



BHARATHIDASANUNIVERSITY, TIRUCHIRAPPALLI – 620024
BACHELOR OF COMPUTER APPLICATIONS
CHOICEBASEDCREDITSYSTEM- LEARNING OUTCOMES BASED
CURRICULUMFRAMEWORK(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 - I (ACP-I)	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)	Programming in PHP	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)	Operating Systems	5	4	3	30	70	100
		Core Course - 8 (CC - 8)	Software Testing and Quality Assurance	5	4	3	30	70	100
		Core Practical - 5(CP - 5)	Programming in PHP 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)	Data Mining and Data Warehousing	5	4	3	30	70	100
		Core Course- 11 (CC - 11)	E-Commerce and Its Applications	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
	GrandTotal			180	150	-	--	--	4900

**ALLIED COURSE
(Allied Papers)**

First Year

Mathematics

Second Year

Accounting and Organizational
Behaviour

SKILL ENHANCEMENT COURSE (SEC)			
Sl. No.	Title of paper	Sl. No.	MANDATORY Naan Mudhalvan Scheme ##
1.	Mobile Application Development	1.	2nd Semester:
2.	Big Data Analytics		
3.	Cloud Computing	2.	3rd Semester:
4.	Internet of Things		
5.	Multimedia Technologies	3.	4th Semester:
6.	Artificial Intelligence		
7.	Machine Learning	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.		Allied Course (AC)	4	4	16	400
6.		Allied Course Practical (ACP)	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.		EXTENSIONACTIVITIES (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 (RegularStream)
- + 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 (POs):

PO1	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 (PSOs):

PSO 1	Understand and analyze the fundamental knowledge in the domain of computer applications
PSO 2	Enhance the logical and analytical thinking to understand the computational systems
PSO 3	Ability to comprehend the structure, development methodologies of software systems and to design the software solutions
PSO 4	Explore the developing areas in the sphere of computer applications and to enrich themselves to be skilful to meet the diverse expectations of the industry
PSO 5	Equip them to be competent to provide optimal and ethical solutions to the technological challenges laid by the professional societies

Year : First

CORE COURSE 1
PROGRAMMING IN C AND DATA STRUCTURES
(Theory)

Semester: I

Code :

Credits: 4

COURSE OBJECTIVES:

This course aims to:

- ❖ Identify and Recall the fundamental syntax of C programming while defining the basic concepts of linear and non-linear data structures.
- ❖ Explain and Interpret the logical flow and the operational mechanics of various linear and non-linear data structures.
- ❖ Apply C programming syntax and memory management techniques to implementation of linear and non-linear data structures.
- ❖ Analyze and Differentiate complex programming constructs and data structures to optimize memory and data management.
- ❖ Evaluate and justify the selection of programming constructs, memory management techniques, and data structures.

UNIT – I: INTRODUCTION

Basic of C: History of C and its importance – Structure of a C program – Data Types – Constants and Variables – Operators and Expressions – Order of Precedence, Evaluating of Arithmetic Expressions – Type Conversion- Decision Statements: if, if-else, and nested if statements.

UNIT – II: LOOPING AND FUNCTIONS

Loops Structures: For Loop, While, Do-while loop – Arrays: - One Dimensional Array, Two-dimensional Arrays, Character Arrays and Strings – Functions: Function with arrays - Function with decision and looping statements - Recursion.

UNIT – III: POINTERS AND STRUCTURES

Pointers: Introduction – Pointer Expressions – Chain of Pointers – Pointers and Arrays – Array of Pointers – Pointers as function arguments – Functions returning Pointers – Pointers to Functions – Function pointer – Structures - declaration, initialization, Array of Structures – Pointer to structures, Structures and functions – Typed of Enumerated data types, Unions.

UNIT – IV: STRING AND FILES

Strings Processing, Standard string library functions – Files: introduction and files functions – Writing and reading in Text mode – Simple application: Display the

contents of a file. Write data to a file. Append data to an existing file – File IO– Reading and writing structures.

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. ReemaThareja, “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. YashavantKanetkar, “Let us C”, BPB Publications, Tenth Edition, New Delhi, 2010.
5. Szuhay, Jeff, and Szuhay, Jeff, “Learn C Programming: A Beginner's Guide to Learning C Programming the Easy and Disciplined Way”, Packt Publishing, 2020.
6. Jena, Sisir Kumar, and Jena, Sisir Kumar, “C Programming: Learn to Code”, CRC Press, 2021.

E-BOOKS:

1. <https://www.tutorialspoint.com/cprogramming/index.htm>
2. <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 ad 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	1	2	2	2	2	1	0	3	1	2	3	2	2	1	1	1.67
CO2	1	3	2	3	2	2	1	3	1	2	3	3	3	0	2	2.07
CO3	1	2	3	3	2	1	2	3	1	1	3	3	3	2	1	2.07
CO4	1	3	2	3	2	1	2	3	1	2	3	3	3	1	1	2.07
CO5	1	3	3	3	2	1	1	3	2	1	3	3	3	2	2	2.20
Average	1.00	2.60	2.40	2.80	2.00	1.20	1.20	3.00	1.20	1.60	3.00	2.80	2.80	1.20	1.40	2.01

Year : First

CORE PRACTICAL 1
PROGRAMMING IN C AND DATA STRUCTURES LAB
(Practical)

Semester: I

Code :

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.

LIST OF 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.

Semester: I**Credits: 2**

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	Explain the basic concepts, generations, classifications, and architecture of computers.
CO2	Describe the functions of CPU, memory, input devices, output devices, and storage devices.
CO3	Explain computer software, programming languages, operating systems, and database management systems.
CO4	Demonstrate knowledge of computer networks, the Internet, email, and web design concepts.
CO5	Analyse the applications of computers and identify common security threats such as viruses, worms, and malware.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	1	1	1	2	2	1	1	2	3	2	1	2	1	1.67
CO2	2	3	3	1	3	2	1	2	2	3	2	1	2	2	2	2.07
CO3	2	3	2	2	3	2	1	2	1	2	3	2	2	3	2	2.13
CO4	3	3	2	2	3	3	3	2	2	3	2	3	2	2	0	2.33
CO5	2	3	2	2	1	2	2	3	3	2	1	3	3	2	2	2.20
Average	2.20	3.00	2.00	1.60	2.20	2.20	1.80	2.00	1.80	2.40	2.20	2.20	2.00	2.20	1.40	2.08

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

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.

E – BOOKS :

1. <https://www.javatpoint.com/java-tutorial>
2. <https://www.geeksforgeeks.org>
3. <https://www.javatpoint.com>
4. <https://www.w3schools.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.
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Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O 1	PS O 2	PS O 3	PS O 4	PS O 5	Mean COs
CO1	1	3	2	2	2	1	0	3	1	1	3	2	2	1	0	1.60
CO2	1	3	2	3	2	1	2	3	0	1	3	3	3	1	1	1.93
CO3	1	3	3	3	2	1	1	3	1	1	3	3	3	2	1	2.07
CO4	1	3	3	3	3	1	1	3	2	1	3	3	3	2	2	2.27
CO5	2	3	3	3	2	1	1	3	2	2	3	3	3	3	2	2.40
Average	1.20	3.00	2.60	2.80	2.20	1.00	1.00	3.00	1.20	1.20	3.00	2.80	2.80	1.80	1.20	2.05

Year: First

CORE PRACTICAL 2

Semester: II

OBJECT ORIENTED PROGRAMMING USING JAVA LAB

Code : (Practical)

Credits: 4

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

LIST OF 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 in heritage.
9. Program to implement the concept of **packages**.
10. Program to create **multiple threads** using thread class.
11. JAVA app let 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

INTERDISCIPLINARY COURSE 2

Semester: II

Code :

**WORKING PRINCIPLES OF INTERNET
(Theory)**

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Understand the fundamentals and architecture of the Internet.
- ❖ Learn various methods of Internet connectivity and online communication.
- ❖ Explore the World Wide Web and common Internet tools.
- ❖ Understand multimedia, e-commerce, and intranet applications.
- ❖ Gain awareness of Internet security and safe online practices.

UNIT – I: INTRODUCTION TO THE INTERNET

Basics of Internet – Internet Architecture – Basic Internet Services.

UNIT – II: INTERNET CONNECTIVITY AND COMMUNICATION

Connecting to the Internet – Internet Service Providers – E-mail – Online Communication Tools.

UNIT – III: WORLD WIDE WEB

How the World Wide Web Works – Web Browsers – Search Engines – Common Internet Tools.

UNIT – IV: INTERNET APPLICATIONS

Multimedia on the Internet – Intranet – E-Commerce and Online Shopping.

UNIT – V: INTERNET SECURITY

Internet Security Basics – Safe Browsing Practices – Cyber Threats – Privacy and Data Protection.

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

Contemporary Developments Related to the Course during the Semester Concerned.

RECOMMENDED BOOK:

1. Xavier C, “Fundamentals of Internet and emerging technologies”, (1st ed.). New Age International Publishers, 2021.

REFERENCES:

1. Comer D. E, “The Internet book: Everything you need to know about computer networking and how the Internet works”, (5th ed.). CRC Press, 2018.

2. Fox, R., & Hao, W, "Internet infrastructure: Networking, web services, and cloud computing", CRC Press, 2017.

COURSE OUTCOMES:

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

CO1	Explain the basic concepts and architecture of the Internet.
CO2	Use Internet services and communication tools effectively.
CO3	Demonstrate the use of the World Wide Web and common Internet tools.
CO4	Apply Internet-based services such as multimedia applications and online shopping.
CO5	Identify Internet security threats and adopt safe online practices.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	1	1	1	2	1	1	1	2	3	2	1	1	2	1.60
CO2	3	2	2	3	2	3	3	2	2	1	3	2	3	2	1	2.27
CO3	3	2	2	1	2	1	3	2	2	3	3	2	2	2	2	2.13
CO4	3	2	2	1	2	1	2	1	3	2	2	2	3	2	1	1.93
CO5	2	3	2	2	1	2	1	3	3	2	3	3	3	2	1	2.20
Average	2.60	2.40	1.80	1.60	1.60	1.80	2.00	1.80	2.20	2.00	2.80	2.20	2.40	1.80	1.40	2.03

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

Year : Second

CORE COURSE 3

Semester: III

**PROGRAMMING IN PYTHON
(Theory)**

Code :

Credits: 4

COURSE OBJECTIVES:

This course aims to:

- ❖ Identify core language features—including reserved keywords, identifiers, and variables—and 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 – find all() method - compile() method.

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. Reema Thareja, “PYTHON Programming”, Oxford University Press, New Delhi, Third Edition, 2025.
2. Jeeva Jose and P. SojanLal, “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. Jake Vander Plas, “Python Data Science Handbook: Essential Tools for Working with Data”, O'Reilly Media, 2016.
6. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	1	3	1	1	0	1	1	2	0	2	3	2	1	1	1	1.33
CO2	1	3	2	3	1	1	2	3	1	2	3	3	2	2	1	2.00
CO3	2	3	3	3	2	2	2	3	2	3	3	3	2	0	1	2.27
CO4	2	3	3	3	2	2	3	3	2	3	3	3	2	1	1	2.40
CO5	2	2	3	3	2	2	2	3	3	3	3	1		2	0	2.07
Average	1.60	2.80	2.40	2.60	1.40	1.60	2.00	2.80	1.60	2.60	3.00	2.40	1.40	1.20	0.80	2.01

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0= No Significant Correlation

Year : Second

CORE PRACTICAL 3

Semester: III

PROGRAMMING IN PYTHON LAB

Code : (Practical)

Credits: 4

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.

LIST OF 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.

Year : Second

INTER DISCIPLINARY COURSE 3

Semester :III

Code :

**WEB DESIGN
(Theory)**

Credits: 2

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. C. 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”, Shripiti 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	1	3	1	2	1	1	1	2	3	2	1	2	3	1.87
CO2	3	2	2	3	2	1	2	2	2	3	3	1	2	2	1	2.07
CO3	3	2	3	1	2	2	1	3	2	2	3	2	2	3	3	2.27
CO4	2	3	2	2	1	2	2	2	2	3	2	3	2	2	1	2.07
CO5	2	3	2	2	1	2	2	2	2	3	2	3	2	2	2	2.13
Average	2.40	2.60	2.00	2.20	1.40	1.80	1.60	2.00	1.80	2.60	2.20	1.80	2.20	2.00	2.00	2.08

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

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 Assessments 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, AvitaKatal., "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. WilfriedLemahieu, 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.
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Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	3	3	1	2	2	2	1	3	3	3	2	3	1	2.27
CO2	2	3	2	2	2	3	2	2	3	3	3	2	1	1	0	2.07
CO3	1	3	2	3	2	1	2	3	2	2	3	3	3	2	1	2.20
CO4	1	3	3	3	2	2	3	3	2	3	3	3	3	2	2	2.53
CO5	2	3	3	2	3	3	3	3	3	3	3	0	1	0	1	2.20
Average	1.60	3.00	2.60	2.60	2.00	2.20	2.40	2.60	2.20	2.80	3.00	2.20	2.00	1.60	1.00	2.25

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0= No Significant Correlation

Year : Second

CORE PRACTICAL 4

Semester: IV

RDBMS AND NoSQL LAB

Code :

(Practical)

Credits: 4

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 : Second

INTER DISCIPLINARY COURSE 4

Semester: IV

DIGITAL MARKETING

Code :

(Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Identify the historical transition from traditional to digital marketing and define core e-concepts essential for modern e-business
- ❖ 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
- ❖ Apply various digital media channels, including search engine marketing (SEM), ePR, affiliate marketing, and interactive display advertising to reach target audiences
- ❖ Analyze online consumer behavior and the cultural implications of website characteristics to optimize digital engagement
- ❖ 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	Implement the four pillars of online marketing (e-product, e-promotion, e-price, e-place)
CO3	Understand and apply key digital marketing channels for effective online promotion and customer engagement.
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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	3	2	2	2	1	2	3	1	1	3	1	1	1	3	2	1.87
CO2	3	2	2	2	1	2	1	3	1	1	2	3	2	3	1	1.93
CO3	3	2	2	2	1	2	3	2	1	3	2	2	2	3	3	2.20
CO4	3	2	3	3	1	2	1	2	2	3	1	2	1	3	3	2.13
CO5	3	2	3	3	1	3	2	2	2	3	3	3	2	1	1	2.27
Average	3.00	2.00	2.40	2.40	1.00	2.20	2.00	2.00	1.40	2.60	1.80	2.20	1.60	2.60	2.00	2.08

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

Year : Third

CORE COURSE 5

Semester: V

**PROGRAMMING IN PHP
(Theory)**

Code :

Credits: 4

COURSE OBJECTIVES:

This course aims to:

- ❖ Provide a strong foundation in PHP programming for developing dynamic web applications.
- ❖ Understand how to integrate PHP with HTML and handle user input through web forms.
- ❖ Apply object-oriented programming concepts in PHP for structured and reusable code.
- ❖ Learn browser handling, sessions, cookies, FTP operations.
- ❖ Develop skills in database connectivity and performing CRUD operations using PHP and MySQL.

UNIT – I: ESSENTIAL PHP

Creating your Development Environment - Creating a First PHP Page - Mixing HTML and PHP - Printing Some Text - Printing Some HTML - More Echo Power - Using PHP “Here” Documents – Adding Comments to PHP - Variables - Constants - Data Types, Operators and Flow Control.

UNIT – II: PHP BASICS

Strings and Arrays - Creating Functions - Reading Data in Web Pages: Setting Up Web Pages to Communicate with PHP - Handling Text Fields and Text Areas Handling Check Boxes and Radio Buttons – Handling List Boxes, Password Controls, Hidden Controls, Image Maps, File Uploads and Buttons.

UNIT – III: ADVANCED OOPs

Basics of Object-Oriented Programming - Auto loading Classes - Advanced Object-Oriented Programming: Static Methods, Abstract Classes, Interfaces and Class Constants - Object Iteration – Comparing Objects - Final Keyword - Cloning Objects – Reflection.

UNIT – IV: BROWSER – HANDLING, SESSION, COOKIES AND FTP

PHP Browser - Handling Power – Session, Cookies and FTP: Setting, Reading, Deleting Cookies - Working with FTP - Downloading, Uploading, and Deleting a File with FTP - Creating and Removing Directories with FTP - Working with E-mail - Storing Data and Writing a Hit Counter using Sessions.

UNIT – V: FILE HANDLING AND MYSQL USING PHP

File Handling - Working with Databases: Accessing the Database in PHP - Update Data into the Database - Insert Data into the Database - Delete Data from Database – Create a New Table – Create a New Databases - Drawing image on the server.

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. VikramVaswani, "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	Develop dynamic and interactive web applications using PHP.
CO2	Handle and process user input from web forms effectively.
CO3	Apply object-oriented programming concepts in PHP.
CO4	Handle browsers, manage sessions and cookies, perform FTP.
CO5	Connect databases and perform CRUD operations using PHP and MySQL.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	3	1	2	2	3	1	3	3	3	2	1	1	2.13
CO2	2	2	2	3	1	1	2	3	1	2	2	3	3	2	2	2.07
CO3	1	3	3	3	2	2	2	3	3	3	3	2	1	1	1	2.20
CO4	2	2	2	2	2	3	3	2	3	2	3	3	3	3	0	2.33
CO5	2	3	2	2	3	3	2	3	3	3	2	0	1	2	0	2.07
Average	1.80	2.60	2.20	2.60	1.80	2.20	2.20	2.80	2.20	2.60	2.60	2.20	2.00	1.80	0.80	2.16

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

Year : Third

CORE COURSE 6

Semester: V

**FUNDAMENTALS OF ALGORITHMS
(Theory)**

Code :

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", TataMcgraw 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. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms"
4. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, 2022.

E - BOOKS

1. 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	1	3	3	3	2	2	2	3	3	3	2	2	1	1	2	2.20
CO2	1	3	3	3	2	2	2	3	2	3	3	3	1	2	0	2.20
CO3	1	3	3	3	1	2	2	3	3	3	3	3	1	1	1	2.20
CO4	2	3	3	3	2	2	3	3	2	3	3	3	2	2	1	2.47
CO5	2	3	3	3	2	2	3	3	2	1	1	1	1	2	1	2.00
Average	1.40	3.00	3.00	3.00	1.80	2.00	2.40	3.00	2.40	2.60	2.40	2.40	1.20	1.60	1.00	2.21

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

Year : Third

CORE COURSE 7

Semester: V

Code :

**OPERATING SYSTEMS
(Theory)**

Credits: 4

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. Ann McIver Mc Hoes, Ida M. Flynn, "Understanding Operating Systems", Course Technology, Cengage Learning, 2011.
2. Greg Tomsho, "Guide to Operating Systems", Cengage Learning, 2020.

REFERENCES:

1. E. Madnick & John J. Donavan, "Operating Systems", Tata McGraw Hill Publishing Co., Limited.
2. Cesar Herrera, Darrell Hajek, Flor Narciso, "Principles of Operating Systems", Amazon Digital Services LLC - KDP Print US, 2020.
3. D.M. Dhamdhare, "System Programming and Operating Systems", Tata McGraw Hill Publishing Co., Limited.
4. Remzi H. Arpaci-Dusseau, Andrea C. Arpaci-Dusseau, "Operating Systems: Three Easy Pieces", Create Space Independent Publishing Platform, 2018.
5. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley Publisher, 2018.

E - BOOKS

1. <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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	2	1	2	1	2	1	3	3	2	2	3	1	2.00
CO2	2	3	2	3	2	2	2	2	1	2	3	3	3	2	1	2.20
CO3	1	3	3	3	2	2	2	3	3	3	3	3	2	1	2	2.40
CO4	1	3	3	3	2	2	2	3	2	3	3	3	1	2	2	2.33
CO5	2	3	2	2	3	3	2	3	3	3	2	1	1	2	0	2.13
Average	1.60	3.00	2.40	2.60	2.00	2.20	1.80	2.60	2.00	2.80	2.40	1.80	2.00	1.20	1.20	2.21

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0= No Significant Correlation

Year: Third

CORE COURSE 8

Semester: V

**SOFTWARE TESTING AND QUALITY
ASSURANCE
(Theory)**

Code:

Credits: 4

COURSE OBJECTIVES:

This course aims to :

- ❖ Understand software testing principles and SDLC models.
- ❖ Learn different testing techniques like white box and integration testing.
- ❖ Study specialized testing methods such as performance and regression testing.
- ❖ Gain hands-on knowledge in planning, managing, executing, and documenting test cases.
- ❖ Explore industry-standard software test automation concepts, quality metrics, and Measurements.

UNIT – I: FUNDAMENTALS

Principles of Testing – Software Development Life Cycle Models.

UNIT – II: TYPES OF SOFTWARE TESTING

White Box Testing - Integration Testing - System and acceptance testing.

UNIT – III: TESTING FUNDAMENTALS TECHNIQUES

Testing Fundamentals - 2 & Specialized Testing: Performance Testing - Regression testing - Testing of Object Oriented Systems - Usability and Accessibility Testing.

UNIT – IV: TEST MANAGEMENT PROCESS

Test Planning – Management - Execution and Reporting.

UNIT – V: AUTOMATION AND QUALITY ASSURANCE

Software Test Automation - Test Metrics and Measurements.

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. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing”, Pearson Education, 2006.
2. Ron Patten, “Software Testing”, SAMS Techmedia, Indian Edition, 2001.

REFERENCES:

1. Louis Tamres, "Introducing Software testing", Addison Wesley Publications, First Edition.
2. Mordechai Ben Menachem, Gary S Marliss, "Software Quality - Producing Practical, Consistent Software", Thomson Learning, 2003.
3. KshirasagarNaik and PriyadarshiTripathy, "Software Testing and Quality", John Wiley & Sons, Inc. (Wiley India Edition), Hoboken, New Jersey (USA) / New Delhi (For Indian Edition), First Edition, 2008.
4. Boris Beizer, "Software Testing Techniques", New Delhi, Second Edition, 2003.
5. Daniel Galin, "Software Quality Assurance: From Theory to Implementation", Pearson Education (Addison-Wesley), First Edition, 2004.

E-BOOKS:

1. <https://www.geeksforgeeks.org/software-testing/software-engineering-software-quality-assurance/>
2. https://www.tutorialspoint.com/software_testing/index.htm

COURSE OUTCOMES:

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

CO1	Apply various software testing techniques effectively.
CO2	Perform different levels of testing including system and acceptance testing.
CO3	Evaluate specialized system testing techniques including regression, performance, usability, and object-oriented architectures.
CO4	Use test planning, execution, and reporting methods in projects.
CO5	Analyze test results using automation tools and metrics.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	1	3	3	3	2	2	2	3	2	3	3	3	3	3	2	2.53
CO2	2	3	2	2	3	3	2	3	3	3	2	0	1	2	1	2.13
CO3	2	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2.80
CO4	3	2	2	3	2	3	3	3	3	2	1	1	0	1	2	2.07
CO5	2	3	3	2	3	3	3	3	3	3	2	2	1	1	1	2.33
Average	2.00	2.80	2.60	2.60	2.60	2.60	2.60	3.00	2.80	2.80	2.20	1.80	1.60	2.00	1.60	2.37

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0= No Significant Correlation

Year: Third

CORE PRACTICAL 5

Semester: V

PROGRAMMING IN PHP LAB

Code:

(Practical)

Credits: 4

COURSE OBJECTIVES:

This course aim to :

- ❖ Learn basics PHP concepts (control statements, strings, functions)
- ❖ Develop problem-solving using arrays and algorithms
- ❖ Provide hands-on experience in handling state management using cookies and sessions
- ❖ Impart skills on File operations and data driven web applications by connecting PHP with a MySQL databases
- ❖ Explore web graphics creation using PHP's GD/image processing functions

LIST OF EXERCISES

1. Create a PHP program using Control Statements.
2. Implement a PHP program using String functions.
3. Construct a PHP program to find the maximum value in a given multi dimensional array.
4. Design a program to find the GCD of two numbers using user-defined functions.
5. Build a server side PHP program that displays marks, total, grade of a student in tabular format by accepting user inputs for name, number and marks from a HTML form.
6. Write a program to download a file from the server.
7. Implement a program to store the current date and time in a COOKIE and display the 'Last Visited' date and time on the web page.
8. Design a program to store page views count in SESSION, to increment the count on each refresh and to show the count on web page.
9. Construct a PHP program to create a directory, and to read contents from the directory.
10. Develop a PHP program using File Handling functions.
11. Build a PHP program interface to create a MYSQL database and to insert a table into it.
12. Design a program to draw the human face.

COURSE OUTCOMES:

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

CO1	Apply basic server-side programming constructs, including control structures, conditional loops, and built-in string manipulation functions to solve programmatic problems.
CO2	Construct modular algorithms using multi-dimensional arrays, data structures, and custom user-defined functions to process complex datasets.
CO3	Design interactive HTML forms to capture user input, process dynamic calculations on the backend, and manage user states via HTTP Cookies and Sessions.
CO4	Implement backend file handling functions to securely upload, download, read, write, and manage files or directories on a live web server.
CO5	Develop database-driven web applications by executing CRUD operations with MySQL and rendering dynamic graphics using server-side image processing.

Year : Third

CORE COURSE 9

Semester: VI

DATA COMMUNICATION AND NETWORKS

Code : (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.

REFERENCE BOOKS:

1. William Stallings, Data and Computer Communication, Pearson Education India, Eighth Edition, 2007.

E – BOOKS:

1. <https://elcomhu.com/Subjects/Computer/Compulsory/Communication/Data-Communications-and-Network-5e.pdf>
2. <https://nptel.ac.in/courses/106105183>
3. 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	2	1	2	1	2	1	2	3	2	2	2	1	1.87
CO2	1	3	3	3	2	2	2	3	2	2	3	3	3	2	1	2.33
CO3	1	3	3	3	2	2	2	3	2	2	3	3	2	2	1	2.27
CO4	1	3	3	3	2	2	2	3	2	3	3	3	2	0	1	2.20
CO5	3	3	2	3	1	2	2	3	1	3	3	3	2	1	0	2.13
Average	1.60	3.00	2.60	2.80	1.60	2.00	1.80	2.80	1.60	2.40	3.00	2.80	2.20	1.40	0.80	2.16

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

Year: Third

CORE COURSE 10
DATA MINING AND DATA WAREHOUSING
(Theory)

Semester: VI

Code:

Credits: 4

COURSE OBJECTIVES:

This course aims to:

- ❖ Introduce fundamental concepts and techniques of data mining and data warehousing.
- ❖ Provide knowledge on data pre-processing methods for improving data quality.
- ❖ Explain data warehouse architecture and OLAP operations.
- ❖ Familiarize students with data mining techniques such as association rules, classification, and clustering.
- ❖ Explore recent trends and applications of data mining including text mining and sentiment analysis.

UNIT – I: INTRODUCTION TO DATA MINING

Introduction: Data Mining– Moving towards the Information Age-Data Mining the Evolution of Information Technology– Kinds of Data Can Be Mined – Kinds of Patterns Can Be Mined– Technologies–Applications– Major issues in Data Mining.

UNIT – II: DATA PREPROCESSING TECHNIQUES

Data Preprocessing: An Overview – Data Cleaning – Data Integration-Entity Identification Problem - Redundancy & Correlation Analysis – Data Reduction – Data Transformation and Data Discretization–Data Transformation Strategies Overview.

UNIT – III: FREQUENT PATTERN MINING AND CLASSIFICATION

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts – Frequent Itemset Mining Methods - Apriori Algorithm- Finding Frequent Itemsets by Confined Candidate Generation - Generating Association Rules from Frequent Itemsets - Classification: Basic Concepts–Decision Tree Induction- Decision Tree Induction–Attribute Selection Measures- Bayes Classification Methods.

UNIT – IV: CLUSTERING AND OUTLIER ANALYSIS

Cluster Analysis: Cluster Analysis-Partitioning Methods– k-means– Hierarchical Methods-Agglomerative versus Divisive Hierarchical Clustering – Distance Measures in Algorithmic Method–Outlier Detection: Outliers and Outlier Analysis – Outlier Detection Methods-Data Mining Trends and Research Frontiers: Data Mining Applications.

UNIT – V: DATA WAREHOUSING AND OLAP

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts – Data Warehouse Modeling-Data Cube and OLAP - Data Cube: A Multidimensional Data Model Stars, Snowflakes, and Fact Constellations: Schemas for Multidimensional Data Models - Typical OLAP Operations – Data Warehouse Design and Usage.

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. Jiawei Han, MichelineKamber, Jian Pei, Data Mining: Concepts and Techniques, 3rd Edition, Morgan Kaufmann, 2012, ISBN: 978-0123814791

REFERENCES:

1. Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, 1st Edition, Pearson Education, 2003, ISBN: 978-0130888921
2. Arun K. Pujari, Data Mining Techniques, 3rd Edition, University Press, 2010, ISBN: 978-8173716126

COURSE OUTCOMES:

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

CO1	Explain data mining concepts, functionalities, and applications.
CO2	Apply data pre-processing techniques such as cleaning, integration, and transformation.
CO3	Understand data warehouse design, OLAP operations, and multidimensional models.
CO4	Design and implement modular software solutions using functions and recursion.
CO5	Evaluate clustering methods, outlier detection techniques, and recent trends in data mining.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	2	1	3	3	2	1	3	1	2	0	1	2	1.87
CO2	1	3	3	3	2	2	2	3	2	2	3	3	2	2	1	2.27
CO3	2	3	2	2	2	3	2	3	3	3	1	1	2	1	2	2.13
CO4	1	3	3	3	2	2	2	3	3	3	3	2	1	0	1	2.13
CO5	2	3	3	2	3	3	3	3	2	2	1	1	1	2	1	2.13
Average	1.60	3.00	2.60	2.40	2.00	2.60	2.40	2.80	2.20	2.60	1.80	1.80	1.20	1.20	1.40	2.11

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

Year: Third

CORE COURSE 11
E-COMMERCE AND ITS APPLICATIONS
(Theory)

Semester: VI

Code:

Credits: 4

COURSE OBJECTIVES:

Students will be able to :

- ❖ Provide fundamental understanding of electronic commerce concepts and frameworks.
- ❖ Explain Internet infrastructure and its role in enabling e-commerce.
- ❖ Introduce security mechanisms and architectural models used in e-commerce systems.
- ❖ Familiarize students with electronic payment systems and consumer-oriented applications.
- ❖ Develop knowledge on EDI, inter-organizational commerce, and real-world applications.

UNIT – I: INTRODUCTION TO ELECTRONIC COMMERCE

Introduction to Electronic Commerce - Electronic Commerce Framework - Media Convergence - Anatomy of E-Commerce Applications - Network Infrastructure for Electronic Commerce - Components of the Information Superhighway (I-Way) - Network Access Equipment.

UNIT – II: INTERNET AND NETWORK INFRASTRUCTURE

The Internet as a Network Infrastructure - Internet Terminology - Chronological History of the Internet - NSFNET: Architecture and Components - National Research and Education Network (NREN) - Globalization of the Academic Internet - Internet Governance and Applications.

UNIT – III: SECURITY AND ELECTRONIC COMMERCE ARCHITECTURE

Network Security and Firewalls: Client–Server Network Security - Emerging Client–Server Security Threats - Firewalls and Network Security - Data and Message Security - Challenge–Response Systems - Encrypted Documents and Electronic Mail. Electronic Commerce and the World Wide Web: Architectural Framework for Electronic Commerce - Technology Behind the Web - Security and the Web

UNIT – IV: CONSUMER-ORIENTED ELECTRONIC COMMERCE AND PAYMENTS

Consumer-Oriented Electronic Commerce: Consumer-Oriented Applications - Mercantile Process Models. Electronic Payment Systems: Types - Digital

Token-Based - Smart Cards - Credit Card-Based - Risk - Designing Electronic Payment Systems.

UNIT – V INTER-ORGANIZATIONAL COMMERCE AND EDI

Inter-organizational Commerce: Electronic Data Interchange (EDI) - EDI Applications in Business - EDI: Legal, Security, and Privacy Issues - EDI and Electronic Commerce. EDI Implementation: EDI Software Implementation - EDI Envelope for Message Transport

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. Ravi Kalakota, Andrew B. Whinston, Frontiers of E-Commerce, 2nd Edition, Pearson Education, 2004, ISBN: 978-8131708378

REFERENCES:

1. Kamlesh K. Bajaj, Debjani Nag, E-Commerce: The Cutting Edge of Business, 1st Edition, Tata McGraw-Hill, 2000, ISBN: 978-0074638897
2. E-Commerce journals, industry reports, and standard web resources
Government and industry portals on digital payments and e-commerce

COURSE OUTCOMES:

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

CO1	Explain the concepts, framework, and applications of electronic commerce.
CO2	Describe Internet infrastructure, its evolution, and its role in e-commerce.
CO3	Analyze security issues, firewalls, and architectural frameworks in e-commerce systems.
CO4	Evaluate different electronic payment systems and consumer-oriented e-commerce models.
CO5	Understand EDI concepts, implementation, and inter-organizational commerce practices.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	3	3	2	2	1	2	1	2	1	3	3	2	1	3	2	2.07
CO2	2	3	2	2	2	2	1	3	3	3	2	3	1	1	0	2.00
CO3	2	3	3	3	3	2	3	3	2	3	3	3	3	2	1	2.60
CO4	3	3	3	3	2	2	2	3	3	3	2	3	3	1	1	2.47
CO5	3	3	2	3	2	2	2	3	3	2	3	3	3	2	1	2.47
Average	2.60	3.00	2.40	2.60	2.00	2.00	1.80	2.80	2.40	2.80	2.60	2.80	2.20	1.80	1.00	2.32

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

Year : Third
Code :

CORE PROJECT WORK
PROJECT WORK

Semester: VI
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. 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 Blueprint 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 - Broadcast 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.

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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	1	3	2	1	1	2	1	1	2	3	2	2	3	1	1	1.73
CO2	1	3	3	3	1	2	2	3	2	3	3	3	2	2	1	2.27
CO3	2	3	2	2	1	2	2	2	1	3	3	3	2	2	2	2.13
CO4	1	3	2	2	1	2	2	2	1	3	3	3	2	1	1	1.93
CO5	3	3	2	2	1	3	2	2	2	3	3	2	3	3	2	2.40
Average	1.60	3.00	2.20	2.00	1.00	2.20	1.80	2.00	1.60	3.00	2.80	2.60	2.40	1.80	1.40	2.09

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

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.BramahHazela, 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.

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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	1	1	2	1	1	1	2	3	2	1	3	1	1.73
CO2	1	3	2	2	1	2	3	3	2	3	1	1	1	2	1	1.87
CO3	2	3	3	3	2	2	3	3	2	3	3	3	3	3	2	2.67
CO4	2	3	3	3	2	2	3	3	2	3	3	3	2	2	1	2.47
CO5	2	3	3	3	3	3	3	3	3	3	3	2	1	2	1	2.53
Average	1.80	3.00	2.60	2.40	1.80	2.20	2.60	2.60	2.00	2.80	2.60	2.20	1.60	2.40	1.20	2.25

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0 = No Significant Correlation

SKILL ENHANCEMENT COURSE

Code :

3. CLOUD COMPUTING (Theory)

Credits: 2

COURSE OBJECTIVES:

- ❖ 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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	1	1	2	1	1	2	3	2	1	3	2	1	1.80
CO2	2	3	2	2	1	2	1	3	3	2	2	3	2	1	2	2.07
CO3	1	3	3	3	2	2	2	3	1	3	3	3	2	1	1	2.20
CO4	1	3	3	2	1	2	2	2	1	3	3	2	3	2	1	2.07
CO5	2	3	3	3	2	2	2	3	3	3	3	3	2	1	1	2.40
Average	1.60	3.00	2.60	2.20	1.40	2.00	1.60	2.40	2.00	2.80	2.60	2.40	2.40	1.40	1.20	2.11

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

SKILL ENHANCEMENT COURSE

Code :

4. 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 lot - 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 blocksof IoT device- Raspberry Pi-Linuxon Raspberry Pi - Raspberry Pi interfaces.

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. Bahga, A., & Madisetti, 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. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-On Approach”.
2. Rajkumar Buyya and Amir Vahid Dastjerdi, “Internet of Things: Principles and Paradigms”.
3. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”.

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 of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	1	1	2	1	2	2	3	2	1	3	2	2	1.93
CO2	2	3	3	2	1	2	1	3	2	1	3	2	2	2	1	2.00
CO3	1	3	2	2	1	3	3	2	3	2	1	2	2	1	2	2.00
CO4	2	3	3	3	2	2	3	3	2	3	3	3	2	1	1	2.40
CO5	3	3	3	3	3	2	2	1	2	2	2	2	2	2	1	2.20
Average	2.00	3.00	2.60	2.20	1.60	2.20	2.00	2.20	2.20	2.20	2.20	2.00	2.20	1.60	1.40	2.11

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

SKILL ENHANCEMENT COURSE

Code:

5. MULTIMEDIA TECHNOLOGIES (Theory)

Credits: 2

COURSE OBJECTIVES:

This course aims to :

- ❖ Introduce the fundamental concepts, components, and applications of multimedia systems
- ❖ Develop understanding of text design, fonts, and principles used in multimedia content creation.
- ❖ Provide knowledge of image processing basics, including bitmap and vector graphics.
- ❖ Familiarize students with digital audio concepts, formats, and multimedia integration techniques
- ❖ Explain animation, video technologies, and multimedia tools used for web-based applications

UNIT – I: INTRODUCTION & TEXT

Multimedia: Definition, Applications - Delivering Multimedia - Text Basics: Fonts, Cases, Serif vs Sans Serif - Designing with Text.

UNIT – II: TEXT & IMAGES

HTML Documents - Character Sets - Hypertext and Hypermedia - Image Basics: Bitmaps vs Vector

UNIT – III: IMAGES & AUDIO

Color Concepts - Image Formats - Digital Audio Basics - MIDI and Audio Formats

UNIT – IV: ANIMATION & VIDEO

Animation Principles - Video Basics - Video Formats and Editing

UNIT – V: MULTIMEDIA & WEB

Multimedia Project Basics - Authoring Tools - Multimedia on Web

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. Tay Vaughan, Multimedia: Making It Work, 8th Edition, McGraw-Hill Education, 2011, ISBN: 978-0071748506

REFERENCES:

1. Ze-Nian Li, Mark S. Drew, Fundamentals of Multimedia, 2nd Edition, Pearson Education, 2014, ISBN: 978-0133356724
2. Ralf Steinmetz, Klara Nahrstedt, Multimedia Computing, Communications and Applications, 2nd Edition, Pearson Education, 2004, ISBN: 978-0130173201

COURSE OUTCOMES:

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

CO1	Explain the core concepts and applications of multimedia technologies.
CO2	Design and format effective text elements using appropriate fonts and styles.
CO3	Differentiate between image types and apply suitable formats for multimedia projects.
CO4	Analyze and utilize audio components and formats in multimedia environments.
CO5	Develop basic multimedia content integrating text, images, audio, video, and web technologies.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	1	1	2	1	2	1	2	3	2	1	3	1	1.80
CO2	3	2	3	3	2	2	2	2	2	2	3	2	3	3	2	2.40
CO3	2	2	1	2	2	2	3	2	2	2	2	2	1	2	2	1.93
CO4	2	2	2	2	1	2	3	2	1	3	2	3	2	3	1	2.07
CO5	3	3	2	2	1	3	2	2	2	3	3	2	3	3	1	2.33
Average	2.40	2.40	2.00	2.00	1.40	2.20	2.20	2.00	1.60	2.40	2.60	2.20	2.00	2.80	1.40	2.11

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

SKILL ENHANCEMENT COURSE

Code:

**6. ARTIFICIAL INTELLIGENCE
(Theory)**

Credits: 2

COURSE OBJECTIVES:

This course aims to:

- ❖ Understand fundamentals and concepts of Artificial Intelligence.
- ❖ Learn problem-solving methods and search techniques.
- ❖ Study knowledge representation and logic programming.
- ❖ Understand the internal software architectures that allow intelligent agents to operate autonomously.
- ❖ Explore AI applications and practical NLP.

UNIT – I:INTRODUCTION

Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents.

UNIT – II: PROBLEM SOLVING METHODS

Search Strategies - Uninformed – Informed – Heuristics – Local Search Algorithms.

UNIT – III: KNOWLEDGE REPRESENTATION

First Order Predicate Logic – Prolog Programming – Unification – Forward Chaining - Backward Chaining.

UNIT – IV: INTELLIGENT AGENTS

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining.

UNIT – V: APPLICATIONS OF AI

Language Models – Information Retrieval - Information Extraction – Natural Language Processing – Machine Translation – Speech Recognition – Handwritten Recognition.

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 Russell, Peter Norvig, “Artificial Intelligence: A Modern Approach”, University of California at Berkeley, Pearson Education, 4th Edition, 2020.
2. Ivan Bratko, “Prolog: Programming for Artificial Intelligence”, Fourth Edition, Addison Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. K. R. Chowdhary, "Fundamentals of Artificial Intelligence", Springer Nature India Pvt., 2016.
2. S. Seshadri, "A first course in Artificial Intelligence and Agent Technology", First Edition, Lap Lambert Academic Publishing, 2017.
3. W. Ertel, "Introduction to Artificial Intelligence", Springer, 2017.
4. K. Knight, E. Rich, S. B. Nair, "Artificial Intelligence", McGraw Hill Education, 2017.
5. SarojKaushik, "Artificial Intelligence", Cengage Learning India, 2012.

COURSE OUTCOMES:

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

CO1	Explain AI concepts and intelligent agent characteristics.
CO2	Apply search algorithms and problem-solving techniques.
CO3	Use logic and knowledge representation methods in AI.
CO4	Represent real-world knowledge using First-Order Predicate Logic and implement automated reasoning using Prolog and Resolution methods.
CO5	Analyze and implement AI applications in real-world scenarios.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	2	1	3	3	3	2	3	2	1	1	1	1	2.00
CO2	1	3	3	3	1	2	2	3	2	3	3	3	2	1	1	2.20
CO3	1	3	3	3	2	2	2	3	2	3	3	2	3	2	1	2.33
CO4	2	3	3	3	2	2	3	3	2	3	3	3	2	1	2	2.47
CO5	3	3	3	3	2	3	3	3	3	3	3	1	1	2	1	2.47
Average	1.80	3.00	2.80	2.80	1.60	2.40	2.60	3.00	2.20	3.00	2.80	2.00	1.80	1.40	1.20	2.29

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

SKILL ENHANCEMENT COURSE

Code:

7. MACHINE LEARNING (Theory)

Credits: 2

COURSE OBJECTIVES:

- ❖ Understand the basic concepts, perspectives, issues, types, and real-world applications of Machine Learning.
- ❖ Master probabilistic frameworks and stochastic models including Bayes Theorem and Bayes Optimal Classifier.
- ❖ Learn and implement core Supervised Learning algorithms for regression, classification, and Artificial Neural Networks.
- ❖ Explore Unsupervised Learning methodologies, cluster analysis, and algorithms like K-means and Hierarchical clustering.
- ❖ Study the end-to-end process of building, training, evaluating, and improving models using standard performance metrics.

UNIT – I: INTRODUCTION

Introduction to Machine Learning - Easy for Human Hard for Machines - Types of Machine Learning - Applications of Machine Learning.

UNIT – II: PROBABILISTIC AND STOCHASTIC MODELS

Bayesian Learning – Bayes theorem - Concept learning - Bayes optimal classifier.

UNIT – III: SUPERVISED LEARNING

Introduction, Regression, Linear regression, Classification: Decision trees, k-Nearest Neighbours.

UNIT – IV: UNSUPERVISED LEARNING

Introduction, Supervised vs Unsupervised Cluster Analysis, K-means Clustering, Hierarchical Clustering.

UNIT – V: MODELLING AND EVALUATION

Building the Model, Training a Model, Evaluating a Model, Improving a Model - Performance Metrics.

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. SaikatDutt, Subramanian Chandramouli, Amit Kumar Das, – Machine Learning, Pearson Education, 2018. (Unit 1: Chapter 1: 1.4, 1.5, 1.7, 1.9; Unit 2: Chapter 6; Unit 3: Chapter 7, 8, 10; Unit 4: Chapter 9 (9.1, 9.4), Unit 5: Chapter 3).
2. E. Alpaydin, “Introduction to Machine Learning”, Third Edition, MIT Press, Prentice Hall of India, 2014.

REFERENCES:

1. Sebastian Raschka and VahidMirjalili, “Python Machine Learning”, Packt Publishing, Third Edition, 2019.
2. Andreas C. Müller, Sarah Guido, “Introduction to Machine Learning with Python”, First Edition, Published by O’Reilly Media, 2016.
3. Oliver Theobald, “Machine Learning For AbsoluteBeginners”, Second Edition, 2017.
4. Hui Jiang, “Machine Learning Fundamentals: A Concise Introduction”, Cambridge University Press, 2022.
5. C. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2009.

COURSE OUTCOMES:

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

CO1	Understand the core types, applications, and basic concepts of Machine Learning.
CO2	Apply probabilistic models like Bayes Theorem and classification.
CO3	Implement Supervised Learning Algorithms for Regression andClassification.
CO4	Perform Unsupervised Cluster Analysis using K-means and Hierarchical clustering.
CO5	Build, train, evaluate, and improve models using performance metrics.

Mapping of Course Outcomes with Programme Outcomes and Programme Specific Outcomes

COs / POs & PSOs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PS O1	PS O2	PS O3	PS O4	PS O5	Mean COs
CO1	2	3	2	2	1	3	3	2	3	2	1	1	1	1	0	1.80
CO2	1	3	3	3	2	2	2	3	2	3	3	3	2	2	1	2.33
CO3	1	3	3	3	2	2	3	3	2	3	3	3	2	1	1	2.33
CO4	1	3	3	3	2	2	3	3	2	3	3	3	2	1	1	2.33
CO5	2	3	3	3	3	2	2	1	1	2	1	1	1	1	0	1.73
Average	1.40	3.00	2.80	2.80	2.00	2.20	2.60	2.40	2.00	2.60	2.20	2.20	1.60	1.20	0.60	2.11

Correlation Scale: 3 = Strong, 2 = Moderate, 1 = Low, 0=No Significant Correlation

