomputer – Microprocessor Applications – Buses- Memory Addressing capacity and CPU – Microcomputers – Processor Architecture – Intel 8085 – Instruction cycle – Timing Diagram.

UNIT - V: INTEL 8085

Instruction Set of Intel 8085 – Instruction and Data Format – Address Modes – Status Flags – Intel 8085 instruction - Programming Microprocessor – Assembly language – Assembler.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities For continuous internal assessment only)

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti. Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, 2018
2. Badri Ram, “Fundamentals of Microprocessors and Microcomputers”, Dhanpat Rai Publications, 2012.

REFERENCES:

1. Dhanasekharan Natarajan, "Fundamentals of Digital Electronics", Springer International Publishing, 2020
2. Dr. S Salivahanan, "Analog and Digital Electronic", McGraw-Hill Education, 2019.
3. Soumitra Kumar Mandal, "Digital Electronics", McGraw-Hill Education, 2018.
4. A. Anand Kumar, "Fundamentals of Digital Circuits", Prentice Hall India Pvt. Limited, 2016.
5. Senthil Kumar Saravanan, Jeevananthan, “Microprocessors and Microcontrollers”, Oxford University Press, 2010.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|--|
| CO1 | Perform number base conversions (Binary, Octal, Hexa decimal) and explain the structural importance of binary storage, registers, and logic in digital systems |
| CO2 | Interpret Boolean functions and theorems to design standard logic gate configurations and canonical forms within integrated circuits |
| CO3 | Implement complex combinational circuits—including binary adders, multipliers, encoders, and multiplexers—and develop their corresponding Hardware Description Language (HDL) models |
| CO4 | Examine the internal architecture of the Intel 8085, analyze its instruction cycles, and interpret timing diagrams to synchronize CPU and memory operations |
| CO5 | Formulate and evaluate microprocessor programs using the Intel 8085 instruction set, addressing modes, and status flags through assembly language programming |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	2	1	3	2	2	2	2	2	2	3	2	3	2	1	2.0
CO2	3	3	3	3	3	2	2	3	2	3	2	3	3	1	1	2.5
CO3	3	2	1	2	1	2	2	1	3	2	3	3	2	2	2	2.1
CO4	2	2	3	2	3	3	1	1	2	2	3	2	2	3	3	2.3
CO5	3	3	3	3	2	2	2	3	1	3	2	3	2	3	2	2.5
Average	2.6	2.4	2.2	2.6	2.2	2.2	1.8	2.0	2.0	2.4	2.6	2.6	2.4	2.2	1.8	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium , 1- Low

Code : **FUNDAMENTALS OF ALGORITHMS**
(Theory)

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand algorithm specification, asymptotic notations, and performance analysis techniques for evaluating algorithms.
- ❖ Acquire knowledge of tree and graph data structures and their traversal and path-finding algorithms.
- ❖ Learn fundamental sorting, searching, and heap-based techniques for efficient data processing.
- ❖ Apply greedy strategies to solve optimization problems such as knapsack, job sequencing, and merge patterns.
- ❖ Develop problem-solving skills using backtracking techniques for combinatorial and constraint satisfaction problems

UNIT - I: INTRODUCTION

Introduction – Algorithm Specification, Pseudo code for expressing algorithms, Performance Analysis-Space complexity, Time complexity, Asymptotic Notation- Big oh notation, Omega notation, Theta notation and Little oh notation, Performance Measurement, Randomized algorithms.

UNIT - II: TREES

Trees – Binary tree representations – Tree Traversal – Threaded Binary Trees – Binary Tree Representation of Trees – Graphs and Representations – Traversals, Connected Components and Spanning Trees – Shortest Paths and Transitive closure – Activity Networks – Topological Sort and Critical Paths

UNIT - III: SORTING TECHNIQUES

Algorithms – Priority Queues - Heaps – Heap Sort – Merge Sort – Quick Sort – Binary Search – Finding the Maximum and Minimum.

UNIT - IV: GREEDY METHOD

: The General Method – Optimal Storage on Tapes – Knapsack Problem – Job Sequencing with Deadlines – Optimal Merge Patterns.

UNIT - V: BACK TRACKING

Back tracking: The General Method – The 8-Queens Problem – Sum of Subsets – Graph Coloring.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structure", Galgotia Publications, 2008.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms", University Press, 2008.

REFERENCES:

1. Seymour Lipschutz, "Data Structures", Tata McGraw Hill, Schaum's Outline Series, 2014.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2022.
4. https://www.tutorialspoint.com/data_structures_algorithms/algorithms_basics.htm

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Analyze the efficiency of algorithms using time complexity, space complexity, and asymptotic notations.
- CO2 Implement tree and graph traversal algorithms and solve shortest path, spanning tree, and network-related problems.
- CO3 Apply sorting, searching, and heap operations to design efficient solutions for computational problems.
- CO4 Solve optimization problems using greedy algorithms and evaluate their effectiveness.
- CO5 Design and implement solutions for complex problems using backtracking techniques such as N-Queens, subset sum, and graph coloring.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	2	3	2	2	1	2	2	1	2	3	2	1	3	1	2.0
CO2	3	3	2	3	2	2	1	2	1	2	3	3	3	3	1	2.3
CO3	3	3	2	2	3	1	2	2	2	3	3	3	3	3	2	2.4
CO4	2	3	3	1	3	2	2	2	1	2	2	2	3	3	3	2.3
CO5	3	3	3	3	1	1	2	3	3	3	3	3	3	2	2	2.5
Average	2.8	2.8	2.6	2.2	2.2	1.4	1.8	2.2	1.6	2.4	2.8	2.6	2.6	2.8	1.8	2.3

3 - Strong, 2 - Medium, 1- Low

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Steven Holzner, “The Complete Reference PHP”, Tata McGraw Hill Pvt. Ltd., 2012.
2. Luke welling & Laura Thomsan, "PHP and MySQL Web Development", Pearson Education, New Delhi, Fifth Edition, 2016.

REFERENCES:

1. RasmusLerdorf, Kevin Tatro, Peter MacIntyre, “Programming PHP”, 3rd Edition, O’Reilly, 2013.
2. Vikram Vaswani, “PHP: A Beginner's Guide”, McGraw Hill Education, 2008.
3. Don Gosselin, Diana Kokoska, Robert Easterbrooks, "PHP Programming with MySQL", Course Technology, 2010.
4. Antonio Lopez, "Learning PHP 7", Packt Publishing, 2016.
5. Alan Forbes, "The Joy of PHP: A Beginner's Guide to Programming Interactive Web Applications with PHP and MySQL", Create Space Independent Publishing Platform, 2015.

E - BOOKS:

1. <https://www.guru99.com/php-tutorials.html>
2. <https://roadmap.sh/php>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|---|
| CO1 | Explain the fundamentals of PHP, configure the development environment, and execute PHP programs in a web server environment. |
| CO2 | Demonstrate server-side scripting techniques and develop dynamic web pages by integrating PHP with HTML. |
| CO3 | Apply PHP programming constructs such as variables, operators, control structures, and loops to solve computational problems. |
| CO4 | Utilize functions, arrays, file handling operations, and built-in PHP libraries to develop efficient web-based solutions. |
| CO5 | Design interactive web applications using database connectivity, session management, and cookies for effective data management and user authentication. |

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	2	2	3	3	2	3	1	2	1	2	3	2	3	1	2.1
CO2	2	3	2	3	1	1	2	2	3	2	3	3	2	3	3	2.3
CO3	3	3	3	1	2	2	3	2	2	2	2	2	3	2	2	2.2
CO4	3	3	2	1	2	1	2	2	1	1	2	2	2	2	2	1.9
CO5	3	3	2	3	3	1	1	2	1	2	3	2	3	2	3	2.4
Average	2.8	2.8	2.2	2.2	2.2	1.4	2.2	1.8	1.8	1.6	2.4	2.4	2.4	2.4	2.2	2.2

Mean Co : 2.2

3 - Strong, 2 - Medium, 1- Low

**Code : SOFTWARE ENGINEERING
(Theory)****Credits: 4****COURSE OBJECTIVES:**

This course aims to :

- ❖ Understand the fundamental concepts of software engineering and various software process models used in software development life cycle.
- ❖ Analyze and apply requirements engineering techniques for gathering, modeling, and managing software requirements.
- ❖ Learn software design principles, architectural concepts, and object-oriented approaches for developing efficient software systems.
- ❖ Gain knowledge of software coding practices, testing methods, project management, and maintenance activities.
- ❖ Understand web engineering concepts and emerging trends such as cloud computing, service-oriented architecture, and agile development.

UNIT - I: INTRODUCTION

Introduction: Introduction to Software Engineering - Software Process - Software Process Models - Software Model - Requirements Engineering Principles: Requirements Engineering - Importance of Requirements - Types of Requirements - Steps involved in Requirements Engineering.

UNIT - II: REQUIREMENTS ANALYSIS MODELING:

Analysis Modeling Approaches - Structured Analysis - Object Oriented Analysis - Design and Architectural Engineering : Design Process and Concepts - Basic Issues in Software Design - Characteristics of Good Design - Software Design and Software Engineering - Function Oriented System vs Object Oriented System - Modularity, Cohesion, Coupling, Layering - Real Time Software Design - Design Models - Design Documentation

UNIT - III: USER INTERFACE DESIGN:

Object Oriented Concepts: Fundamental Parts of Object Oriented Approach - Data Hiding and Class Hierarchy Creation - Relationships - Role of UML in OO Design - Design Patterns - Frameworks - Object Oriented Analysis - Object Oriented Design - User Interface Design : Concepts of User Interface - Elements of User Interface - Designing the User Interface - User Interface Evaluation - Golden Rules of User Interface Design - User Interface Models - Usability

UNIT - IV: SOFTWARE CODING:

Introduction to Software Measurement and Metrics - Software Configuration - Project Management Introduction - Introduction to Software Testing - Software Maintenance

UNIT - V: WEB ENGINEERING:

Introduction to Web - General Web Characteristics – Web Application Categories - Working of Web Application - Advantages and Drawbacks of Web Applications - Web Engineering - Emerging Trends in Software Engineering – Web 2.0 - Rapid Delivery - Open Source Software Development - Security Engineering - Service Oriented Software Engineering - Web Service - Software as a Service – Service Oriented Architecture - Cloud Computing - Aspect Oriented Software Development - Test Driven Development - Social Computing

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Chandramouli Subramanian, Saikat Dutt Chandramouli Seetharaman, B.G. Geetha, Software Engineering, Pearson Publications, 2015
2. Software Engineering, Jibitesh Mishra, Pearson Education, 2011

REFERENCES:

1. Ian Sommerville, "Software Engineering", Pearson, 2011.
2. Rod Stephens, "Beginning Software Engineering", Wiley, 2015.
3. Ashfaq Ahmed, Bhanu Prasad, "Foundations of Software Engineering", CRC Press, 2016.
4. Titus Winters, Tom Manshreck, Hyrum Wright, "Software Engineering at Google", O'Reilly Media, 2020

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|--|
| CO1 | Explain the principles of software engineering and evaluate different software process models used in the software development life cycle. |
| CO2 | Apply requirements engineering techniques to elicit, analyze, model, and manage software requirements effectively. |
| CO3 | Design software systems using appropriate architectural styles, design principles, and object-oriented methodologies. |
| CO4 | Implement software development best practices, perform software testing activities, and apply project management and maintenance techniques. |
| CO5 | Analyze and utilize web engineering concepts and modern software development technologies such as cloud computing, service-oriented architecture, and agile methodologies. |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	3	2	1	1	2	1	2	3	2	3	2	2.2
CO2	3	3	3	1	1	3	1	2	2	3	3	3	1	2	2	2.0
CO3	3	2	3	3	1	1	3	2	2	3	3	3	3	3	1	2.3
CO4	3	3	2	2	2	2	2	2	1	2	2	3	3	1	2	2.2
CO5	3	3	1	2	2	1	2	2	1	2	3	2	2	3	1	2.0
Average	3.0	2.8	2.4	2.0	1.8	1.8	1.8	1.8	1.6	2.2	2.6	2.8	2.2	2.4	1.6	2.1

Mean Co : 2.1

3 - Strong, 2 - Medium, 1- Low

Year: Third

CORE PRACTICAL 5

Semester: V

Code:

**DIGITAL ELECTRONICS AND
MICROPROCESSOR LAB
(Practical)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Gain hands-on experience in digital electronics concepts through practical experiments and circuit verification.
- ❖ Design and implement basic logic circuits including combinational and sequential circuits such as adders, counters, and shift registers.
- ❖ Understand and verify the working of digital components using laboratory experiments like K-Maps and logic gate operations.
- ❖ Develop skills in writing and executing Assembly Language Programs (ALP) using microprocessor kits for arithmetic and data processing tasks.
- ❖ Apply microprocessor concepts to solve basic computational problems such as addition, subtraction, sorting, and data conversion.

A. Digital Electronics Experiments

1. Verification of Logic gates
2. Construction of half and full adder
3. K-Map
4. Shift register
5. Up Down Counters

B. Microprocessor Experiments

1. Eight Bit Addition and Subtraction
2. Sum of series
3. Data transfer
4. Maximum of N Numbers
5. Decimal to Hexadecimal

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1** Design and implement combinational circuits such as half and full adders.
- CO2** Design and implement combinational circuits such as half and full adders.
- CO3** Simplify and implement logic functions using K-Map techniques.
- CO4** Design and test sequential circuits such as shift registers and up/down counters.
- CO5** Develop simple Assembly Language Programs for basic arithmetic and data transfer operations using microprocessor kits.

**Code: DATA COMMUNICATION AND NETWORKS
(Theory)**

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand the fundamental concepts of data communication, network models, and the OSI and TCP/IP protocol architectures.
- ❖ Learn different transmission techniques, switching methods, and multiplexing techniques used in computer networks.
- ❖ Gain knowledge of data link layer services including error detection, error correction, and reliable data transfer protocols.
- ❖ Analyze network layer concepts such as IP addressing, routing algorithms, and packet forwarding techniques.
- ❖ Understand transport and application layer protocols and their roles in internet communication services.

UNIT - I: INTRODUCTION

Data Communications – Components – Data Flows – Networks – Physical Structures–Network Types–LAN–WAN–Switching–The Internet –Network Models–Principles of Protocol Layering–TCP/IP Protocol Suite– Description of TCP/IP Layers–The OSI Model.

UNIT – II: TRANSMISSION MEDIA

Transmission Impairment - Transmission Modes – Multiplexing –FDM –WDM–TDM–Circuit Switched Networks–Packet Switching–Datagram Networks – Virtual Circuit Networks – Structure of Circuit Switches – Structure of Packet Switches.

UNIT – III: DATA LINK LAYER

Introduction - Error Detection and Correction – Block Coding – Cycle Codes - Checksum – Forward Error Correction – DLC Services – Data Link Layer Protocols–HDLC–CSMA/CD/CA–Controlled Access–Connecting Devices

UNIT – IV: NETWORK LAYER

Network Layer Services–Network Layer Performance–IPv4Addresses– Internet Protocol (IP)–Routing Algorithms–Least Cost Routing- Distance Vector Routing – Link State Routing – Path-Vector Routing.

UNIT – V: TRANSPORT LAYER

Introduction – Transport Layer Protocols – User Datagram Protocol–TransmissionControlProtocol–ApplicationLayer:-WorldWideWeb and HTTP–File Transfer Protocol–E-Mail–TELNET–Domain Name System.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", McGraw-Hill, 5th edition, 2013
2. Andrew S Tanenbaum, Computer Networks, Pearson Education India, Sixth Edition, 2021.

REFERENCES:

1. William Stallings, Data and Computer Communication, Pearson Education India, Eighth Edition, 2007
2. <https://elcomhu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf>
3. <https://nptel.ac.in/courses/106105183>
4. https://onlinecourses.swayam2.ac.in/cec19_cs07/preview

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Explain the fundamental concepts of data communication, network models, and the OSI and TCP/IP reference architectures.
- CO2 Apply transmission techniques, switching methods, and multiplexing concepts in the design of computer networks.
- CO3 Analyze data link layer services including error detection, error correction, and reliable data transfer mechanisms.
- CO4 Evaluate network layer functionalities such as IP addressing, routing algorithms, and packet forwarding techniques.
- CO5 Illustrate transport and application layer protocols and their role in enabling internet-based communication services.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	1	2	2	3	3	2	3	3	2	3	1	2.3
CO2	3	2	3	2	3	2	2	1	2	1	3	3	2	3	2	2.1
CO3	3	3	2	1	2	2	3	2	2	3	3	2	2	2	1	2.2
CO4	3	3	2	2	3	3	1	2	1	1	3	3	3	1	2	2.2
CO5	2	2	2	2	2	2	2	1	1	3	3	3	3	3	1	2.1
Average	2.8	2.6	2.4	1.8	2.2	2.2	2.0	1.8	1.8	2.0	3.0	2.8	2.4	2.4	1.4	2.2

Mean Co : 2.2

3 - Strong, 2 - Medium, 1- Low

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand the fundamental concepts, functions, and evolution of operating systems in computer systems.
- ❖ Learn the services and components of operating systems including process management, memory management, and file systems.
- ❖ Analyze different CPU scheduling algorithms, process synchronization techniques, and deadlock handling mechanisms.
- ❖ Understand memory management techniques such as paging, segmentation, and virtual memory concepts.
- ❖ Gain knowledge of input/output systems, device management, and file system organization in operating systems.

UNIT – I: INTRODUCTION

Introduction - What Is an Operating System-Operating System Software -A Brief History of Machine Hardware -Types of Operating Systems - Brief History of Operating System Development-Object-Oriented Design

UNIT – II: MEMORY MANAGEMENT

Single-User Contiguous Scheme -Fixed Partitions-Dynamic Partitions- Best-Fit versus First-Fit Allocation -Deallocation - Relocatable Dynamic Partitions. Virtual Memory: Paged Memory Allocation-Demand Paging-Page Replacement Policies and Concepts -Segmented Memory Allocation-Segmented/Demand Paged Memory Allocation - Virtual Memory-Cache Memory.

UNIT – III: PROCESSOR MANAGEMENT

Overview-About Multi-Core Technologies-Job Scheduling Versus Process Scheduling- Process Scheduler-Process Scheduling Policies-Process Scheduling Algorithms –A Word About Interrupts-Deadlock-Seven Cases of Deadlock -Conditions for Deadlock- Modeling Deadlock-Strategies for Handling Deadlocks –Starvation-Concurrent Processes: What Is Parallel Processing-Evolution of Multiprocessors-Introduction to Multi-Core Processors- Typical Multiprocessing Configurations--Process Synchronization Software

UNIT – IV: DEVICE MANAGEMENT

Types of Devices-Sequential Access Storage Media-Direct Access Storage Devices-Magnetic Disk Drive Access Times- Components of the I/O Subsystem-Communication among Devices-Management of I/O Requests.

UNIT – V: FILE MANAGEMENT

The File Manager -Interacting with the File Manager -File Organization – Physical Storage Allocation -Access Methods-Levels in a File Management System – Access Control Verification Module

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Operating Systems - E. Madnick& John J.Donavan, Tata McGraw Hill Publishing Co., Limited.
2. Ann McIver Mc Hoes, Ida M. Flynn, "Understanding Operating Systems", Course Technology, Cengage Learning, 2011.Greg Tomsho, "Guide to Operating Systems", Cengage Learning, 2020.
3. Cesar Herrera, Darrell Hajek, Flor Narciso, "Principles of Operating Systems", Amazon Digital Services LLC - KDP Print US, 2020.

REFERENCES:

1. System Programming and Operating Systems - D.M. Dhamdhere, Tata McGraw Hill Publishing Co., Limited.
2. Cesar Herrera, Darrell Hajek, "Principles of Operating Systems", Independently Published, 2019.
3. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", Create Space Independent Publishing Platform, 2018.
4. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley Publisher, 2018.
5. <https://www.guru99.com/os-tutorial.html>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|--|
| CO1 | Explain the fundamental concepts, functions, and evolution of operating systems in modern computer systems. |
| CO2 | Describe operating system services and components including process management, memory management, and file system organization. |
| CO3 | Analyze CPU scheduling algorithms, process synchronization techniques, and deadlock prevention and recovery methods. |
| CO4 | Apply memory management techniques such as paging, segmentation, and virtual memory in operating system design. |
| CO5 | Illustrate input/output systems, device management, and file system structures used in operating systems. |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	2	2	3	2	1	2	1	3	1	2	2	3	3	1	2.1
CO2	3	3	2	2	3	2	2	1	2	3	2	2	3	3	3	2.4
CO3	3	3	3	2	3	2	3	1	2	1	3	3	2	2	2	2.3
CO4	3	3	2	3	3	2	3	1	1	1	3	3	3	2	3	2.4
CO5	3	3	1	2	2	2	3	2	3	2	2	3	3	3	2	2.4
Average	3.0	2.8	2.0	2.4	2.6	1.8	2.6	1.2	2.2	1.6	2.4	2.6	2.8	2.6	2.2	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low

Code :**ARTIFICIAL INTELLIGENCE AND DATA
SCIENCE
(Theory)****Credits: 4****COURSE OBJECTIVES:**

This course aims to :

- ❖ Introduce the fundamental concepts of Artificial Intelligence and intelligent systems
- ❖ To provide knowledge of search techniques and knowledge representation methods used in AI
- ❖ To develop understanding of machine learning algorithms and their applications
- ❖ To familiarize students with data science concepts including data collection, preprocessing, and analysis
- ❖ To enable students to apply data visualization and analytical tools for effective decision-making

UNIT – I: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

Definition of Artificial Intelligence - history and evolution - AI vs Machine Learning, types of AI (Weak and Strong AI) - intelligent agents and environments - problem-solving using AI - applications of AI in various domains.

UNIT – II: SEARCH TECHNIQUES AND KNOWLEDGE REPRESENTATION

Uninformed search strategies (Breadth First Search, Depth First Search) - informed search strategies (A* algorithm, heuristic search) - game playing - constraint satisfaction problems - knowledge representation using logic - semantic networks and frames.

UNIT – III: MACHINE LEARNING FUNDAMENTALS

Introduction to Machine Learning, types of learning (supervised, unsupervised, reinforcement learning), classification and regression techniques, clustering (K-means), basics of neural networks, model evaluation methods.

UNIT – IV: INTRODUCTION TO DATA SCIENCE

Overview of data science and data analytics - Data types and sources - Data collection, preprocessing, cleaning, and transformation - Introduction to statistics and exploratory data analysis.

UNIT – V: DATA ANALYSIS AND VISUALIZATION

Data analysis techniques and tools - Data visualization using charts and graphs - Introduction to Python libraries for data science - Basics of predictive analytics and interpretation of results for decision - making.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 4th Edition, 2020.
2. Sam Lau and Joseph Gonzalez, Learning Data Science: Data Wrangling, Exploration, Visualization, and Modeling, O'Reilly Media, 2023

REFERENCE:

1. Patrick Henry Winston, Artificial Intelligence, Addison-Wesley, 3rd Edition.
2. Crina Grosan and Ajith Abraham, Intelligent Systems: A Modern Approach, Springer.
3. Joel Grus, Data Science from Scratch, O'Reilly Media.
4. John D. Kelleher and Brendan Tierney, Data Science, MIT Press.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Understand the fundamental concepts of Artificial Intelligence, intelligent agents, and problem-solving techniques
- CO2 Apply search algorithms and knowledge representation methods to solve AI problems
- CO3 Analyse and implement basic machine learning algorithms for classification, regression, and clustering tasks.
- CO4 Understand data science concepts including data collection, preprocessing, and exploratory data analysis
- CO5 Apply data analysis and visualization techniques using appropriate tools for effective decision-making

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	2	2	3	3	2	3	2	1	1	2	3	3	3	2	2.3
CO2	3	2	3	2	1	1	2	1	2	2	3	3	3	3	2	2.1
CO3	3	3	2	3	1	1	1	1	2	3	3	2	3	3	2	2.1
CO4	3	3	3	3	3	3	2	2	2	2	3	3	2	2	1	2.3
CO5	3	3	2	2	1	3	2	2	1	1	2	3	2	3	2	2.1
Average	3.0	2.6	2.4	2.6	1.8	2.0	2.0	1.6	1.6	1.8	2.6	2.8	2.6	2.8	1.8	2.2

Mean Co : 2.2

3 - Strong, 2 - Medium, 1- Low

Year: Third

CORE PROJECT WORK

Semester: VI

Code :

PROJECT WORK

Credits: 4

The candidate shall be required to take up a Project Work by group or individual and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the students in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University

Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT/EVALUATION/VIVA VOCE:

PROJECT REPORT EVALUATION (Both Internal & External)

I.	Plan of the Project	20 marks
	Execution of the Plan/collection of Data / Organisation of Materials/ Hypothesis, Testing etc. and presentation of the report	45 marks
	Individual initiative	15 marks
II.	Viva-Voce / Internal & External	20 marks
III.	TOTAL	100 Marks

PASSING MINIMUM:

Project	Vivo-Voce 20 Marks 40% out of 20 Marks (i.e. 8 Marks)	Dissertation 80 Marks 40% out of 80 marks (i.e. 32 marks)
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A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate

SKILL ENHANCEMENT COURSE

Code :

1. COMPUTER GRAPHICS (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Introduce the basic concepts and components of Computer Graphics systems.
- ❖ Understand various input and output devices used in graphics applications.
- ❖ Learn algorithms for drawing graphical objects and applying their attributes.
- ❖ Develop knowledge of 2D geometric transformations and clipping techniques.
- ❖ Understand graphical user interfaces (GUI) fundamental concepts.

UNIT – I: INTRODUCTION TO COMPUTER GRAPHICS

Introduction to Computer Graphics – Video Display Devices – Raster Scan Systems – Random Scan Systems – Graphics Monitors and Workstations – Graphics Software.

UNIT – II: INPUT PRIMITIVES

Input Devices – Hardcopy Devices – User Dialogue – Input of Graphical Data – Input Functions – Interactive Picture Construction Techniques.

UNIT – III: OUTPUT PRIMITIVES

Output Primitives – Line Drawing Algorithms – Loading the Frame Buffer – Line Function – Circle Generating Algorithms – Line Attributes – Curve Attributes – Colour and Grayscale Levels – Area Fill Attributes – Character Attributes – Bundled Attributes – Inquiry Functions.

UNIT – IV: 2D GEOMETRIC TRANSFORMATIONS

Basic Transformations – Matrix Representations – Composite Transformations – Window to Viewport Coordinate Transformations – Point Clipping – Line Clipping – Cohen-Sutherland Line Clipping – Curve Clipping – Text Clipping.

UNIT – V: GRAPHICAL USER INTERFACES

Graphical User Interfaces and Interactive Input Methods: The User Dialogue – Input of Graphical Data – Input Functions – Interactive Picture Construction Techniques.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Donald Hearn M. Pauline Baker, Computer Graphics C Version, Pearson Education, 2014.

- Alexey Boreskov, Evgeniy Shikin, "Computer Graphics From Pixels to Programmable Graphics Hardware", CRC Press, 2013.

REFERENCES:

- Donald Hearn M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2014.
- Branislav Sobota, "Computer Graphics and Imaging", Intech Open Publication, 2019.
- Dr. Deepali A. Godse, Atul P. Godse, "Computer Graphics", UNICORN Publishing Group, 2020.
- Gabriel Gambetta, "Computer Graphics from Scratch A Programmer's Introduction to 3D Rendering", No Starch Press, 2021.
- <https://archive.org/details/computer-graphics-c-version-hearn-baker>.
- <https://gabrielgambetta.com/computer-graphics-from-scratch/>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Explain the fundamentals of computer graphics systems and display technologies.
- CO2 Identify and use different input and output devices in graphics applications.
- CO3 Apply line, circle, and other output primitive generation algorithms.
- CO4 Perform 2D geometric transformations and clipping operations on graphical objects.
- CO5 Design simple graphical applications using GUI concepts.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean Cos
CO1	3	3	3	3	3	2	1	2	1	2	3	2	3	3	1	2.3
CO2	3	3	2	2	3	3	3	3	2	2	3	3	3	2	2	2.6
CO3	3	3	3	3	3	3	1	3	1	1	2	3	3	3	1	2.4
CO4	2	2	2	2	2	3	1	3	2	1	2	3	1	2	2	2.0
CO5	2	3	3	3	3	2	2	3	2	1	2	2	3	3	1	2.3
Average	2.6	2.8	2.6	2.6	2.8	2.6	1.6	2.8	1.6	1.4	2.4	2.6	2.6	2.6	1.4	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE

Code :

2. BIG DATA ANALYTICS (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Explain the concepts and applications of Big Data.
- ❖ Describe Big Data technologies and business applications.
- ❖ Apply data collection, storage, and management techniques
- ❖ Use Hadoop & distributed processing frameworks for Big Data
- ❖ Analyse data using machine learning, and visualization tools

UNIT – I: INTRODUCTION

Concepts and Terminology – Big Data Characteristics – Different Types of Data –case study

UNIT – II: BIG DATA ADOPTION AND PLANNING CONSIDERATIONS

Data Identification – Data Acquisition and Filtering – Data Extraction – Data validation and cleansing – Data Aggregation and Representation

UNIT – III: ENTERPRISE TECHNOLOGIES AND BIG DATA BUSINESS INTELLIGENCE:

Online Transaction and Processing (OLTP) – Online Analytical Processing (OLAP) – Extract Transform Load (ETL) – Data Warehouses – Data Marts.

UNIT – IV: BIG DATA PROCESSING CONCEPTS

Distributed Data Processing – Hadoop – Processing Workloads – Cluster – Processing in Batch Mode – Map – Combine – Partition – Shuffle and Sort.

UNIT – V: BIG DATA STORAGE TECHNOLOGY

On-Disk Storage Devices – NoSQL Database – In- Memory Storage Device

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Paul Buhler, Wajid Khattak and Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Prentice Hall Publications, 1st Edition, January 2016.
2. Dr. A.V.K. Shanthi, Dr. Praveen Kumar Misra, Dr. Bramah Hazela, Dr. Saptarshi Gupta, published a book “Big Data Analytics- Discovering, Analysing, Visualizing and Presenting Data”, by Scientific International Publishing House.

REFERENCES:

1. DT Editorial Services, "Big Data (Hadoop 2, Map Reduce, Hive, YARN, Pig, R and Data Visualization) Black Book", 1st Edition, Dreamtech Press, 2016.
2. Soumendra Mohanty, Madhu Jagadeesh, and Harsha Srivatsa, "Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics", Apress Media, 2013.
3. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly Media, 2012
4. <https://hadoop.apache.org/docs/r1.2.1/hadoop-project-dist/hadoop-common/GettingStarted.html>.
5. <https://www.pdfdrive.com/big-data-fundamentals-e187420663.html>.

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Recall the basics of Big Data and its applications
- CO2 Know about OLTP, OLAP and ETL
- CO3 Apply the cutting-edge tools and technologies to analyse Big Data
- CO4 Analyse various big data tools and techniques
- CO5 Evaluate various storage and analytical techniques

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	2	2	2	1	1	1	2	1	1	3	2	2	2	1	1.73
CO2	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.93
CO3	3	3	3	3	2	1	1	2	1	2	3	3	2	3	1	2.20
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.40
CO5	3	3	3	3	2	1	1	3	2	2	3	3	3	3	2	2.47
Average	3.0	2.8	2.6	2.6	1.8	1.0	1.0	2.4	1.4	1.8	3.0	2.6	2.2	2.6	1.4	2.15

3 - Strong, 2 - Medium , 1- Low

SKILL ENHANCEMENT COURSE

Code :

3. MOBILE APPLICATION DEVELOPMENT (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Gain a comprehensive understanding of the basic concepts of mobile app using Android Platform
- ❖ Learn the detail framework of Android Platform
- ❖ Acquire the knowledge on the design aspects in Creating intuitive, reliable mobile apps using the android services and components
- ❖ Explore the various additional features of mobile app development
- ❖ Impart skills on Graphical features to design attractive web apps

UNIT – I: ANDROID PLATFORM

Introducing the Android Software Development Platform: Understanding Java SE and the Dalvik Virtual Machine-The Directory Structure of an Android Project-Common Default Resources Folders-The Values Folder- Leveraging Android XML-Screen Sizes-Desktop Clocks- Using Android Application Resources-Launching Application: The Android Manifest.xml File - Creating Your First Android Application

UNIT – II: ANDROID FRAMEWORK

Android Framework Overview: The Foundation of OOP: The Object-The Blue print for an Object: The Class-Providing Structure for Classes: Inheritance-Defining an Interface Bundling Classes-An overview of XML- The APK File-Android Application Components Android Activities- Android Services - Broad cast Receivers - Content Providers - Android Manifest XML.

UNIT – III: WORKING WITH SCREEN LAYOUTS

Screen Layout Design- Android View Hierarchies - Nesting Views-Defining Screen Layouts - Editing the main.xml File-Using Relative Layouts- Sliding Drawers- Using Padding and Margins with Views and Layouts.

UNIT – IV: WORKING WITH BUTTONS, MENUS, AND DIALOGS

UI Design: Buttons, Menus, and Dialogs: Using Common UI Elements- Adding an Image Button to Your Layout-Defining Multistate Image Button - Replacing the Default Background- Adding a Text to Your Layout- Adding an Image-Using Menus in Android-Creating the Menu Structure with XML- Running the Application in the Android Emulator

UNIT – V: GRAPHICS IN ANDROID

An Introduction to Graphics Resources in Android: Introducing the Drawables-Implementing Images - Creating Animation in Android- Tween Animation in Android- Using Transitions

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Jackson W, “Android Apps for Absolute Beginners”, 1st Edition, Apress.
2. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2011.

REFERENCES:

1. [Barry Burd](#) and [John Paul Mueller](#), Android Application Development All-in-One For Dummies, 3rd Edition, 2020.
2. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2011.
3. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt,Ltd,2010
4. Mark L Murphy, “Beginning Android3”, Apress Publications, 2011.
5. <https://www.javatpoint.com/android-tutorial>
6. <https://developer.android.com/develop.com/dos>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Identify various concepts of mobile application programming in Android platform
- CO2 Implement the business logic in an app with java
- CO3 Understand Android User Interface Design with XML
- CO4 Know about Common Android APIs
- CO5 Deploy applications to the Android marketplace for distribution

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	2	2	3	2	3	2	1	3	2	1	2	2	3	2	2	2.2
CO2	3	3	2	2	3	2	1	1	1	2	3	2	2	2	2	2.1
CO3	3	3	1	2	3	3	1	2	2	3	3	3	1	3	1	2.3
CO4	3	3	3	3	3	2	2	2	2	1	3	2	3	3	2	2.5
CO5	3	3	3	3	2	1	1	2	3	1	3	2	3	3	2	2.3
Average	2.8	2.8	2.4	2.4	2.8	2.0	1.2	2.0	2.0	1.6	2.8	2.2	2.4	2.6	1.8	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE

Code :

4. SOFTWARE TESTING (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand the fundamentals of software development life cycle models, quality concepts, and verification and validation processes in software engineering.
- ❖ Gain knowledge of black-box testing principles, techniques, applications, and challenges in software testing.
- ❖ Understand white-box testing techniques and integration testing approaches including scenario testing and defect analysis.
- ❖ Learn system testing and acceptance testing methods including functional and non-functional testing strategies.
- ❖ Develop skills in test planning, test management, execution, reporting, and software testing metrics and measurement techniques.

UNIT – I: INTRODUCTION

Software Development Life Cycle models: Phases of Software project – Quality, Quality Assurance, Quality control – Testing, Verification and Validation – Process Model to represent Different Phases

UNIT – II: BLACK-BOX TESTING:

Black-Box Testing: Black-Box Testing – Need for Black-Box Testing – Uses of Black-Box Testing – challenges in Black-Box Testing –

UNIT – III: WHITE BOX TESTING

Challenges in White Box Testing -Integration Testing: Integration Testing as Type of Testing – Integration Testing as a Phase Testing – Scenario Testing – Defect Bash.

UNIT – IV: SYSTEM AND ACCEPTANCE TESTING:

system Testing Overview – Functional versus Non-functional Testing – Functional testing - Non- functional Testing – Acceptance Testing – Summary of Testing Phases.

UNIT – V: TEST PLANNING AND MANAGEMENT

Test Planning – Test Management – Test Process – Test Reporting –Best Practices.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Software Testing Principles and Practices – Srinivasan Desikan & Gopalswamy Ramesh, Pearson Education, 2014
2. Foundations of Software Testing, Aditya P. Mathur, Pearson Education, 2013

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Explain software development life cycle models and apply quality assurance, verification, and validation concepts in software projects.
- CO2 Apply black-box testing techniques to identify defects and evaluate software functionality without internal code knowledge.
- CO3 Analyze and implement white-box and integration testing strategies to ensure software correctness at module and system levels.
- CO4 Perform system and acceptance testing using functional and non-functional testing approaches to validate software requirements.
- CO5 Plan, manage, and evaluate software testing processes using test metrics, reporting methods, and best practices.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	1	1	2	1	2	2	1	2	2	2	3	2	2	2.0
CO2	3	2	3	3	3	1	1	2	2	2	3	3	3	2	1	2.3
CO3	3	3	2	3	1	2	3	2	2	1	3	3	2	1	1	2.1
CO4	2	3	1	3	3	2	2	1	1	2	3	3	2	2	3	2.2
CO5	3	3	2	2	2	3	2	2	2	1	3	2	2	2	2	2.2
Average	2.8	2.8	1.8	2.4	2.2	1.8	2.0	1.8	1.6	1.6	2.8	2.6	2.4	1.8	1.8	2.2

Mean Co : 2.2

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE

Code :

5. CLOUD COMPUTING (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand the concept of cloud computing, its evolution, importance, characteristics, and benefits in modern computing
- ❖ Understand different cloud service models (SaaS, PaaS, IaaS) and deployment models of cloud computing
- ❖ Understand different types of scalability, load balancing, and scalability design techniques in cloud computing
- ❖ Explain virtualization concepts and identify different types such as server, desktop, and data storage virtualization
- ❖ Understand cloud security, data storage, disaster recovery, business continuity, and security threats in cloud computing

UNIT – I: INTRODUCTION TO CLOUD COMPUTING

Evolution of Cloud Computing – Meaning of Cloud Computing – Need for Cloud Computing - Characteristics of Cloud Computing - Benefits of Cloud Computing.

UNIT – II: SERVICE MODELS

Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) - Deployment Models: Public Cloud, Private Cloud, Community Cloud and Hybrid Cloud.

UNIT – III: TYPES OF SCALABILITY

Horizontal Scalability, Vertical Scalability - Load Balancing -Designing for Scalability: Scale out, Scale in – Capacity Planning Vs Scalability.

UNIT – IV: VIRTUALIZATION TECHNOLOGY

Understanding Virtualization, History of Virtualization - Types of virtualizations: Server Virtualization, Desktop Virtualization, Data Storage Virtualization.

UNIT – V: SECURING THE CLOUD

General Security - Understanding Data Storage – Disaster Recovery and Business Continuity in the Cloud – Understanding the Threats.

UNIT – VI: CURRENT CONTOURS (Self-directed learning activities for Continuous Internal Assessments Only):
Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOKS:

1. Kris Jamsa, "Cloud Computing SaaS, Paas, IaaS, Virtualization Business Models, Mobile, Security and more", Published by Jones & Bartlet Learning, 2012.
2. A. Srinivasan and J.Suresh, "Cloud Computing – A Practical Approach for Learning and Implementation", Pearson India Publications, 2014.

REFERENCES:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley India Publication, 2012.
2. Rajkumar Buyya & Co., "Cloud Computing Principles and Paradigms", John Wiley & Sons Publications, 2011.
3. Anthony T. Velte , Toby J. Velte Robert Elsenpeter, "Cloud computing a practical approach", TATA McGraw- Hill , New Delhi – 2010.
4. Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, "Cloud computing for dummies", Wiley Publishing, Inc, 2010.
5. Comer, Douglas, The Cloud Computing Book: The Future of Computing Explained, CRC Press, 2021

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- | | |
|-----|---|
| CO1 | Describe the meaning, need, characteristics, evolution, and benefits of cloud computing. |
| CO2 | Identify and classify cloud service models and identify different cloud deployment models such as Public, Private, Community, and Hybrid Cloud. |
| CO3 | Examine horizontal and vertical scalability, load balancing, and compare capacity planning with scalability. |
| CO4 | Illustrate virtualization concepts and identify different types such as server, desktop, and data storage virtualization. |
| CO5 | Analyze cloud security concepts, data storage, disaster recovery, and identify threats in cloud environments. |

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	3	2	2	2	2	2	1	2	3	3	2	2	2	2.2
CO2	3	3	3	3	2	2	2	2	1	2	3	3	3	2	2	2.3
CO3	3	3	3	3	3	2	2	2	1	2	3	3	3	3	2	2.4
CO4	3	3	3	3	3	3	2	2	1	2	3	3	3	3	3	2.5
CO5	3	3	3	3	3	3	2	2	2	2	3	3	3	3	3	2.6
Average	3.0	3.0	3.0	2.8	2.6	2.4	2.0	2.0	1.2	2.0	3.0	3.0	3.0	2.8	2.6	2.4

Mean Co's : 2.4

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE

Code :

6. DATA MINING (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand the basic concepts and architecture of cloud computing
- ❖ Learn various cloud service and deployment models
- ❖ Understand virtualization and cloud infrastructure.
- ❖ Gain knowledge of cloud security and challenges
- ❖ Apply cloud computing concepts in real-world applications.

UNIT – I: INTRODUCTION TO DATA MINING

Introduction to Data Mining – Data Mining Concepts – Knowledge Discovery in Databases (KDD) – Data Mining Tasks – Applications of Data Mining – Data Mining Architecture – Challenges in Data Mining.

UNIT – II: DATA PREPROCESSING

Introduction to Data Preprocessing – Data Cleaning – Handling Missing Values – Data Integration – Data Transformation – Data Normalization – Data Reduction – Sampling Techniques.

UNIT – III: CLASSIFICATION AND PREDICTION

Introduction to Classification – Classification Process – Training and Testing Data – Decision Trees – Information Gain – Naïve Bayes Classifier – Prediction Techniques – Model Evaluation.

UNIT – IV: CLUSTERING TECHNIQUES

Introduction to Clustering – Types of Clustering – Similarity Measures – Partitioning Methods – Hierarchical Clustering – Density-Based Clustering – K-Means Algorithm – Cluster Evaluation.

UNIT – V: ASSOCIATION RULE MINING

Introduction to Association Rules – Frequent Itemsets – Support and Confidence Measures – Market Basket Analysis – Apriori Algorithm – Rule Generation – Applications of Association Rule Mining.

RECOMMENDED BOOKS:

1. 'Data Mining: Practical Machine Learning Tools and Techniques' – Ian H. Witten, Eibe Frank, Mark A. Hall (2016, 4th Edition)
2. 'The Elements of Statistical Learning' – Trevor Hastie, Robert Tibshirani, Jerome Friedman (2009, 2nd Edition)

REFERENCES:

1. 'Mining of Massive Datasets' – Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman (2020, 3rd Edition)
2. [IBM Data Science & Data Mining Resources](#)
3. [GeeksforGeeks – Data Mining Tutorial](#)

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Understand concepts of data mining and KDD process
- CO2 Apply preprocessing techniques for data analysis.
- CO3 Implement classification and prediction models.
- CO4 Use clustering techniques to analyze data patterns.
- CO5 Analyze association rules for decision-making applications.

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	1	3	3	2	3	2	2	1	3	3	2	3	2	2.4
CO2	3	3	2	2	2	3	3	1	3	3	2	3	3	3	2	2.5
CO3	3	3	3	3	3	2	3	2	1	1	3	2	3	2	2	2.4
CO4	2	2	3	2	1	3	2	2	2	2	3	3	3	3	3	2.4
CO5	3	3	2	1	3	2	2	2	3	3	2	2	2	2	3	2.3
Average	2.8	2.8	2.2	2.2	2.4	2.4	2.6	1.8	2.2	2.0	2.6	2.6	2.6	2.6	2.4	2.4

3 - Strong, 2 - Medium, 1- Low

SKILL ENHANCEMENT COURSE

Code :

7. INTERNET OF THINGS (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Understand the fundamental concepts, architecture, technologies, and applications of the Internet of Things (IoT).
- ❖ Analyse IoT communication models, M2M systems, network management protocols, and enabling technologies.
- ❖ Apply IoT design methodologies to develop domain-specific IoT solutions.
- ❖ Develop IoT applications using Python programming and Raspberry Pi-based embedded systems.
- ❖ Explore cloud computing platforms and web services for IoT data storage, processing, and application deployment.

UNIT – I: INTRODUCTION

Definition & characteristics of IoT - physical design of IoT - logical design of IoT - IoT enabling Technologies - IoT levels & Deployment templates.

UNIT – II: DOMAIN SPECIFIC IOT

Home Automation - cities - Environment - Energy - retail - logistics - Agriculture - Industry Health and life style.

UNIT – III: IoT and M2M

Deference between IoT and M2M - SDN and NFV for IoT - IoT systems management - SNMP - YANG – NETOPEER.

UNIT – III: IoT SPECIFICATION

IoT platforms design Methodology - Domain model specification - Information model specification - IoT level specification - functional view specification - Application Development.

UNIT – IV: LOGICAL DESIGN USING PYTHON

Logical design using python - IoT physical devices and Endpoints, building blocks of IoT device- Raspberry Pi-Linuxon Raspberry Pi - Raspberry Pi interfaces.

UNIT – V: IoT AND CLOUD COMPUTING

IoT physical servers & cloud computing-WAMP-Xively cloud for IoT- python Web application framework-Amazon web services for IoT.

RECOMMENDED BOOKS:

1. Bahga, A., &Madiseti, V. K. (2015). Internet of things: A hands-on approach. Universities Press.
2. Srinivasa, K. G., Siddesh, G. M., & Raju, R. H. (2018). Internet of things. Cengage Learning India.

REFERENCES:

1. *"Internet of Things: A Hands-On Approach"* by ArshdeepBahga and Vijay Madiseti
2. *"Internet of Things: Principles and Paradigms"* by Rajkumar Buyya and Amir Vahid Dastjerdi
3. *"The Internet of Things: Enabling Technologies, Platforms, and Use Cases"* by Pethuru Raj and Anupama C. Raman
4. <https://dotnet.microsoft.com/en-us/learn/iot>
5. <https://docs.aws.amazon.com/iot/latest/developerguide/iot-tutorials.html>
6. <https://techvidvan.com/tutorials/learn-iot/>

COURSE OUTCOMES:

Upon successful completion of this course, the students would be able to:

- CO1 Explain the basic concepts, characteristics, and architecture of IoT.
- CO2 Identify IoT applications in various domains such as smart homes, cities, agriculture, and healthcare.
- CO3 Describe IoT communication, management concepts, and related protocols.
- CO4 Apply IoT design methodologies and specifications to develop IoT solutions.
- CO5 Develop simple IoT applications using Python, Raspberry Pi, and cloud platforms

Mapping with Programme Outcomes and Programme Specific Outcomes

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	Mean COs
CO1	3	3	2	2	2	1	1	2	1	2	3	2	2	2	1	1.9
CO2	3	3	2	2	2	1	1	3	2	2	3	2	2	3	2	2.2
CO3	3	3	3	2	2	1	1	2	2	2	3	3	2	2	2	2.2
CO4	3	3	3	3	2	1	1	3	2	2	3	3	2	3	2	2.4
CO5	3	3	2	3	2	2	1	3	2	2	3	3	3	3	2	2.5
Average	3.0	3.0	2.4	2.4	2.0	1.2	1.0	2.6	1.8	2.0	3.0	2.6	2.2	2.6	1.8	2.3

Mean Co : 2.3

3 - Strong, 2 - Medium, 1- Low