

Master of Computer Application

CURRICULUM & SYLLABUS (CBCS)

Innovation and Product Development for Sustainability

(For students admitted from the Academic Year 2026-2027)



DEPARTMENT OF COMPUTER APPLICATIONS

St. XAVIER'S CATHOLIC COLLEGE OF ENGINEERING

CHUNKANKADAI, NAGERCOIL – 629 003.

KANYAKUMARI DISTRICT, TAMIL NADU, INDIA

VISION OF THE INSTITUTION

To be an institution of eminence of optimal human development, excellent engineering education and pioneering research towards developing a technically–empowered humane society

MISSION OF THE INSTITUTION

To transform the (rural) youth into top class professionals and technocrats willing to serve local and global society with ethical integrity, by providing vibrant academic experience of learning, research and innovation and stimulating opportunities to develop personal maturity and professional skills, with inspiring and high caliber faculty in a quality and serene infrastructural environment

VISION OF THE PROGRAMME

To build quality professionals who all are committed and self –motivated with specific skills and to prepare the students for the diverse work place of the Global Environment.

MISSION OF THE PROGRAMME

Our mission is to provide very high-quality education in computer applications and thereby develop year new and smart generation of computer applications professionals with proper transformation of leadership, commitment and moral values.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Apply their computing skills to analyze, design and develop innovative software products to meet the industry needs and excel as software professionals.

PEO2: To pursue a lifelong development as top class professionals, willing to serve for the diverse work places of local and Global Environment with ethical integrity and moral values.

PEO3: To be committed in pioneering research for developing a technically-empowered humane society.

PEO4: Communicate and function effectively as a leader in teams in multidisciplinary fields involving technical, managerial, economical and social constraints.

PROGRAMME OUTCOMES

PO1 (Foundation Knowledge): Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.

PO2 (Problem Analysis): Identify, review, formulate and analyse problems primarily focussing on customer requirements using critical thinking frameworks.

PO3 (Development of Solutions): Design, develop and investigate problems with an innovative approach for solutions incorporating ESG/SDG goals.

PO4 (Modern Tool Usage): Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.

PO5 (Individual and Teamwork): Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.

PO6 (Project Management and Finance): Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.

PO7 (Ethics): Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware

PO8 (Life-long learning): Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

PROGRAMME SPECIFIC OUTCOMES

PSO1: Able to analyze and select appropriate architecture and techniques to implement interdisciplinary application software.

PSO2: Able to provide effective solutions for problems and challenges in real time environments.

PSO3: Able to design and develop innovative products for societal needs using existing and upcoming Technologies.

PSO4: Able to inculcate the knowledge of computing and management principles to manage software projects effectively and create innovative career paths.

PEOs – POs & PSOs MAPPING

PEO	PO								PSO			
	1	2	3	4	5	6	7	8	1	2	3	4
I.	3	3	3	3	2	2	2	2	3	3	3	2
II.	2	2	2	2	3	1	3	3	2	2	2	2
III.	2	2	3	2	1	1	3	3	3	2	3	3
IV	2	2	2	2	3	3	2	2	1	2	2	3

PROGRAMME ARTICULATION MATRIX

Ye ar	Se m est er	Course name	PO								PSO			
			1	2	3	4	5	6	7	8	1	2	3	4
I	I	Mathematical Statistics for Computer Applications	3	2	1	1				1	-	1	-	-
		Data Communication and Network Systems	2.8	2.4	2.2	3	1.4	1.4	1.4	2.4	2.8	2.6	2.4	2.2
		Software Project Management	2.2	2.6	2.4	2.2	2	2.8	2.2	2	2.2	2.4	2.4	2.8
		Advanced Data Structures And Algorithms(Lab Integrated)	3	2.75	2.25	3	1	1	1	2.25	2.75	2.75	2.25	2
		Web Technology(Lab Integrated)	1.8	1.5	2.0	1.0	1.2	1.6	1	1	1.8	1.2	1.6	1.6
		Advanced Java Programming	2.8	2.6	3	2.4	1.8	0.8	1	1.4	2.8	2.8	2.4	2
		Advanced Java Programming Laboratory	3	2.8	2.8	2.2	1.4	1	1	1.8	3	2.8	2.4	2
I	II	Data Science and Visualization	3	3	2.8	2.2	2.8	1.2	1.2	2	3	2.8	2.6	2.2
		Software Quality and Testing	2.2	2.2	2	1.8	2	1	1	1.8	2.4	1.8	1.8	2.2
		Full Stack Web Development	3	2.8	2.8	2.8	1.8	2	1.2	2.2	2.8	2.8	2.0	2.2

		Mobile Application Development (Lab Integrated)	2.6	2.2	2.8	2.8	2.0	1.2	1.4	2	3	2.2	2.2	1.8
		High Performance Computing	3	2.6	2.6	2.4	1.3	1	1	1.2	2.6	2.4	2.6	1.6
		Software Quality and Testing Laboratory	3	2.8	2.8	2.2	1.4	1	1	1.8	3	2.8	2.4	2
		Full Stack Web Development Laboratory	2.8	2.6	2.2	3	1.2	1.4	1	2.2	2.2	2.8	2	1.2

SUSTAINABLE DEVELOPMENT GOALS

GOAL 1: No Poverty

- End poverty in all its forms everywhere

GOAL 2: Zero Hunger

- End hunger, achieve food security and improved nutrition and promote sustainable agriculture

GOAL 3: Good Health and Well-being

- Ensure healthy lives and promote well-being for all at all ages

GOAL 4: Quality Education

- Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

GOAL 5: Gender Equality

- Achieve gender equality and empower all women and girls

GOAL 6: Clean Water and Sanitation

- Ensure availability and sustainable management of water and sanitation for all

GOAL 7: Affordable and Clean Energy

- Ensure access to affordable, reliable, sustainable and modern energy for all

GOAL 8: Decent Work and Economic Growth

- Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

GOAL 9: Industry, Innovation and Infrastructure

- Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

GOAL 10: Reduced Inequality

- Reduce inequality within and among countries

GOAL 11: Sustainable Cities and Communities

- Make cities and human settlements inclusive, safe, resilient and sustainable

GOAL 12: Responsible Consumption and Production

- Ensure sustainable Consumption and Production

GOAL 13: Climate Action

- Take urgent action to combat climate change and its impacts

GOAL 14: Life Below Water

- Conserve and sustainably use the oceans, seas and marine resources for sustainable development

GOAL 15: Life on Land

- Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

GOAL 16: Peace and Justice Strong Institutions

- Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels

GOAL 17: Partnerships to achieve the Goal

- Strengthen the means of implementation and revitalize the global partnership for sustainable development

INDUCTION PROGRAMME

Course Code	Course Title	Course Type	Semester	Classroom Instruction(CI) (in Hours per Semesters)		Lab Instruction(LI) (in Hours per Semesters)	Term Work(TW) and Self Learning(SL) (in Hours per Semesters)	Total Number of Hours (in Hours per Semesters)	Total Credits (C)=(Total Hours/30)	SDG Goal Mapped
				L	T	P				
IP26C08	Induction programme	-	01	24	0	0	06	30	0	4,9,10,12,17

SEMESTER: I

Number of Courses :9

Total Credits : 23

Course Code	Course Title	Course Type	Classroom Instruction(CI) (in Hours per Semesters)		Lab Instruction(LI) (in Hours per Semesters)	Term Work(TW) and Self Learning(SL) (in Hours per Semesters)	Total Number of Hours (in Hours per Semesters)	Total Credits (C)=(Total Hours/30)	SDG Goal Mapped	Category
			L	T	P					
BX 26001	Problem Solving and Programming in C(Lab Integrated)	TCP	45	0	30	45	120	4	4,9,10,12,17	BC
BX 26002	DataBase Management Systems(Lab Integrated)	TCP	45	0	30	45	120	4	4,8,9,16,17	BC
IP26C08	Induction programme	-	24	0	0	06	30	0	4,9,10,12,17	IP
MA 26106	Mathematical Statistics for Computer Applications	TC	45	15	0	60	120	4	3,4,9,16	BSC
MC 26101	Data Communicati	TC	45	0	0	45	90	3	9,11,12	PCC

	on and Network Systems									
MC 26102	Software Project Management	TC	45	0	0	45	90	3	4,5,8,9,12	PCC
MC 26103	Advanced Data Structures and Algorithms(Lab Integrated)	TCP	30	0	30	30	90	3	9,4,11,17	PCC
MC 26104	Web Technology(Lab Integrated)	TCP	30	0	30	30	90	3	4,8,9,16,17	PCC
MC 26105	Advanced Java Programming	TC	45	0	0	45	90	3	1,2,3, 7	PCC
MC 26106	Advanced Java Programming Laboratory	PC	0	0	60	0	60	2	4,8,9,17	PCC
MC 26107	Technical Seminar	-	0	0	30	0	30	1	9, 8, 11,12	EEC
SD26101	Professional Skills – I*	PC	0	0	60	60	120	1	4,5,8,9,10,16,17	SD
Total			294	15	180			23		

SEMESTER: II

Number of Courses : 11

Total Credits : 26

Course Code	Course Title	Course Type	Classroom Instruction(CI) (in Hours per Semesters)		Lab Instruction(LI) (in Hours per Semesters)	Term Work(TW) and Self Learning(SL) (in Hours per Semesters)	Total Number of Hours (in Hours per Semesters)	Total Credits (C)=(Total Hours/30)	SDG Goal Mapped	Category
			L	T	P					
MC 26201	Data Science and Visualization	TC	45	0	0	45	90	3	1, 2, 3,7	PCC

MC 26202	Software Quality and Testing	TC	45	0	0	45	90	3	4,9,8,12,16	PCC
MC 26203	Full Stack Web Development	TC	45	0	0	45	90	3	4,6,7,9,11	PCC
MC 26204	Mobile Application Development(Lab Integrated)	TCP	45	0	30	45	120	4	4,9,10,12,17	PCC
MC 26205	High performance Computing	TC	45	0	0	45	90	3	4, 7, 9, 11	PCC
	Professional Elective I	TC	45	0	0	45	90	3	3,5,8,10,16	PEC
MC 26206	Software Quality and Testing Laboratory	PC	0	0	60	0	60	2	4,9,12,16	PCC
MC 26207	Full Stack Web Development Laboratory	PC	0	0	60	0	60	2	4,8,9	PCC
MC 26S01	Industry-Oriented Course I**		30	0	0	0	0	1	4,5,8,9,12,13	EEC
MC 26S02	Self-Learning Course*		0	0	0	0	0	1	4,5,8,9,10,12,13	EEC
SD26201	Professional Skills – II*	PC	0	0	60	60	120	1	4,8,9	SD
Total			300	0	210			26		

* Internally Evaluated Courses.

** Continuous Assessment. The evaluation procedure is detailed in the syllabus.

PROFESSIONAL ELECTIVE I

Number of Courses : 1

Total Credits : 3

Course Code	Course Title	Course Type	Semester	Classroom Instruction(CI) (in Hours per Semesters)		Lab Instruction(LI) (in Hours per Semesters)	Term Work(TW) and Self Learning(SL) (in Hours per Semesters)	Total Number of Hours (in Hours per Semesters)	Total Credits (C)=(Total Hours/30)	SDG Goal Mapped
				L	T	P				
MC 26001	Digital Marketing	TC	02	45	0	0	45	90	3	2,4,7,8,9
MC 26002	Professional Ethics in IT	TC	02	45	0	0	45	90	3	3,5,8,10,16
MC 26003	Intellectual property rights	TC	02	45	0	0	45	90	3	1,2,3,7
MC 26004	Accounting and Financial Management	TC	02	45	0	0	45	90	3	4,8,9,12
MC 26005	Entrepreneurship Development	TC	02	45	0	0	45	90	3	4,5,8,9,10,11,12,16
MC 26006	E-Commerce Technologies	TC	02	45	0	0	45	90	3	1,3,4,8,9

BRIDGE COURSE

BX26001	PROBLEM SOLVING AND PROGRAMMING IN C (Lab Integrated)	L	T	P	TW/S L	Total	C	SDG
		45	0	30	45	120	4	4, 9, 10, 12, 17
COURSE OBJECTIVES:								
- To understand the basic concepts of problem solving approaches and to develop the algorithms. - To apply Techniques of structured(functional) decomposition to break a program into smaller pieces and describe the mechanics of parameter passing. - To design, implement, test, and apply the basic C programming concepts.								
COURSE CONTENT:								
Unit 1	COMPUTER PROBLEM SOLVING	9	0	0	9	18		4, 9, 10
Introduction–The Problem-Solving aspect–Top down design–Implementation of algorithm–Program Verification–The efficiency of algorithms – The analysis of algorithms –Fundamental Algorithms. Activities: Identify and list the steps involved in solving a real-world problem (e.g., ATM withdrawal or result processing). Prepare a concept map showing the stages of problem solving.								
Unit 2	PROGRAMMING AND ALGORITHM	9	0	0	9	18		4,9,10
Programs and Programming – building blocks for simple programs -pseudo code representation – flowcharts - Programming Languages - compiler –Interpreter, Loader and Linker - Program execution – Classification of Programming Language- Structured Programming Concept–Algorithm to check whether a given number is Armstrong number or not- Find factorial of a number. Activities: Complete a short quiz at the end of the session to evaluate understanding of key concepts.								
Unit 3	BASICS OF ‘C’, INPUT/OUTPUT & STATEMENTS	9	0	10	9	28		4,9,17

Introduction- Identifier – Keywords - Variables – Constants – I/O Statements - Operators - Initialization –Expressions – Expression Evaluation – L values and R values – Type Conversion in C –Formatted input and output functions - Specifying Test Condition for Selection and Iteration- Conditional Execution – and Selection – Iteration and Repetitive Execution- go to Statement – Nested Loops- Continue and break statements.

Practical:

1. Write programs to get some input, perform some operation and display the output using I/O statements
2. Write a program to execute some specific statements based on the test condition

Activities:

Use real-life scenarios to demonstrate how control statements (if, switch, loops) are used in decision-making processes.

Engage in a quiz-based activity to assess understanding of variables, data types, operators, and control structures.

Unit 4	ARRAYS, STRINGS, FUNCTIONS AND POINTERS	9	0	10	9	28		4,9,12
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Array– One dimensional Character Arrays - Multi dimensional Arrays –Two dimensional character array – Functions - Parameter passing mechanism – Storage classes – Recursion - Comparing iteration and recursion – Pointers– Uses of pointers- Arrays and pointers– Pointers and strings -Dynamic memory allocation.

Practical:

1. Display all prime numbers between two intervals using functions.
2. Write a C program to find the largest and smallest element in an array.
3. Write a C program to reverse a sentence using recursion.

Activities:

Participate in an interactive quiz to assess understanding of arrays, pointers, functions, and recursion concepts

Unit 5	USER- DEFINED DATA TYPES & FILES	9	0	10	9	28		4,9,10
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Structures – Initialization – Structures and arrays – Union – Typedef and Enumeration types - Bit fields - File Management in C – Files and Streams - Command line arguments.

Practical:

1. Write a C program to Store Student Information in Structure and Display it.

Activities:

Create a mind map for a given real-world scenario such as student record management or a banking system.

COURSE OUTCOMES:

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

CO1: Design a computational solution for a given problem.

CO2: Decompose a problem into logical modules for solution development.

CO3: Develop a problem solution into programs involving program constructs.

CO4: Develop programs using arrays, strings, functions and pointers for solving complex problems.

CO5: Develop programs using structures and files for solving complex computational problems..

Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%.

Assessment Methodology: Internal Assessment Test: 30%, Activities :10%, Practical:10%.

REFERENCES:

1.	Deitel and Deitel, “C How to Program”, Ninth Edition Pearson Education. 2022.
2.	Gottfried, B.S., Programming with C (Schaum’s Outline), Second Edition, McGraw-Hill, latest reprint 2024.
3.	Gustedt, Jens, Modern C, Third Edition, Manning, 2025.
4.	Anandamurugan, S., Programming for Problem Solving Using C, First Edition, S.K. Kataria& Sons, 2023.
5.	Saxena, Amisha; Arya, Nancy; Tanwar, Anil, Modern Approach to C Programming, BPB Publications, 2024.

E resources/E materials:

1.	NPTEL Video Lectures: Programming, Data Structures and Algorithms using C – Prof. P.P. Chakraborty NPTEL – Programming, Data Structures and Algorithms using C
2.	MIT OpenCourseWare: Introduction to Algorithms – Problem Solving Concepts MIT OpenCourseWare – Introduction to Algorithms
3.	GeeksforGeeks – C Programming (Control Statements, Operators) GeeksforGeeks – C Programming Tutorial
4.	TutorialsPoint – C Language Basics TutorialsPoint – C Tutorial
5.	NPTEL – Programming in C (Variables, Expressions, Loops) NPTEL – Introduction to Programming in C

6.	SWAYAM MOOCs – C Programming and Problem Solving SWAYAM Central – C Programming Courses
7.	Spoken Tutorial (IIT Bombay): C Programming https://spoken-tutorial.org/

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	1	1	1	1	1	2	2	1	1
CO2	3	3	3	2	1	1	1	1	2	3	2	1
CO3	3	3	3	3	2	1	1	1	3	3	2	2
CO4	3	3	3	3	2	1	1	2	3	3	3	2
CO5	3	3	3	3	2	2	1	2	3	3	3	3

BX26002	DATABASE MANAGEMENT SYSTEMS(Lab Integrated)	L	T	P	TW/SL	Total	C	SDG
		45	0	30	45	120	4	4,8,9,16,17
COURSE OBJECTIVES:								
- To understand the fundamentals of data models and conceptualize and depict a database system using ER diagrams. - To make a study of SQL and relational database design. - To understand the concepts of database design using normalization. - To impart knowledge in transaction processing, concurrency control techniques, recovery procedures and query processing. - To familiarize the students with the internal storage structures using different file and indexing techniques.								
COURSE CONTENT:								
Unit 1	FOUNDATIONS OF DATABASES	9	0	0	9	18		8,16
File systems versus Database systems – Data Models – DBMS Architecture – Data Independence – Data Modeling using Entity – Relationship Model – E-R Modeling. Activities: Create an ER diagram for Library Management System using any tool (MySQL Workbench / Draw.io / LucidChart)								
Unit 2	RELATIONAL MODEL AND QUERY EVALUATION	9	0	24	9	42		4,9
Relational Model Concepts – Relational Algebra – SQL – Basic Queries – Complex SQL Queries – Views – Constraints. Practical: 1. Data Definition Commands to create, describe, alter, rename, drop and truncate the tables 2. Data Manipulation Commands for inserting, deleting, updating and retrieving in Tables 3. Perform database querying using simple query, nested query, subquery and join operations 4. Create a PL/SQL block to implement implicit and explicit cursors 5. Create a PL/SQL block to implement procedures and functions 6. Create a PL/SQL block to execute triggers Activities: Convert a real-world scenario (library, hospital, college) into relational tables.								
Unit 3	DATABASE DESIGN & APPLICATION DEVELOPMENT	9	0	0	9	18		8,9

Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form. Activities: Normalize a large unstructured dataset step-by-step from 1NF to 3NF.								
Unit 4	TRANSACTION PROCESSING	9	0	0	9	18		9,16
Query Processing -Transaction Processing – Properties of Transactions - Serializability – Transaction support in SQL - Locking Techniques –Validation Techniques - Recovery concepts. Activities: Compare two execution plans and decide which is more efficient.								
Unit 5	FILES AND INDEXING	9	0	6	9	24		9,17
File operations – Hashing Techniques – Indexing – Single level and Multi-level Indexes – B+ tree – Static Hashing. Practical: 1. Order of B+ Tree = 3 a) Insert the following keys in order: 10, 20, 5, 6, 12, 30, 7, 17 b) Draw the B+ Tree after each split. c) Perform: ● Search for key 12 ● Range query: 5 to 20 Activities: Analyze which technique (hashing/indexing) is best for different applications.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Apply fundamental concepts to construct ER diagrams from given relational models. CO2: Apply SQL concepts to formulate queries for solving problems in relational database systems. CO3: Apply normalization techniques to design efficient and well-structured database schemas. CO4: Apply transaction management concepts to analyze real-time scenarios involving schedules, recovery processes, and concurrency control techniques. CO5: Apply indexing and hashing strategies to select appropriate methods for different database system requirements.								
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%								
Assessment Methodology: Internal Assessment Test:30, Practical :10, Activities:10%.								

REFERENCES:	
1.	Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Sixth Edition, Tata McGraw Hill, 2011.
2.	RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.
3.	C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
4.	Raghu Ramakrishnan, “Database Management Systems”, Fourth Edition, McGrawHill College Publications, 2015.
5.	G.K.Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
E resources/E materials:	
1.	https://onlinecourses.nptel.ac.in/noc22_cs91/preview
2.	https://onlinecourses.swayam2.ac.in/ntr25_ed136/preview

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	1	2	1	1	1	-	-	1	1	1	1
CO2	1	-	-	-	1	1	-	-	1	1	1	1
CO3	3	1	2	-	2	3	-	-	2	1	2	1
CO4	2	2	-	1	1	2	1	1	3	2	1	2
CO5	2	2	-	-	1	1	-	-	2	1	3	3

SEMESTER I

IP26C08	INDUCTION PROGRAMME	L	T	P	TW/SL	Total	C	SDG
		24	0	0	6	30	0	4,9,10,12,17
COURSE OBJECTIVES:								
- Understand academic structure and ethics. - Strengthen foundational computing knowledge. - Develop mathematical foundations for computing. - To build confidence, communication, and interpersonal skills. - To promote physical and mental well-being								
COURSE CONTENT:								
Unit 1	Orientation & academic framework	6	0	0	0	6		4, 9, 10
Introduction to MCA program structure and objectives - Curriculum overview (core subjects, electives, projects) - Credit system, grading policy, and evaluation methods - Academic ethics and integrity - Introduction to College facilities (library, labs, LMS). Activities: My Academic Roadmap.								
Unit 2	Computing fundamentals	6	0	0	0	6		4,9,10
Basics of Computer Organization - Introduction to Operating Systems - Fundamentals of Programming (C / Python basics) - Data representation and number systems - Problem-solving approaches and algorithmic thinking. Activities: Mini Programming & System Quiz Lab.								
Unit 3	Mathematics for computing	6	0	0	0	6		4,9,17
Discrete Mathematics (logic, sets, relations) - Basic Linear Algebra concepts - Probability and Statistics fundamentals - Mathematical reasoning for algorithms - Applications of mathematics in computing. Activities: Math to Algorithm Conversion Task.								

Unit 4	Soft Skills	6	0	0	0	6		4,9,12
Communication skills and interpersonal skills -Teamwork and collaboration- Time management and goal setting- Critical thinking and problem-solving- Professional etiquette and behavior. Activities: Students work in small groups to complete a task and practice communication and Teamwork.								
Unit 5	Physical Activities	0	0	0	6	6		4,9,10
Yoga and meditation -Basic fitness exercises -Sports and games -Stress management techniques- Importance of physical and mental health. Activities: Students practice simple yoga, exercises, or games to learn stress management and the Importance of physical and mental health.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO 1: Apply academic policies and ethical practices in academic and professional contexts. CO 2: Apply basic computing and programming concepts. CO 3: Apply mathematical concepts to address computing-related problems. CO 4: Apply soft skills such as teamwork, time management, and interpersonal communication in Collaborative activities. CO 5: Apply and evaluate physical wellness practices and insights from expert lectures for Personal and professional development.								
Weightage: Continuous Assessment: 100%								
Assessment Methodology: Active Participation : 40%, Assignments: 30%, Quiz:30%.								
REFERENCES:								
1.	Patterson, D.A. and Hennessy, J.L., “Computer Organization and Design”, Sixth Edition, Morgan Kaufmann, 2021.							
2.	Silberschatz, A., Galvin, P.B. and Gagne, G., “Operating System Concepts”, Tenth Edition, Wiley, 2021.							
3.	Matthes, E.,” Python Crash Course”, Third Edition, No Starch Press, 2023.							
4.	Rosen, K.H., “Discrete Mathematics and Its Applications”, Eighth Edition, McGraw Hill, 2020.							

5.	Strang, G.,” Introduction to Linear Algebra ”, Sixth Edition, Wellesley-Cambridge Press, 2023.
6.	Devore, J.L., “Probability and Statistics for Engineering and the Sciences ”, Tenth Edition, Cengage Learning, 2021.
7	Alex, K., “Soft Skills: Know Yourself and Know the World”, S. Chand Publishing, 2020.
8	Covey, S.R., “The 7 Habits of Highly Effective People ”, Updated Edition, Simon & Schuster, 2020.
9.	Yogendra, H., “Yoga for Beginners ”, The Yoga Institute, 2021.
E resources/E materials:	
1.	https://www.aicte-india.org/Initiatives/Induction-Programme
2.	https://fdp-si.aicte-india.org
3.	https://uhv.org.in

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO 3	PS O4
CO1	-	-	1	-	2	1	-	-	1	-	-	1
CO2	-	1	-	1	-	-	-	-	1	-	1	-
CO3	1		-	-	-	-	--	-	2	-	1	-
CO4	1	-	3		1		2	-	-	1	-	2
CO5	1	1	-	2	-	1	1	2	-	2	-	3

MA26106	Mathematical Statistics for Computer Applications	L	T	P	TW/SL	Total	C	SDG
		45	15	0	60	120	4	3,4,9,16
COURSE OBJECTIVES:								
● To introduce the basic concepts of probability and random variables. ● To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems. ● To acquaint the knowledge of non-parametric tests which plays an important role in real life problems. ● To encourage students to develop a working knowledge of Analysis of Variance. ● To enable the students to use the concepts of logical and mathematical ability to deal with abstractions.								
COURSE CONTENT:								
Unit 1	Probability and Random Variables	9	3	0	12	24		4,9
Probability – Axioms of probability – Discrete random variable – Probability mass function – Probability distribution – Cumulative distribution function – Mean, Variance – Special distributions: Binomial, Poisson distributions (Derivations not included). Activity: Apply binomial and Poisson distribution in the college campus activities.								
Unit 2	Testing of Hypothesis	9	3	0	12	24		3,4
Statistical hypothesis – Sampling Distribution – Level of significance – Degrees of freedom – Type I and Type II errors – Large sample tests based for single mean and difference of means –Tests based on t distribution for single mean and equality of means – Test based on F distribution for equality of variances. Activity: Apply t-test to test the hypothesis that average loading time of MCA department website is 3 seconds and apply F-test to test the programming skill variance of two batches.								
Unit 3	Non-Parametric Test	9	3	0	12	24		3,4
Introduction – Rank sum tests: Mann – Whitney U test – Kruskal -Wallis H test – Tests based on Runs: One sample run test – Test of randomness – The Kolmogorov-Smirnov test for goodness of fit – Chi-Square test for independence of attributes. Activity: Compare the coding task of two groups using U test and compare the coding performance among three languages using Kruskal-Wallis test.								
Unit 4	Design of Experiments	9	3	0	12	24		4

Experimental Design – Basic principles: replication, randomization, local control – Analysis of variance – One-way and two-way classifications – Completely randomized design – Randomized block design – Latin square design. Activity: Test whether the browser type and internet speed each have a significant effect on webpage loading time using two-way classification.								
Unit 5	Propositional Calculus	9	3	0	12	24		4,16
Mathematical Logic: Statement and Notation – Connectives – Statement formulas and Truth tables – Tautologies – Equivalence of formulas – Normal forms – Principal disjunctive normal forms – Principal conjunctive normal forms. Activity: Find the PCNF and PDNF of the compound proposition related to computer application.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Apply probability and discrete distributions in Computer Applications. CO2: Apply hypothesis testing for means in large and small samples and for variance in small samples to real-life situations. CO3: Apply non-parametric testing procedures to validate results in research and software analytics projects. CO4: Apply the basic concepts of classifications of design of experiments in real life problems. CO5: Evaluate logical propositions using truth tables and logical equivalences.								
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%								
Assessment Methodology: Internal Assessment Test (70%) and Activity (30%).								
REFERENCES:								
1.	Johnson. R. A., Miller. I. and Freund. J., “Miller and Freund’s Probability and Statistics for Engineers”, Ninth edition, Pearson Education, New Delhi, Asia, Reprint 2023.							
2.	Devore. J. L, “Probability and Statistics for Engineering and the Sciences”, Tenth edition, Cengage Learning, 2024.							
3.	Gupta. S.P., “Statistical Methods”, Forty ninth edition, Sultan Chand & Sons, New Delhi, 2024.							
4.	Speigel. M.R., Schiller. J. and Srinivasan. R.A., “Schaum’s Outlines on Probability and Statistics, Fifth edition, Tata McGraw Hill Edition, Reprint 2024.							
5.	Tremblay. J.P. and Manohar. R., “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw-Hill Edition, Reprint 2024.							

E resources/E materials:	
1.	Introduction to probability and Statistics, npTEL course, https://nptel.ac.in
2.	Logic for CS, npTEL course, https://youtu.be/dpxvIrJIsEQ https://youtu.be/dpxvIrJIsEQ

Mapping of Course Outcomes to Programme Outcomes

Course Outcomes	Program Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	3	2	1	1	-	-	-	1
CO 2	3	2	1	1	-	-	-	1
CO 3	3	2	1	1	-	-	-	1
CO 4	3	2	1	1	-	-	-	1
CO 5	3	2	1	1	-	-	-	1
Average	3	2	1	1	-	-	-	1

MC26101	DATA COMMUNICATION AND NETWORK SYSTEMS	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	9,11,12
COURSE OBJECTIVES								
- To familiarize the students with computer networks communication architecture, basic technologies, protocols, and applications. - To help students acquire knowledge in network design and management. - To enable students to understand recent trends in networking and modern computing tools. - To develop skills in applying networking and communication concepts to real-world applications. - To understand the recent trends in networking, IoT and cloud.								
COURSE CONTENT								
Unit I	CORE CONCEPTS OF DATA COMMUNICATION	9	0	0	9	18		9
Introduction - Data Communication System and its Components - Data Flow, - Networks - Types of Connections and Topologies - LAN, MAN, WAN, Internetwork - Internet - Network Models - OSI Models - Layers in OSI Models, TCP/IP protocol Suite. Activities: Create visual OSI vs TCP/IP Model Mapping Chart with real-world protocol examples at each layer.								
Unit II	PHYSICAL LAYER AND DATALINK LAYER PROTOCOLS	9	0	0	9	18		9,11
Physical Layer - Digital Transmission - Transmission Modes - Bandwidth Utilization - Multiplexing; Switching: Circuit Switched Network - Datagram Network - Error Detection and Correction - Types of errors - Detection versus correction - CRC encoder and decoder, checksum - Data Link Control Framing, flow and error control - Multiple Access - CSMA/CA, CSMA/CD. Activities: Illustrate Time Division Multiplexing (TDM) and Frequency Division Multiplexing (FDM) using charts or simulation tools.								
Unit III	NETWORK LAYER	9	0	0	9	18		9,12
Network layer functions - IP routing and forwarding - packet switching - Connectionless and Connection-Oriented networks - Routing algorithms: Distance vector, Link state, OSPF, BGP,								

IGMP, and ICMPv6. Activities: Simulate IP Routing in a Virtual LAN using Packet Tracer Tool.								
Unit IV	TRANSPORT LAYER AND APPLICATION LAYER PROTOCOLS	9	0	0	9	18		9,11
Transport Layer - Connectionless and Connection-oriented protocols - Transport layer protocol - UDP - TCP services and features - Three-way Handshake for connection establishment and termination - Application Layer - Client-Server programming, WWW and HTTP, FTP, Email, and SNMP. Activities: Demonstrate file transfer or messaging using basic network applications.								
Unit V	MODERN NETWORK TRENDS, IOT, CLOUD & SECURE NETWORKING	9	0	0	9	18		9,8
Modern Network Trends: IoT, Cloud & Secure Networking, Cloud networking and virtualization - IoT architecture and protocols (MQTT, CoAP) - Edge and fog computing - Network security basics: Firewalls, encryption, VPNs - Network challenges in modern computing (5G, SDN, NFV). Activities: Design a Smart Campus Network for a college that incorporates modern networking technologies.								
COURSE OUTCOMES								
At the end of the course, the students will be able to: CO1: Evaluate and implement various data communication protocols and standards to compare their functionalities, performance, and real-world applications. CO2: Analyze various switching techniques and evaluate network performance. CO3: Evaluate IP addressing methods and routing protocols to configure and simulate network routing using tools such as Cisco Packet Tracer. CO4: Apply transport layer protocols (TCP/UDP) and application layer services to establish reliable communication and implement client-server communication. CO5: Apply modern networking concepts to design secure network systems incorporating Internet of Things, cloud computing, VPNs, and firewalls.								

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment test:70%, Activities:30%.	
REFERENCES	
1.	Brahampal Singh, "Data Communication and Networking-Understanding network architecture design and Management", Eighth Edition, BPB Publication, 2024.
2.	Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Sixth Edition, Elsevier, 2020.
3.	Andrew S. Tanenbaum, Nick Feamster, David J. Wetherall, "Computer Networks", Sixth Edition, Pearson Education, 2021.
4.	William Stallings," Network Security Essentials", Latest Edition, Pearson Education, 2021.
5.	ArshdeepBahga and Vijay Madiseti, "Internet of Things: A Hands-On Approach", Revised/Recent Edition, Universities Press, 2021.
E resources/E materials	
1.	https://nptel.ac.in/courses/106105082
2.	Preview: Computer Networking and Data Communication SWAYAM
3.	Data Communication Tutorial - GeeksforGeeks

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO 4
CO1	3	3	2	2	1	-	-	2	3	2	1	-
CO2	3	3	2	2	1	-	-	2	2	3	1	-
CO3	3	3	3	3	2	1	-	2	3	3	2	1
CO4	2	3	2	2	2	-	2	2	2	3	2	1
CO5	3	3	2	2	3	3	3	3	3	3	3	2

MC26102	SOFTWARE PROJECT MANAGEMENT	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	4,5,8,9,12
COURSE OBJECTIVES:								
- To develop an awareness of the need for project planning and management. - To know about activity planning. - To explore risk and people management. - To learn about project monitoring and control mechanisms. - To learn how to manage people and build the effective team.								
COURSE CONTENT:								
Unit 1	BASICS OF SOFTWARE PROJECT MANAGEMENT	9	0	0	9	18		4,8,9,12
Project definition – Types of project –Problem with Software project- Activities covered by Software project management – Management control cycle-Strategic assessment – Technical assessment –Cost benefit evaluation techniques – Risk evaluation.								
Activities: Select a software project example and link each potential problem to an appropriate mitigation strategy.								
Unit 2	ACTIVE PLANNING	9	0	0	9	18		4,5,9
Objective of activity planning-Project Schedule –Activity based approach- Product based approach, Hybrid approach Sequencing and Scheduling activities –Network planning models – Forward pass – Backward pass Techniques.								
Activities: Develop a Work Breakdown Structure, schedule tasks, allocate resources, estimate costs, and identify risks in a real-time project scenario.								
Unit 3	CATEGORIES OF RISK	9	0	0	9	18		4,5,8
Risk identification, Risk assessment, Risk planning, Nature of risk – Types of risk – Risk Management – Software project risk and strategies to reduce the risk- PERT using three estimates.								
Activities: Apply the PERT technique for scheduling a specific banking project, such as developing an online banking or loan processing system, in a real-time scenario.								

Unit 4	MONITORING AND CONTROL	9	0	0	9	18		7
Creating framework – Collecting the data – Visualizing progress – Cost monitoring – Earned value analysis, Change control – Managing contracts – Types of contract – Contract Management Activities: Develop Gantt charts or milestone charts to monitor and track project tasks effectively.								
Unit 5	MANAGING PEOPLE AND ORGANIZING TEAMS	9	0	0	9	18		4,9,12
Introduction – Understanding behaviour – Organizational behavior: A background – Selecting the right person for the job – Working in group- Decision making & Leadership. Activities: Implement DevOps practices while managing project tasks, risks, and scheduling in an IT Industry.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Apply the fundamental elements and concepts of Project Management to different types of software projects. CO2: Analyze and schedule project activities to determine and evaluate the critical path using appropriate techniques. CO3: Identify, analyse, and evaluate risks in software projects and propose suitable mitigation strategies. CO4: Analyze and evaluate project monitoring and control mechanisms for effective project execution. CO5: Estimate the organizing team based on industry exposure.								
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%								
Assessment Methodology: Internal Assessment test: 70%, Activities: 30%.								
REFERENCES:								
1.	Bob Hughes, Mike Cotterell “Software Project Management”, Sixth Edition, Tata McGraw-Hill Education, 2020.							
2.	Ian Sommerville, “Software Engineering (Project Management Topics)” Tenth Edition, Pearson,2020.							
3.	Walker Royce, Software Project Management: A Unified Framework, Addison-							

	Wesley, 2020 (Reprint).
4.	Harold Kerzner, “Project Management: A Systems Approach to Planning, Scheduling, and Controlling”, Thirteen Edition, Wiley, 2022.
5.	Ken Schwaber, “Agile Project Management with Scrum”, Microsoft Press, 2020.
E resources/E materials:	
1.	https://onlinecourses.nptel.ac.in/noc25_cs109

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	2	1	3	2	2	3	2	2	3
CO2	2	3	2	3	2	2	2	2	2	2	2	3
CO3	2	3	3	2	2	3	3	2	2	3	3	2
CO4	2	3	3	2	2	3	2	2	2	3	3	3
CO5	2	2	2	2	3	3	2	2	2	2	2	3

MC26103	ADVANCED DATA STRUCTURES AND ALGORITHMS (Lab Integrated)	L	T	P	TW/SL	Total	C	SDG
		30	0	30	30	90	3	9,4, 11,17
COURSE OBJECTIVES:								
• To understand the usage of algorithms in computing • To apply suitable design techniques for problem-solving. • To design, analyse, and implement efficient algorithms for searching, sorting, and problem-solving. • To understand and implement various tree data structures • To develop skills in applying algorithmic thinking and data structure concepts to real world computational problems								
COURSE CONTENT:								
Unit 1	DATA STRUCTURES AND ALGORITHMS	6	0	6	6	18		4,9
Algorithms – Algorithms as a Technology -Time and Space complexity of algorithms-Asymptotic analysis -Average and worst-case analysis-Asymptotic notation. ADTs, ADT and Classes, Stack ADT, Queue ADT. Practical: 1. Implement Custom Stack and Queue ADTs with Recursion and Algorithm Analysis 2. Implement an Abstract Data Type (ADT) for a List with operations such as insert, delete, search, and display. Activities: Complexity Comparison Table for Algorithms Using Best-Case, Average-Case, and Worst-Case Analysis								
Unit 2	ALGORITHM DESIGN TECHNIQUES	6	0	6	6	18		4,11
Greedy Algorithms: The job/event scheduling problem - Minimum-spanning-tree - Prim's and Kruskal's algorithms; Recursive, Dynamic programming - Longest common subsequence problem - Knapsack problem. Practical: 1. Construct the Minimum Spanning Tree using Prim’s algorithm.								

2. Implement a recursive algorithm to compute the factorial of a given number.

Activities:

Mention practical applications of the Knapsack problem in resource allocation and budgeting.

Unit 3	SORTING AND SEARCHING	6	0	6	6	18		9,11
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Algorithms: Bubble sort, selection sort, insertion sort, merge sort, quick sort, analysis of sorting algorithms, Searching Techniques: linear search, binary search.

Practical:

Implement sorting algorithms in Python Bubble Sort, Selection Sort.

Activities:

Implement all five sorting algorithms in Python and compare their outputs

Unit 4	TREE STRUCTURES	6	0	6	6	18		4,11
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Tree ADT, Binary Tree ADT, tree traversals, binary search trees, AVL trees. Definition of B-trees, basic operations on B-Trees, Heap, Heap Implementation, Disjoint Sets

Practical:

1. Implement Binary Tree ADT.
2. Implement insertion and search operations in a B-Tree of order 3 for the keys:
10, 20, 5, 15, 25, 30, 35.

Activities:

Construct a B-Tree of order 3 with keys:10, 20, 5, 6, 12, 30, 7, 17

Unit 5	GRAPH STRUCTURES	6	0	6	6	18		11,17
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Graph ADT, representations of graph, graph traversals, DAG, topological ordering, Dynamic Programming - All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication, The Floyd-Warshall Algorithm.

Practical:

Implement Breadth-First Search (BFS), Depth-First Search (DFS)

Activities:

Create a task scheduling graph and find valid execution order.

COURSE OUTCOMES:

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

- CO1: Analyse algorithm complexity and implement Stack and Queue ADTs.
CO2: Apply linear and nonlinear data structures to solve algorithmic problems efficiently
CO3: Evaluate and implement classical algorithms for sorting, searching, traversing, and

optimization with complexity analysis CO4: Design and implement Python-based applications using ADTs to solve real-world computational challenges. CO5: Apply graph algorithms to solve real-world problems efficiently.	
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%	
Assessment Methodology: Assignments: 30%, Practical:10%, Activities:10%.	
REFERENCES:	
1.	Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser, Data Structures and Algorithms in Python, Wiley,1st Edition, 2021.
2.	B. Agarwal and B. Baka, Hands-On Data Structures and Algorithms with Python, Packt Publishing,1st Edition, 2022.
3.	Bradley N. Miller and David L. Ranum, Problem Solving with Algorithms and Data Structures using Python, Runestone Interactive, 2020.
4.	Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2021). Data structures & algorithms in Python (Indian adaptation). John Wiley & Sons.
5.	Narasimha Karumanchi, Data Structures and Algorithms Made Easy in Python, CareerMonk Publications, 1st Python Edition,2020.
6.	Benjamin Baka, Python Data Structures and Algorithms, Packt Publishing,1st Edition2023.
E resources/E materials:	
1.	https://nptel.ac.in/courses/106106145
2.	https://runestone.academy/ns/books/published/pythonds/index.html
3.	https://www.geeksforgeeks.org/data-structures-and-algorithms-in-python

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	3	1	1	1	2	2	2	1	2
CO2	3	3	2	3	1	1	1	2	3	3	2	1
CO3	3	3	3	3	1	1	1	2	3	3	3	2
CO4	3	3	3	3	1	1	1	3	3	3	3	3
CO5	3	2	1	3	1	1	1	2	2	2	1	2

MC26104	WEB TECHNOLOGY (Lab Integrated)	L	T	P	TW/SL	Total	C	SDG
		30	0	30	30	90	3	4,8,9,16,17
COURSE OBJECTIVES:								
- Understand the fundamentals of HTML5.0 for web page development. - Understand the fundamentals of Cascading Style Sheets (CSS) and its role in web design. - Explain the architecture and features of AngularJS for SPA development. - Use the PHP Manual effectively for learning functions and syntax. - Understand the need for using frameworks in modern web application development.								
COURSE CONTENT:								
Unit 1	HTML 5.0	6	0	6	6	18		8,16
Basics of HTML -Syntax and tags of HTML-Introduction to HTML5.0 -Semantic/Structural Elements -HTML5 style Guide and Coding Convention– HTML Svg and Canvas – HTML API’s - Audio & Video - Drag/Drop - Local Storage - Web socket API– Debugging and validating HTML. Practical : - HTML Basics: Create a simple HTML document with headings, paragraphs, lists, links, images, and tables. - HTML Forms: Design a form with various input types and validate it using HTML5 attributes. Activities: Analyze 2–3 websites and create a wireframe diagram showing their page structure using semantic HTML elements.								

Unit 2	CSS, JAVA SCRIPT	6	0	6	6	18		4,9
CSS: Declarations, Using CSS, Sample CSS File, Selectors, Box Model Concept, Padding, Float and Clear, Z-Index. Introduction to Web Styling: Websites. JavaScript: Introduction, Basic Syntax, Variables, Identifiers, Data Types and Values, Scope, Literals, Reserved Words, Operators and Statements, Functions, Objects (Math, String, Date), Regular Expressions, DOM Event Handling. Practical : 1. CSS Styling: Apply CSS to an HTML document to style text, borders, backgrounds, and layouts using the Box Model. 2. JavaScript Basics: Write a JavaScript script to perform basic arithmetic operations and manipulate the DOM. Activities: 1. Compare two websites based on layout, color, readability, and responsiveness, and suggest design improvements.								
Unit 3	ANGULAR JS	6	0	6	6	18		8,9
Single page application (SPA): Development using AngularJS. Core Concepts: Creating a module, defining a simple controller, embedding AngularJS script in HTML, AngularJS features and capabilities. Routing: \$routeProvider service from ngRoute, navigating between pages. Directives: HTML DOM directives, ng-disabled, ng-show, ng-hide, ng-click. Modules and Forms: Modules (Application, Controller), Forms (Events, Data validation, ng-click) Practical : 1. AngularJS Application: Develop a single-page application (SPA) using AngularJS that includes a module, controller, and view. Activities: Illustrate the event flow and logic of a real-world web feature (e.g., login or form submission) using a flowchart.								
Unit 4	PHP	6	0	6	6	18		9,16
Introduction: Basic HTML syntax, Basic PHP Syntax, using SFTP, Testing your script. Output Handling: Sending text to browser, Sending HTML to the browser. Development Practices: Using the PHP Manual, Adding comments to Scripts, Basic debugging steps. Variables: Variable Syntax, Types of Variables, Variable Values. Forms and Data Handling: Creating a Simple Form, Choosing a Form Method, Receiving Form Data in PHP. Error Handling: Displaying Errors, Error Reporting. Data Transmission: Manually Sending Data to a Page. Practical : 1. Write a simple PHP script to process form data and display it on a webpage.								

Activities: Break down a web application interface into components and represent it using a component hierarchy diagram based on React.								
Unit 5	LARAVEL	6	0	6	6	18		9,17
Introduction to Frameworks: Why Use a Framework, Why Laravel. Laravel Setup: Setting up a Laravel development environment. Artisan CLI: Introduction to Artisan, basic Artisan commands, writing custom Artisan commands, calling Artisan commands in normal code. Tinker: Introduction to Tinker and its usage. Practical : 1. Set up a Laravel development environment and create a simple application using Artisan commands. Activities: Design a basic architecture diagram showing data flow between frontend, backend, and database for a web application using Laravel.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Develop web pages using HTML5 elements and validation techniques. CO2: Apply CSS and JavaScript to implement styling and client-side interactivity in web pages. CO3: Implement navigation, event handling, and dynamic UI behavior using Angular JS. CO4: Develop dynamic web applications using PHP for server-side processing. CO5: Apply Laravel framework concepts to build database-driven web applications.								
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%								
Assessment Methodology: Internal Assessment Test :30%, practical :10%, Activities:10%.								
REFERENCES:								
1.	Jon Duckett, “PHP & MySQL: Server-side Web Development”, Wiley, 2022.							
2.	Matt Stauffer, “Laravel: Up & Running: A Framework for Building Modern PHP Applications”, Third Edition, O'Reilly Media, 2023.							
3.	Andy Harris, “HTML5 and CSS3 All-in-One For Dummies”, Fourth Edition, Wiley, 2022.							
4.	Laurence Lars Svekis, Nils Jansons, and Alan Simpson, “JavaScript from Beginner to Professional”, Packt Publishing, 2021.							

5.	Adam Freeman, “Pro Angular 16”, Fifth Edition, Apress, 2023.
6.	Kevin Tatroe and Peter MacIntyre, “Programming PHP: Creating Dynamic Web Pages”, Fourth Edition, O'Reilly Media, 2020.
7.	Robin Nixon, Learning PHP, “MySQL & JavaScript: With jQuery”, CSS & HTML5, Sixth Edition, O'Reilly Media, 2021.
E resources/E materials:	
1.	https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr25_ed123
2.	https://onlinecourses.swayam2.ac.in/e-learning/preview/aic20_sp32
3.	https://laravel.com/learn

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-	-	-	-	-	1	1	1	1
CO2	3	3	3	-	-	-	-	1	1	1	1	1
CO3	3	3	3	2	-	-	-	-	2	1	2	1
CO4	3	3	3	2	-	-	-	-	3	2	1	2
CO5	1	3	3	3	-	-	-	1	2	1	3	3

MC26105	ADVANCED JAVA PROGRAMMING	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	1,2,3,7
COURSE OBJECTIVES:								
● To provide in-depth knowledge of advanced Java programming concepts. ● To enable the development of object-oriented, event-driven, and multithreaded applications. ● To introduce JDBC and modern web user interface technologies.								

- To impart skills in Servlets, JSP, and Java EE for server-side development.
- To develop proficiency in Java frameworks like Spring, Spring Boot, Hibernate, and Maven for enterprise application development.

COURSE CONTENT:

Unit 1	CORE JAVA FUNDAMENTALS	9	0	0	9	18		1,3
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Java Virtual Machine, data types, variables, keywords, operators, expressions, control statements. Classes and objects, constructors, access control, method overloading, static members. Arrays and strings. Inheritance: types of inheritance, constructors in inheritance, method overriding, use of super keyword. Abstract classes and Interfaces, dynamic method dispatch. Packages and exception handling.

Activities:

Prepare a concept map showing relationships between OOP concepts (inheritance, polymorphism, abstraction, interfaces) and explain how they are applied in real-world software systems.

Unit 2	MULTITHREADING, JDBC, AND WEB CLIENT UI DEVELOPMENT	9	0	0	9	18		2,3
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Java Thread Model, concurrent programming, thread life cycle, thread priorities, creating and managing threads, thread methods and exceptions, inter-thread communication, synchronization. JDBC architecture and drivers, CRUD operations, connecting to relational databases. Web client UI: HTML and CSS, responsive web design using Bootstrap, JavaScript, React JS, creating reusable UI components with React.

Activities:

Compare single-threaded and multithreaded application behavior in real-life scenarios (e.g., banking system or ticket booking system) and present findings using a flowchart or diagram.

Unit 3	JAVA SERVLETS	9	0	0	9	18		1,2,7
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Java EE Architecture, application servers and containers. Servlet API and lifecycle, handling client requests and responses. Working with Databases through servlets. Servlet advanced concepts: request dispatcher, session management, cookies and HTTP session. Working with files and non-blocking I/O in servlets.

Activities:

Draw and explain the architecture of a web application using Servlets, highlighting request-response flow, session handling, and database interaction.

Unit 4	JAVA SERVER PAGES AND JSTL	9	0	0	9	18		1,2,7
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JSP architecture and lifecycle. Action elements, implicit objects, scripting elements, Scope and Expression Language (EL). JSP Standard Tag Libraries (JSTL). Developing Dynamic Web Applications using JSP.

Activities:

Analyze how JSP separates presentation and logic in web applications and prepare a comparison chart between JSP, Servlets, and HTML-based static pages.

Unit 5	JAVA FRAMEWORKS	9	0	0	9	18		2,7
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MVC Architecture. Spring framework, Spring modules, Spring MVC, and Spring Boot. Hibernate framework and other popular frameworks. Maven Installation. Maven core concepts, basic structure of the POM File. Maven build life cycle, phases and goals. Maven build profiles.

Activities:

Prepare a framework comparison chart showing Spring Boot, Hibernate, and traditional Java EE, highlighting their roles, advantages, and real-world usage scenarios.

COURSE OUTCOMES:

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

- CO1:** Apply object-oriented programming concepts to develop modular Java applications.
- CO2:** Implement multithreading and JDBC for concurrent programming and database connectivity.
- CO3:** Design responsive web interfaces using HTML, CSS, JavaScript, and React JS.
- CO4:** Develop server-side web applications using Servlets with session management.
- CO5:** Build enterprise applications using JSP, Spring Boot, Hibernate, and Maven.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Internal Assessment Test :70%, Activities :30%.

REFERENCES:

1.	Schildt, H., & Coward, D. "Java: The Complete Reference", Thirteenth Edition. McGraw Hill Education, 2024.
2.	Walls, C., "Spring in Action", Sixth Edition. Manning Publications, 2022.
3.	Fugaro, L. and Minocari, A., "Jakarta EE 10 Cookbook", Packt Publishing, 2023.

4.	Fakhroutdinov, K., “React Key Concepts”, Packt Publishing, 2022.
5.	Horstmann, C. S., “Core Java, Volume II: Advanced Features”, Twelfth Edition. Pearson Education, 2022.
E resources/E materials:	
1.	Jakarta EE Official Documentation: https://jakarta.ee/specifications/
2.	Spring Boot Reference Guide: https://docs.spring.io/spring-boot/docs/current/reference/html/
3.	React Official Documentation: https://react.dev/
4.	Hibernate ORM User Guide: https://hibernate.org/orm/documentation/
5.	Apache Maven Project: https://maven.apache.org/guides/

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	1	1	1	2	3	1	2	1
CO2	3	3	2	3	1	1	1	2	3	2	2	1
CO3	3	3	3	3	1	1	1	2	3	3	3	1
CO4	2	3	3	3	1	1	1	3	2	3	3	2
CO5	3	3	3	3	1	1	1	3	3	3	3	2

MC26106	ADVANCED JAVA PROGRAMMING LABORATORY	L	T	P	TW/SL	Total	C	SDG
		0	0	60	0	60	2	4,8,9, 17
COURSE OBJECTIVES:								

- To provide hands-on experience in advanced Java programming.
- To practice OOP, exception handling, and multithreading through lab exercises.
- To enable students to perform database operations using JDBC.
- To develop server-side applications using Servlets, JSP, and Web technologies.
- To build enterprise-level applications using Spring, Hibernate, and JPA frameworks.

LIST OF ACTIVITIES:

1. Write a Java program that demonstrates the use of classes, objects, constructors, method overloading, inheritance, super, and abstract classes.
2. Create a Java application that includes built-in and user-defined exception handling using try, catch, finally, throw, and throws.
3. Implement multiple threads in Java using the Thread class and Runnable interface. Demonstrate thread lifecycle, priorities, and synchronization.
4. Connect to a relational database (MySQL/PostgreSQL) and perform Create, Read, Update, and Delete operations using JDBC.
5. Implement a servlet for uploading files to the server and downloading them using Multipart Config and File Output Stream.
6. Develop a servlet to handle HTTP GET and POST methods. Accept form data (e.g., user registration) and display it.
7. Design a responsive UI form using Bootstrap and React to capture user input and display the result.
8. Create a JSP application using scripting elements, EL for data display, and JSTL for conditional and loop-based rendering.
9. Build a Java application using Hibernate and JPA annotations to perform CRUD operations on a Student entity.
10. Mini-project integrating Spring and Hibernate framework.

COURSE OUTCOMES:

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

CO1: Apply OOP concepts and exception handling to develop Java programs.

CO2: Implement multithreading and synchronization in Java applications.

CO3: Apply JDBC concepts to implement CRUD operations in Java-based database applications.

CO4: Develop server-side applications using Servlets, JSP, EL, and JSTL.

CO5: Build enterprise applications using Spring Boot, Hibernate, and JPA.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Evaluation 75%, Model practical test 25%

REFERENCES:

1.	Schildt, H., & Coward, D. "Java: The Complete Reference", Thirteenth Edition. McGraw Hill Education, 2024.
2.	Walls, C., "Spring in Action", Sixth Edition. Manning Publications, 2022.
3.	Fugaro, L. and Minocari, A., "Jakarta EE 10 Cookbook", Packt Publishing, 2023.
4.	Fakhroutdinov, K., "React Key Concepts", Packt Publishing, 2022.
5.	Horstmann, C. S., "Core Java, Volume II: Advanced Features", Twelfth Edition. Pearson Education, 2022.
E resources/E materials:	
1.	Jakarta EE Official Documentation: https://jakarta.ee/specifications/
2.	Spring Boot Reference Guide: https://docs.spring.io/spring-boot/docs/current/reference/html/
3.	React Official Documentation: https://react.dev/
4.	Hibernate ORM User Guide: https://hibernate.org/orm/documentation/
5.	Apache Maven Project: https://maven.apache.org/guides/

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1	1	0	1	1	3	2	2	1
CO2	3	3	3	2	1	0	1	2	3	3	2	2
CO3	3	3	3	2	1	2	1	2	3	3	2	2
CO4	3	3	3	3	2	1	1	2	3	3	3	2
CO5	3	3	3	3	2	2	1	2	3	3	3	3

MC26107	TECHNICAL SEMINAR	L	T	P	TW/SL	Total	C	SDG
		0	0	30	0	30	1	9,8,11,12

COURSE OBJECTIVES:

- To identify and critically evaluate a well-defined set of research subjects related to current technological trends.
- To generate original, convincing insights and actively engage in academic discussions, peer debate, and constructive feedback loops.
- To synthesize scientific data progressively and compile a comprehensive review paper conforming to standard project specifications.
- To build expert oral communication, technical defense strategies, and report-writing skills necessary to present before a faculty panel and external examiners.

COURSE CONTENT:

The goal of this course is to train the students to critically evaluate a well-defined set of research subjects and to summarize the findings concisely in a paper of scientific quality. The paper will be evaluated based on the ability to understand a topic, communicate it and identify the issues. Results from this term paper will be presented to fellow students and a committee of faculty members.

1. Every student selects a topic related to current trends and the same should be approved by the respective committee. This selection should have at least 5 distinct primary sources.
2. Every student must write a short review of the topic and present it to fellow students and faculty (discuss the topic – expose the flaws – analyse the issues) every week.
3. The faculty should evaluate the short review and award marks with respect to the following.
 - a. Has the student analysed – not merely quoted – the most significant portions of the primary sources employed?
 - b. Has the student offered original and convincing insights?
 - c. Plagiarism to be checked.
4. Every student should re-submit and present the review article including issues/ comments/ conclusions which had arisen during the previous discussion.
5. Every student should submit a final paper as per project specifications along with all short review reports (at least 4 internal reviews) and corresponding evaluation comments.
6. Every student should appear for a final external review exam to defend themselves.

COURSE OUTCOMES:

CO1: Formulate a systematic research theme by shortlisting, filtering, and validating contemporary technical resources.

CO2: Execute an analytical literature review that dissects, evaluates, and draws original conclusions

from complex scientific documents instead of merely summarizing quotes.

CO3: Produce technically sound, plagiarism-checked scientific papers that adhere strictly to publication specifications and formal academic guidelines.

CO4: Integrate professional peer feedback and iterative faculty evaluations to systematically revise and upgrade ongoing technical review documents.

CO5: Defend research insights dynamically, present complex data with confidence, and address challenging technical inquiries before an external review panel.

Weightage: Continuous Assessment: 100%.

Assessment Methodology: Presentation: 70%, Report Writing: 30%.

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO2	PSO 3	PS O4
CO1	2	3	1	3	1	0	0	3	3	2	1	2
CO2	3	3	2	2	1	0	1	3	3	3	2	2
CO3	2	1	2	2	2	1	3	3	2	2	2	3
CO4	1	2	2	1	3	2	2	3	2	3	2	3
CO5	1	3	2	1	1	2	3	1	2	3	2	3

SD26101	Professional Skills - I	L	T	P	TW/SL	Total	C	SDG
		0	0	60	60	120	1	4,5,8,9,10,16,17
COURSE OBJECTIVES:								
- To develop effective verbal and non-verbal communication skills through structured soft skills activities including self-introduction, debate, extempore, and role play. - To enhance critical thinking, logical reasoning, and persuasive communication through collaborative and competitive group activities. - To introduce fundamental programming concepts including input/output operations, operators, and decision-making constructs using Java. - To build confidence, audience engagement, and professional presentation skills through real-world simulation exercises like tourism pitch and reporter activities. - To cultivate teamwork, leadership, conflict resolution, and problem-solving skills essential for a professional computing environment.								
COURSE CONTENT:								
Unit 1	SOFT SKILLS – INTERPERSONAL COMMUNICATION AND SELF-PRESENTATION			12	12	24		4,8,16
Self-introduction structure and components, Techniques for introducing others formally and informally, Clarity and pace in speech delivery, Confidence building exercises and body language awareness, Audience engagement strategies during presentation, Critical thinking frameworks for decision-making activities, Justification of choices using logical reasoning in group discussions, Persuasive communication techniques and vocabulary, 'Who Gets the Heart?' activity – ethical dilemma discussion, Constructing and presenting arguments in group settings, Identifying assumptions and evaluating evidence, Active listening and empathetic response skills, Managing stage fright and building speaking confidence Activities - Professional Self-Introduction and Presentation Challenge "Who Gets the Heart?" – Ethical Decision-Making Group Discussion - Persuasive Debate and Elevator Pitch Competition								
Unit 2	SOFT SKILLS – CREATIVE EXPRESSION AND PUBLIC			12	12	24		4,8

	SPEAKING							
Story building principles – beginning, middle, and end structure, Imagination and creative idea generation techniques, Verbal expression and vocabulary enrichment, Listening and continuation skills in collaborative storytelling, 'Story Mason' activity – group narrative construction, Argument construction techniques for formal debates, Presenting viewpoints clearly with supporting evidence, Rebuttal skills and counter-argument strategies, Public speaking fundamentals – posture, eye contact, and gesture, Debate activity – structured rounds and evaluation criteria, Building confidence through repeated public speaking practice, Voice projection and articulation in debate settings, Handling pressure and thinking quickly in extempore scenarios Activities 1. Story Mason: Collaborative Storytelling and Creative Expression 2. Structured Debate: Argumentation, Rebuttal, and Evidence-Based Communication 3. Extempore and Public Speaking Challenge								
Unit 3	SOFT SKILLS – NON-VERBAL COMMUNICATION, TEAMWORK AND PROFESSIONAL PITCHING			12	12	24		4,8,17
Role play fundamentals – character, context, and performance, Voice modulation techniques – pitch, tone, and pace variation, Facial expressions and their impact on communication, Non-verbal communication cues – gestures, posture, and proxemics, 'Theatrix' activity – scripted and unscripted role play, Thinking on the spot – extempore speech structure (Point-Reason-Example-Point), Fluency development and filler word reduction, Pitching ideas clearly and persuasively, Storytelling frameworks for tourism and product pitches, 'Tourism Pitch' activity – researching, structuring, and presenting a destination pitch, Audience analysis and adapting message to audience, Visual aids and their use in presentations, Feedback and self-evaluation of communication performance Activities 1. Theatrix: Scripted and Improvised Role Play 2. Extempore Speaking and Idea Pitch Challenge 3. Tourism Pitch: Destination Presentation and Audience Engagement								
Unit 4	SOFT SKILLS – COLLABORATION, LEADERSHIP AND REPORTING SKILLS			12	12	24		4,16,17
Collaboration principles – shared goals, roles, and accountability, Leadership styles and situational leadership in team activities, Strategy building under pressure and resource constraints, Conflict resolution techniques – negotiation and compromise, Decision making under pressure in 'Team vs. Wild' activity, Interviewing skills – preparing structured and open-ended questions, Questioning								

techniques – probing, clarifying, and follow-up questions, Active listening and note-taking during interviews, Summarizing and paraphrasing gathered information accurately, 'Reporter' activity – conducting peer interviews and presenting findings, Visual interpretation and pattern recognition from images, Connecting ideas across visuals for coherent storytelling, 'Picture Connector' activity – creative reasoning and group narrative, Reflective practice and peer feedback in team activities

Activities

1. Team vs. Wild: Collaborative Leadership and Decision-Making Challenge
2. Reporter: Peer Interview and Presentation Activity
3. Picture Connector: Visual Reasoning and Collaborative Storytelling

Unit 5	FUNDAMENTALS OF PROGRAMMING – INPUT, OUTPUT, OPERATORS AND DECISION MAKING IN JAVA			12	12	24		4,8,9
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Introduction to Java programming environment and console applications, System.out.println() for standard console output, Formatted output using printf() and format() methods, Scanner class – importing and creating Scanner objects, Input methods: nextInt(), nextDouble(), nextLine(), and nextFloat(), Practical: Personalized greeting message using System.out.println(), Practical: Accepting two numbers and displaying their sum, Arithmetic operators – addition, subtraction, multiplication, division, modulus, Relational operators – greater than, less than, equal to, not equal to, Logical operators – AND (&&), OR (||), NOT (!), Assignment operators – simple and compound assignment, Bitwise operators – AND, OR, XOR, NOT, left shift, right shift, Practical: Program demonstrating all operator categories with sample outputs, if-else and if-elif-else decision structures in Java, Nested conditional statements and compound conditions, switch-case statement – syntax, break, and default case, Practical: Determining if a number is positive, negative, or zero, Practical: Checking divisibility by 2 and 3 using nested conditions, Practical: Day-of-the-week program using switch-case (1–7 input)

Activities

1. Console-Based Java Programming and Input–Output Lab
2. Java Operators and Expression Evaluation Challenge
3. Decision Making with Conditional Statements and Switch-Case Programming

COURSE OUTCOMES:

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

CO1: Remember and reproduce key soft skills concepts including self-introduction structure, speech clarity, audience engagement techniques, and basic Java input/output syntax.

CO2: Understand critical thinking frameworks, logical reasoning approaches, story structuring techniques, and the use of arithmetic, relational, logical, and bitwise operators in Java programs.

CO3: Apply communication strategies in debate, extempore, theatrix, and pitching scenarios, and implement decision-making constructs such as if-else and switch-case in Java programs.

CO4: Analyze group dynamics, leadership styles, conflict resolution strategies, and evaluate the correctness and efficiency of Java programs involving operators and control flow.

CO5: Create persuasive pitches, structured arguments, collaborative stories, and develop complete Java programs integrating input/output, operators, and decision-making to solve real-world problems.

Weightage: Continuous Assessment: 100%

Assessment Methodology:

Assessment Type	Weightage	Marks	Mode of Evaluation
Continuous Skill Assessment (CSA)	60%	60	Continuous — soft skills rubrics + hands-on Java lab work
Terminal Skill Assessment (TSA)	40%	40	Weekly assessment + programming practical + interview + viva
Total	100%	100	—

A. Continuous Skill Assessment

Component	Description	CO(s)	Marks
Daily Topical Assessment	Short assessment at the close of each session on that day's topic — concept recall (soft skills) or code demonstration (Java), recorded continuously	CO1, CO3	10
In-class Soft Skills Activities & Participation	Rubric-based evaluation of unit activities (Who Gets the Heart, Story Mason, Theatrix, Tourism Pitch, Team vs. Wild, Reporter, Picture Connector)	CO1, CO3	10
Group Discussion, Debate & Pitching	Structured GD, debate and pitch performance — reasoning, rebuttal, persuasion and audience engagement	CO2, CO4	10
Hands-on Programming Practice (Java Lab)	Continuous, execution-based evaluation of practical exercises — I/O programs, operator demonstration, and decision-making programs written and run in the lab	CO3, CO5	10
Programming Lab Record & Debugging	Maintained lab record of completed programs with outputs, plus in-lab debugging and code walkthrough exercises	CO4, CO5	10
Mock Interview &	HR/technical mock interview (STAR method)	CO4,	10

Professional Portfolio	and portfolio of resume, professional emails and reflective journal	CO5	
Subtotal (CSA)			60

B. Terminal Skill Assessment (TSA)

Component	Description	CO(s)	Marks
Weekly Assessment	Cumulative score of weekly consolidation tests held at the end of each week, covering both soft skills and programming topics of that week	CO1, CO2	10
Programming Practical Examination	Hands-on Java exam — write, compile and execute a program using I/O, operators and decision-making constructs for a given problem, with correct output	CO3, CO5	15
Personal Interview / Extempore	Panel-based interview or on-the-spot presentation assessing communication, confidence and professionalism	CO2, CO4	10
Portfolio & Lab Record Viva-Voce	Review of resume, email samples, reflective journal and programming lab record	CO1, CO5	5
Subtotal (TSA)			40

C. Common Evaluation Rubric (Soft Skills Components)

Applied uniformly across all performance-based soft skills components. Each criterion is rated on a four-point scale — 4 = Excellent, 3 = Good, 2 = Satisfactory, 1 = Needs Improvement.

Evaluation Criterion	Descriptor	Weight
Content & Structure	Relevance, logical organization and clarity of ideas	25%
Delivery & Fluency	Articulation, pace, vocabulary and language accuracy	25%
Confidence & Body Language	Posture, eye contact, gestures and poise	20%
Engagement & Responsiveness	Audience connect, active listening and handling of questions	20%
Professionalism & Etiquette	Time management, appropriateness and courtesy	10%

D. Programming Evaluation Rubric (Hands-on Java Components)

Applied to all hands-on programming practice and practical examination components.

Evaluation Criterion	Descriptor	Weight
Logic & Correctness	Program produces the correct output for the given problem	35%
Syntax & Compilation	Error-free compilation and proper Java syntax	20%

Use of Constructs	Appropriate use of I/O, operators and decision-making constructs	20%
Code Readability	Meaningful naming, indentation and comments	15%
Execution & Testing	Correct handling of sample inputs and edge cases	10%
TEXT BOOKS:		
1.	Sanjay Saha, “ <i>Soft Skills and Professional Communication</i> ”, 2nd Edition, McGraw Hill Education (India) Pvt. Ltd., 2019.	
2.	Herbert Schildt, "Java: The Complete Reference", 13th Edition, McGraw Hill Education, 2024.	
3.	Seema Kedar, “Programming in Java,”2nd Edition. Technical Publications, Pune, 2020.	
REFERENCES:		
1.	Meenakshi Raman, and Sangeeta Sharma, “Technical Communication: Principles and Practice”, 4th Edition, Oxford University Press, 2022.	
2.	James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley, "The Java Language Specification", Java SE 17 Edition, Addison-Wesley Professional, 2021.	
3.	Carnegie, Dale, “The Quick and Easy Way to Effective Speaking”, Updated Edition. Pocket Books (Simon & Schuster), 2020.	
4.	Stephen E Lucas, “The Art of Public Speaking”, 14th Edition, McGraw Hill, 2023.	
5.	Dale Carnegie, “How to Develop Self-Confidence and Influence People by Public Speaking”, Updated Edition, Simon & Schuster, 2022.	
Web / Online Resources		
1.	Enhancing Soft Skills and Personality – NPTEL Course (NPTEL) — https://nptel.ac.in/courses/109104098	

2.	Programming in Java – NPTEL Course (NPTEL) — https://nptel.ac.in/courses/106105191
3.	Java Programming and Software Engineering Fundamentals – Coursera (Coursera) — https://www.coursera.org/specializations/java-programming

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	2	3	–	1	1	2	1	1	2
CO2	3	3	2	2	2	–	1	2	3	2	2	2
CO3	3	3	3	3	3	1	1	2	3	3	2	3
CO4	3	3	2	3	3	2	2	2	3	3	2	3
CO5	3	3	3	3	3	2	2	3	3	3	3	3

SEMESTER II

MC 26201	DATA SCIENCE AND VISUALIZATION	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	1,2,3,7
COURSE OBJECTIVES:								
- To introduce the fundamental concepts and process lifecycle of Data Science. - To enable students to collect, preprocess, and transform real-world datasets for analysis. - To explore data using descriptive and inferential statistical techniques. - To build proficiency in Python programming and data visualization libraries. - To develop skills for presenting data insights through effective storytelling and dashboards.								
COURSE CONTENT:								
Unit I	DATA SCIENCE BASICS	9	0	0	9	18		1,7
Definition, scope, importance and interdisciplinary nature of Data Science – Data Science life cycle – Data Science vs Business Analytics vs Machine Learning – Roles in Data Science (Data Engineer, Analyst, Scientist) – Tools: Python, R, Jupyter, Anaconda – Applications and Case Studies.								
Activities: Basic data loading and visualization using Python/R;								
Unit II	DATA COLLECTION AND PREPROCESING	9	0	0	9	18		2,3
Types of data: structured, semi-structured, unstructured – Data acquisition from databases, APIs, and web sources – Data cleaning (missing data, outliers, duplicates) – Data transformation (normalization, encoding, scaling) – Data integration and feature reduction techniques.								
Activities: Data cleaning, transformation, integration and feature reduction using sample datasets.								

Unit III	EXPLORATORY DATA ANALYSIS (EDA)	9	0	0	9	18		1,2
Data summarization: measures of central tendency and dispersion – Correlation, covariance – Hypothesis testing and inferential statistics – Introduction to data manipulation using NumPy and Pandas – Case study-based EDA. Activities: Calculate mean, median, standard deviation, correlation and covariance using small sample datasets in NumPy/Pandas.								
Unit IV	DATA VISUALIZATION FUNDAMENTALS AND DASH BOARDS	9	0	0	9	18		1,2,7
Principles of effective visualization – Types of plots: bar, histogram, pie, line, scatter, box, heatmap – Visualization libraries: Matplotlib, Seaborn, Plotly – Best practices in chart selection and labeling– Dashboards using Tableau / Power BI / Plotly Dash – Storytelling with visuals. Activities: Create basic plots (bar, line, histogram, scatter, box) using Matplotlib and Seaborn with sample datasets.								
Unit V	ADVANCED VISUALIZATION	9	0	0	9	18		2,3,7
Multidimensional and interactive visualization– Integrating analytics with decision-making – Case studies from business, healthcare, and social media analytics – Mini project on data analysis and visualization. Activities: Build a dashboard integrating analytics for decision-making using a real-world case study								
COURSE OUTCOMES:								
At the end of the course, the students will be able to:								

CO1: Apply the fundamentals of Data Science lifecycle and tools to solve data-driven problems.

CO2: Implement data collection, cleaning, transformation, and preprocessing techniques using Python.

CO3: Analyze datasets using exploratory data analysis (EDA) and statistical techniques.

CO4: Create effective static and interactive data visualizations using modern tools.

CO5: Design dashboards and data-driven stories for informed decision-making.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Internal Assessment Test :70%,Activities :30%.

REFERENCES:

1.	Wes McKinney, 'Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Jupyter', Third Edition, O'Reilly Media, 2022.
2.	PrachiManoj Joshi, ParikshitNarendraMahalle, 'Data Storytelling and Visualization with Tableau: A Hands-on Approach', CRC Press, 2023.
3.	Brent Dykes, 'Effective Data Storytelling: How to Drive Change with Data, Narrative and Visuals', Wiley, 2020.
4.	Anna Feigenbaum and Aria Alamalhodaie, 'The Data Storytelling Workbook', Routledge, 2020.
5.	Cole NussbaumerKnaflie, 'Storytelling with Data: Let's Practice!', Wiley, 2021.

E resources/E materials:

1.	IBM Data Science Learning Hub – https://www.ibm.com/data-science
2.	Google Data Analytics & Visualization – https://developers.google.com/machine-learning
3.	Kaggle Learn (Hands-on Data Science & Visualization) – https://www.kaggle.com/learn
4.	Matplotlib Documentation – https://matplotlib.org/stable

5.	Seaborn Documentation – https://seaborn.pydata.org
6.	Plotly& Dash Documentation – https://plotly.com/python/
7.	Tableau Public Learning Resources – https://public.tableau.com/en-us/s/resources
8.	Microsoft Power BI Learning Path – https://learn.microsoft.com/power-bi

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	1	2	1	1	1	3	2	2	1
CO2	3	3	3	2	3	1	1	2	3	3	2	2
CO3	3	3	3	3	3	1	1	2	3	3	3	2
CO4	3	3	3	2	3	1	1	2	3	3	3	3
CO5	3	3	3	3	3	2	2	3	3	3	3	3

MC 26202	SOFTWARE QUALITY AND TESTING	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	4,9,8, 12,16
COURSE OBJECTIVES:								
• To understand the basics of software testing • To learn how to do the testing and planning effectively • To learn about the software quality models. • To focus on wide aspects of testing and understanding multiple facets of testing • To get an insight about test automation and the tools used for test automation								
COURSE CONTENT:								
Unit 1	FOUNDATIONS OF SOFTWARE	9	0	0	9	18		4,9

	TESTING							
Software Testing Life Cycle, V- model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing. Activities: Create a test plan document for a login page.								
Unit 2	TEST PLANNING &PLAYWRIGHT	9	0	0	9	18		8,12
The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics. Activities: Prepare a simple Gantt chart for testing activities.								
Unit 3	SOFTWARE QUALITY MODELS	9	0	0	9	18		9,12
Software quality –Verification versus Validation– Components of Quality Assurance – SQA Plan – Quality Standards – CMM – PCMM – CMMI – Malcolm Baldrige National Quality Award Activities: Case Study:A small software company wants to improve its development process and reduce defects. Currently, processes are not standardized, and results vary.								
Unit 4	ADVANCED TESTING CONCEPTS	9	0	0	9	18		11,16
Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications. Activities: Design a load testing scenario for an online shopping website								
Unit 5	TESTING TOOLS	9	0	0	9	18		9,8
Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Introduction to TestNG, TestNG Annotations, Testng.xml configuration, Adding Classes, Packages, Methods to Test, Test Reports. Activities: Execute multiple test cases using TestNG.								
COURSE OUTCOMES:								

CO1: Apply software testing concepts and principles to identify defects in software systems. CO2: Apply test planning techniques to prepare test plans, test cases, and testing schedules. CO3: Apply software quality models to evaluate and improve software quality. CO4: Apply various testing methods such as functional, performance, and security testing in real-world scenarios. CO5: Apply automated testing tools like Selenium and TestNG to execute and manage test cases.	
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment Test: 70%, Activities: 30%	
REFERENCES:	
1.	Glenford J. Myers, Corey Sandler, Tom Badgett, Todd M. Thomas, The Art of Software Testing, John Wiley & Sons,3rd Edition, 2023.
2.	Paul C. Jorgensen, Software Testing A Craftsman's Approach, CRC Press,4th Edition 2021.
3.	Aditya P. Mathur, Foundations of Software Testing ISTQB Certification, Pearson, 2nd Edition,2021.
4	Mark Winteringham, Testing Web APIs, Manning Publications, 1st Edition,2021.
5	Bas Dijkstra, Automating and Testing a REST API, Packt Publishing, 1st Edition,2022.
E resources/E materials:	
1	https://github.com/testng-team/testng/
2	https://www.selenium.dev/selenium-ide/
3	https://www.guru99.com/selenium-tutorial.html .

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcome

CO-PO Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	1	1	-	1	3	1	1	1
CO2	2	3	2	1	2	1	-	1	2	2	1	2
CO3	2	2	3	2	2	1	1	2	3	1	3	2
CO4	2	2	2	3	2	1	1	2	2	2	2	3
CO5	2	2	2	2	3	1	-	3	2	3	2	3

MC26203	FULL STACK WEB DEVELOPMENT	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	4,6,7,9,11
COURSE OBJECTIVES:								
- To understand the fundamentals of web programming and client-side scripting. - To learn server-side development using NodeJS. - To understand and architect databases using NoSQL and SQL databases. - To understand API development with Express Framework. - To learn the advanced client-side scripting and ReactJS framework.								
COURSE CONTENT:								
Unit 1	JAVA SCRIPT OBJECT NOTATION&BOOTSTRAP	9	0	0	9	18		4,6
Introduction to JavaScript Object Notation (JSON) – Working with JSON – Converting JSON to JavaScript Objects – Converting JavaScript Objects to JSON – Implementing a Simple JSON File								

and Using the HTTP Service – Introduction to Bootstrap – Grid System – Components – Labels – Buttons – Forms – Form Elements. Activities: Build an online MCQ quiz app								
Unit 2	NODE JS	9	0	0	9	18		4,7,11
Node.js basics - Local and Export Modules - Node Package Manager - Node.js web server - Express.js Web App -Node.js Data Access - Express REST APIs - REST - Resource Based - HTTP Methods as Actions - JSON- Express -Routing – Handler Function Activities: Develop an app using REST API								
Unit 3	MONGODB	9	0	0	9	18		4,9,11
Introduction to NoSQL databases – MongoDB system overview - Basic querying with MongoDB shell – Request body parsing in Express – NodeJS MongoDB connection – Adding and retrieving data to MongoDB from NodeJS – Handling SQL databases from NodeJS – Handling Cookies in NodeJS – Handling User Authentication with NodeJS Activities: Build a blog website where you can add blog posts through a simple admin panel and the users can view the blog posts.								
Unit 4	EXPRESS FRAMEWORK	9	0	0	9	18		6,7,9
Implementing Express in Node.js -Configuring routes -Using Request and Response objects - Angular -Typescript -Angular Components -Expressions -Data binding -Built-in directives Activities: Develop an application using Angular								
Unit 5	REACT JS	9	0	0	9	18		7,11
React Introduction - React ES6 - React Render HTML - React JSX - Components -React Classes – Composing Components - Passing Data - Dynamic Composition - Stateless Components - Designing components- React Forms React CSS - React SaaS Activities: Build a simple calculator app with React.								
COURSE OUTCOMES:								

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

CO1: Apply HTML, CSS, and JavaScript to develop client-side web applications.

CO2: Implement web applications using Node.js for server-side development.

CO3: Apply MongoDB concepts to design and manage NoSQL databases.

CO4: Develop and implement server-side applications using the Express framework in Node.js.

CO5: Construct a full-stack single-page application using React and integrate it with backend services.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Internal Assessment Test :70%, Activities:30%.

REFERENCES:

1.	Alex Banks and Eve Porcello, Learning React, O'Reilly Media, 3rd Edition,2020.
2.	Ethan Brown, Web Development with Node and Express, O'Reilly Media, 2nd Edition,2020
3.	Vasan Subramanian, Pro MERN Stack Full Stack Web App Development, Apress, first Edition,2020.
4.	KirupaChinnathambi, Learning React A Hands-On Guide, Addison-Wesley,First Edition, 2021.
5.	Matt Frisbie, Professional JavaScript for Web Developers, Wiley,4th Edition, 2020.
6.	AzatMardan, Full Stack JavaScript Development with MEAN, Packt Publishing, 1st Edition,2021.

E resources/E materials:

1.	https://www.coursera.org/specializations/full-stack-react
2.	https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
3.	https://www.udemy.com/course/the-full-stack-web-development/Web Reference .

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	1	1	1	2	2	2	1	2
CO2	3	3	3	2	2	2	1	2	3	3	2	2
CO3	3	3	3	3	1	2	1	2	3	3	2	2
CO4	3	3	3	3	2	2	1	2	3	3	2	2
CO5	3	3	3	3	3	3	2	3	3	3	3	3

MC26204	MOBILE APPLICATION DEVELOPMENT (Lab Integrated)	L	T	P	TW/SL	Total	C	SDG
		45	0	30	45	120	4	4,9,10,12,17
COURSE OBJECTIVES:								
● To understand mobile application development trends and Android framework. ● To relate the basic and important design concepts and issues of development of mobile applications. ● To learn basic CRUD Operation in mobile application. ● Use Flutter/Kotlin multi-platform environment for building cross-platform mobile applications. ● Design and develop real-time mobile applications								
COURSE CONTENT:								
Unit 1	FOUNDATIONS OF MOBILE APPLICATION DEVELOPMENT	9	0	6	9	24		4,9
A brief history of mobile - Designing for context- Developing a Mobile strategy-Mobile application architecture - Mobile application model - Frameworks and Tools - Workflow for application.								

Practical: 1. Develop a web based mobile application that accesses internet and location data. 2. Develop an android application using telephony to send SMS. Activities: Fishbowl Activity: Native vs Hybrid Apps .								
Unit 2	ANDROID APPLICATION DESIGN	9	0	6	9	24		4,9,10
Generic UI Development - Multimodal and Multichannel UI – Gesture based UI – Screen elements and layouts – Voice XML. Java for android, components of an Android application, Intents and Services – Storing and Retrieving data – Packaging and Deployment. Practical : 1.Develop an application that makes use of Notification Manager. Activities: Role-Play on Mobile UI Design & Android Application Development.								
Unit 3	ANDROID DATABASES	9	0	6	9	24		4,9,17
Working with SQLite Databases - Querying a Database, extracting values from a cursor, Adding, Updating, and Removing rows, Creating and implementing content provider’s database - Content provider transactions - Storing files in a Content provider. Graphics and Multimedia: Layer animation, Event handling and Graphics services. Practical : 1. Develop an application that uses Layout Managers and Event Listeners. Activities: Case Study on Database Handling & Multimedia in Android Applications.								
Unit 4	FOUNDATIONS OF FLUTTER AND DART.	9	0	6	9	24		4,9,12
Introduction to Flutter, Flutter architecture, Overview of mobile platforms, Native solutions, Dart: Dart Programming basics, Features of Dart, Structure of a Dart program, Keywords, Built-in types, Functions, Operators, Control flow statements, Exceptions, Classes, generics, Libraries and visibility. Practical : 1.Develop a native calculator application. Activities: Students install and explore a development tool (Android Studio, Xcode, Flutter SDK)								

and document what features or components they discover.								
Unit 5	BASICS OF WRITING FLUTTER CODE&UI	9	0	6	9	24		4,9,10
Basic UI Widgets: Appbar, Column, Row, Container, Image, Icon, Buttons and Text, Important widgets: Theme and Layout, List view, Grid view, Stack .User interaction: Forms and Gestures. Practical : 1. Develop an application that uses Widgets, GUI components, Fonts, and Colors. Activities: Quiz-Based Learning on UI Widgets and Interaction.								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Make use of mobile application frameworks and tools. CO2: Design an application based on mobile OS like Android CO3: Develop mobile applications using databases. CO4: Build a multiplatform based mobile application. CO5: Build real-time mobile applications for society/environment.								
Weightage: Continuous Assessment: 50%, End Semester Examinations: 50%								
Assessment Methodology: Internal Assessment Test: 30%, Practical :10% , Activities:10%.								
REFERENCES:								
1.	Bill Phillips, Chris Stewart, Brian Hardy, and Kristin Marsicano, “Android Programming”: The Big Nerd Ranch Guide, Fifth Edition, 2022							
2.	Christian Keur, Aaron Hillegass, “iOS Programming”: The Big Nerd Ranch Guide, Seventh Edition, 2021							
3	Phillips, B. and Stewart, C., “Android Programming ”: The Big Nerd Ranch Guide, Fifth Edition, Big Nerd Ranch Guides, 2022.							
4	Griffiths, D. and Griffiths, D., “Head First Android Development”, Third Edition, O’Reilly Media, 2021.							
5	Smyth, N.,” Android Studio Development Essentials”, Payload Media, 2021.							
6	Alberto Miola, A., “Flutter Complete Reference ”, Independently Published, 2021.							

7	Napoli, M.L., “Beginning Flutter: A Hands-On Guide to App Development”, Wiley, 2020.
8	Zaccagnino, “C., Programming Flutter: Native, Cross-Platform Apps the Easy Way, Pragmatic Bookshelf”, 2020.
9	Ray Wenderlich Team, Dart Apprentice, Razeware LLC, 2021.
10	Simone Alessandria, “Flutter Projects: A practical project-based guide to building real-world cross-platform mobile applications and games”, Packt publishing, 2020.
11	Eric Windmill, “Flutter in Action”, Manning Publications, 2020.
E resources/E materials:	
1.	https://onlinecourses.swayam2.ac.in/nou25_ge63/preview .
2.	https://onlinecourses.swayam2.ac.in/nou26_cs17/preview

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	1	2	3	1	1	1	2	3	1	1	2
CO2	3	3	3	3	2	2	1	1	3	3	2	1
CO3	3	2	3	3	2	1	1	2	3	3	2	2
CO4	2	2	3	3	3	1	1	2	3	2	3	3
CO5	2	3	3	2	2	1	3	3	3	2	3	1

MC26205	HIGH PERFORMANCE COMPUTING	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	4, 7, 9, 11
COURSE OBJECTIVES:								
- To understand the fundamentals of parallel and high-performance computing systems. - To understand various parallel architectures and programming models. - To develop parallel algorithms using modern tools and frameworks. - To analyze the performance and scalability of parallel systems. - To apply HPC concepts in real-world applications like AI, big data, and scientific computing.								
COURSE CONTENT:								
Unit 1	FOUNDATIONS OF HIGH PERFORMANCE COMPUTING	9	0	0	9	18		4, 9
Introduction to HPC – Need and applications – Flynn’s Classification (SISD, SIMD, MISD, MIMD) – Parallel processing concepts: Concurrency vs parallelism – Amdahl’s Law and Gustafson’s Law – Types of parallelism: Data, task, pipeline – Overview of HPC architectures.								
Activities: Analyze performance improvement using Amdahl’s Law for a given problem.								
Unit 2	PARALLEL ARCHITECTURES AND MEMORY MODELS	9	0	0	9	18		7, 9
Shared memory architecture (UMA, NUMA) – Distributed memory systems – Hybrid systems – Memory hierarchy – Cache Coherence – Interconnection Networks (Bus, Mesh, Hypercube) – Multicore and manycore processors.								
Activities: Compare different parallel architectures for real-world applications.								
Unit 3	PARALLEL PROGRAMMING MODELS	9	0	0	9	18		4, 9
Introduction to parallel programming – Thread-based Programming – OpenMP Concepts – Message Passing Model (MPI basics) – Data Parallel Programming – Synchronization: Locks, Barriers, Deadlocks – Parallel debugging techniques.								
Activities:								

Develop simple parallel programs using OpenMP.									
Unit 4	GPU AND ACCELERATED COMPUTING	9	0	0	9	18			4, 7
GPU Architecture – CUDA programming model – Threads, Blocks, Grids – Memory Types (Global, Shared, Constant) – Performance Optimization techniques – Applications in AI and Deep Learning. Activities: Study GPU acceleration in real-world applications.									
Unit 5	PERFORMANCE ANALYSIS AND APPLICATIONS	9	0	0	9	18			9, 11
Performance Metrics: Speedup, Efficiency, Scalability – Benchmarking (LINPACK, SPEC) – Load Balancing Techniques – Fault tolerance in HPC – HPC in big data, AI, Scientific computing – Cloud-based HPC. Activities: Conduct a case study on HPC applications (e.g., weather forecasting or healthcare systems).									
COURSE OUTCOMES:									
At the end of the course, the students will be able to: CO1: Apply the fundamentals of high-performance computing and parallel architectures to solve computational problems. . CO2: Analyze parallel architectures and memory models for efficient computation. CO3: Develop parallel programs using OpenMP and MPI. CO4: Apply GPU programming techniques for high-performance applications. CO5: Evaluate and optimize the performance of parallel systems in real-world applications.									
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%									
Assessment Methodology: Internal Assessment Test :70%, Activities:30%.									
REFERENCES:									
1.	Kai Hwang and Naresh Jotwani, Advanced Computer Architecture: Parallelism, Scalability, Programmability, Third Edition, McGraw Hill Education, 2026.								
2.	Pacheco, P. S., &Malensek, M., “An Introduction to Parallel Programming”, Second Edition. Morgan Kaufmann, 2022.								

3.	Kirk, D. B., and Hwu, W. W., “Programming Massively Parallel Processors: A Hands-on Approach”, Fourth Edition, Morgan Kaufmann, 2022.
4.	Barlas, G., “Multicore and GPU Programming: An Integrated Approach”, Second Edition, Morgan Kaufmann, 2022.
5.	Robey, R., and Zamora, Y., “Parallel and High Performance Computing”, Manning Publications, 2021.
6.	David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors: A Hands-on Approach”, Morgan Kaufmann, Fourth Edition, 2022.
E resources/E materials:	
1.	OpenMP 5.2/6.0 Specifications: https://www.openmp.org/specifications/
2.	NVIDIA GTC On-Demand: https://www.nvidia.com/en-us/on-demand/
3.	MPI 4.1 Standard: https://www.mpi-forum.org/docs/
4.	SWAYAM / Coursera HPC Courses: https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ma27

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO\PO \PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PSO1	PSO2	PSO 3	PS O4
CO1	3	2	–	1	–	–	–	1	2	1	2	–
CO2	3	3	–	2	–	–	–	1	2	2	2	–
CO3	3	2	3	3	1	–	–	1	3	3	3	1
CO4	3	3	3	3	2	1	–	1	3	3	3	2
CO5	3	3	2	3	1	1	1	2	3	3	3	2

MC26206	SOFTWARE QUALITY AND TESTING LABORATORY	L	T	P	T W/ SL	Total	C	SDG
		0	0	60	0	60	2	4,9,12,

								16
COURSE OBJECTIVES:								
- To know the behaviour of the testing techniques and to design test cases to detect the errors in the software. - To gain an understanding of software testing methodologies. - To understand standard emerging areas in testing. - To learn about the software quality models. - To understand the models and metrics of software quality and reliability.								
List of Experiments: 1. Perform data flow testing for any C program to verify def-use variables using Playwright reporting. 2. Using Selenium IDE, write a test suite containing minimum 4 test cases. 3. Conduct a web test suite for any two websites using Playwright. 4. Write and test a login a specific web page. 5. Write and test a program to count the number of check boxes on the page checked and unchecked count. 6. Performing iterative testing in an Agile environment on web and mobile applications 7. Write and test a program to get the number of list items in a list / combo box. (Selenium) 8. Identify system specification and design test cases to test any application using any one of the testing tools. 9. Automate the test cases of the above system using any test automation tool. 10. Design automated test scripts on a sample web application using Playwright.								
COURSE OUTCOMES:								
CO1: Apply appropriate software testing techniques to meet the requirements of a given project. CO2: Apply the components of software quality assurance systems in practical scenarios. CO3: Apply various software testing strategies for effective test planning and execution. CO4: Apply software quality models in the design and evaluation of software systems. CO5: Apply statistical methods to analyze and improve software quality.								

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%	
Assessment Methodology: Evaluation 75%, Model Practical Test: 25%	
REFERENCES:	
1.	Glenford J. Myers, Corey Sandler, Tom Badgett, Todd M. Thomas, The Art of Software Testing, John Wiley & Sons, 2023.
2.	Paul C. Jorgensen, Software Testing A Craftsman's Approach, CRC Press, 2021.
3.	Aditya P. Mathur, Foundations of Software Testing ISTQB Certification, Pearson, 2021.
4	Mark Winteringham, Testing Web APIs, Manning Publications, 2021.
5	Bas Dijkstra, Automating and Testing a REST API, Packt Publishing, 2022.
E resources/E materials	
1	https://www.selenium.dev/documentation/ .
2	https://www.browserstack.com/guide/
3	https://www.w3schools.com/

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcome

CO-PO Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4
CO1	3	3	2	2	2	-	-	1	3	1	1	1

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

MC26207	FULL STACK WEB DEVELOPMENT LABORATORY	L	T	P	TW/SL	Total	C	SDG
		0	0	60	0	60	2	4,8,9

COURSE OBJECTIVES:

- To implement the client side of the web application using JavaScript
- To implement JavaScript on the desktop using NodeJS
- To develop a web application using NodeJS and Express
- To implement a SPA using React
- To develop a full stack single page application using React, NodeJS, and a Database (MongoDB or SQL)

LIST OF EXPERIMENTS:

1. Implement registration form using bootstrap.
2. Develop an chat module application using bootstrap.
3. Create a NodeJS server using Express that stores data from a form as a JSON file and displays it in another page.
4. Create a counter using ReactJS.
5. Create a star rating system using AngularJS.
6. Create a Todo application using ReactJS. Store the data to a JSON file using a simple NodeJS server and retrieve the information from the same during page reloads.
7. Develop an application to perform CRUD operations in Mongo DB.
8. Develop an application to demonstrate tuples, object types and unions in Typescript.
9. Create a simple calculator Application using React JS
10. Create a voting application using React JS
11. Backend application development with Node.js and Express
12. Create a simple Sign up and Login mechanism and authenticate the user using Node.js and Express.

SOFTWARE REQUIREMENTS

1. NodeJS/Express JS, ReactJS, any IDE like NOTEPAD++/visual studiocode/sublime text etc.,
2. MySQL, MongoDB

COURSE OUTCOMES:

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

CO1: Design, implement, and deploy client-side web applications.

CO2: Develop, test, and deploy server-side applications using Node.js.

CO3: Build scalable web applications using the Express.js framework.

CO4: Design and implement database systems using both SQL and NoSQL databases, and integrate them with web applications.

CO5: Develop and deploy a full-stack single-page application (SPA) using React, Node.js.

Weightage: Continuous Assessment: 60%, End Semester Examinations: 40%

Assessment Methodology: Evaluation 75%, Model Practical Test: 25%

REFERENCES:

- | | |
|----|---|
| 1. | Alex Banks and Eve Porcello, <i>Learning React</i> , O'Reilly Media, 3rd Edition, 2020. |
| 2. | Ethan Brown, <i>Web Development with Node and Express</i> , O'Reilly Media, 4th Edition, 2020. |
| 3. | Vasan Subramanian, <i>Pro MERN Stack Full Stack Web App Development</i> , Apress, 2020. |
| 4. | Brad Dayley, Brendan Dayley, and Caleb Dayley, <i>Node.js, MongoDB and Angular Web Development</i> , Addison-Wesley, 1st Edition, 2022. |
| 5. | KirupaChinnathambi, <i>Learning React: A Hands-On Guide</i> , Addison-Wesley Professional, second Edition, 2021. |
| 6. | StoyanStefanov, <i>React Up and Running</i> , O'Reilly Media, 1st Edition, 2021. |

E resources/E materials:

- | | |
|----|---|
| 1. | https://www.freecodecamp.org/ |
| 2. | https://developer.mozilla.org/ |
| 3. | https://learn.mongodb.com/ |

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	3	1	1	1	2	2	3	1	1
CO2	3	3	2	3	1	1	1	2	2	3	2	1
CO3	2	2	2	3	1	1	1	2	2	3	1	1
CO4	3	3	2	3	1	2	1	2	2	2	3	1
CO5	3	3	3	3	2	2	1	3	3	3	3	2

SD26201	Professional Skills - II	L	T	P	TW/SL	Total	C	SDG
		0	0	60	60	120	1	4,8,9
COURSE OBJECTIVES:								
- To equip students with speed mathematics techniques for rapid and accurate arithmetic computations in competitive examinations. - To develop quantitative aptitude skills covering number systems, time-work, percentages, profit-loss, permutations, and time-speed-distance. - To strengthen logical and analytical reasoning abilities essential for placement aptitude tests and competitive assessments. - To introduce fundamental programming concepts including looping constructs and array data structures through practical exercises. - To build confidence and examination temperament through timed practice, shortcut methods, and systematic problem-solving strategies.								
COURSE CONTENT:								
Unit 1	SPEED MATHEMATICS – FOUNDATIONAL TECHNIQUES			12	12	24		4,8
SAW Method: speed addition and fast subtraction techniques, mental arithmetic practice, shortcut calculations, Oz Method: quick multiplication tricks and rapid calculation techniques, Mirror Method: fast division and reverse calculation methods for mental math accuracy, High 5 Method: multiplication shortcuts using 5-based calculations and quick percentage estimations, Minion's Method: simplified arithmetic tricks and approximation techniques, King and Queen Method: advanced number manipulation and rapid comparison techniques, Butterfly Method: fraction addition and subtraction shortcuts using LCM-based fast calculations, Square Root and Cube Root:								

quick square root finding and cube root shortcut methods using Vedic math, Inception Method: multi-step arithmetic shortcuts and nested calculation techniques, Conversion of Percentage into Fraction: common percentage-fraction conversions and shortcut memorization, HCF and LCM: prime factorization, divisibility concepts and application problems

Activities

1. Mental Math Marathon: Speed Arithmetic Challenge
2. Vedic Mathematics Shortcut Techniques Workshop
3. Rapid Calculation and Problem-Solving Competition

Unit 2	SPEED MATHEMATICS – ADVANCED TECHNIQUES AND ASSESSMENT			12	12	24		4,8
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Cube of a Number: fast cube calculation techniques, cube patterns and shortcut multiplication methods, Goldeneye Method: advanced mental calculation techniques and rapid arithmetic simplifications, Base Multiplication Method: multiplication using base values 10, 100 and 1000 with shortcut techniques, Crisscross Method: fast multiplication using cross multiplication and multi-digit multiplication shortcuts, Super Power Method: advanced arithmetic shortcuts and speed enhancement techniques for competitive aptitude, Cast Away Method: error checking techniques, divisibility validation and quick verification methods, Timed Speed Math Test: aptitude-based calculations under time constraint, shortcut application evaluation, combined practice of all speed math methods, building calculation speed and accuracy for competitive exams

Activities

1. Advanced Speed Math and Multiplication Techniques Workshop
2. Mental Calculation Mastery Challenge
3. Timed Aptitude Speed Math Competition

Unit 3	QUANTITATIVE APTITUDE – NUMBER SYSTEMS, TIME AND WORK, PERCENTAGES AND INTEREST			12	12	24		4,8
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Number System fundamentals: natural, whole, integers, rational and irrational numbers, Power cycle: cyclicity of units digit in powers, Remainder cycle: patterns in remainders for repeated powers, Factors and Multiples: properties, number of factors, factor pairs, HCF and LCM: prime factorization method, shortcut methods and word problems, Time and Work: work with different efficiencies, combined work problems, Pipes and Cisterns: filling and emptying pipe problems, Work Equivalence: man-days concept and work equivalence principle, Division of Wages: proportional wage distribution based on work done, Percentages as Fractions and Decimals: interconversion and shortcuts, Percentage Increase and Decrease: successive percentage changes, Simple Interest: formula-based problems and applications, Compound Interest: annual, half-yearly and quarterly compounding, Relation Between Simple and Compound Interest: difference formulas

and comparative problems

Activities

1. Number System and Arithmetic Problem-Solving Workshop
2. Time, Work, and Interest Applications Challenge
3. Quantitative Aptitude Practice Test and Speed Challenge

Unit 4	QUANTITATIVE APTITUDE – PROFIT AND LOSS, PERMUTATION, COMBINATION, PROBABILITY AND TIME-SPEED-DISTANCE			12	12	24		4,8
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Profit and Loss fundamentals: cost price, selling price, marked price, discount, Partnership basics: simple and compound partnership, ratio-based profit sharing, Averages: weighted average, average speed, combined averages, Permutation fundamentals: factorial notation, arrangements of distinct and identical objects, Combination fundamentals: selection problems, nCr formula and applications, Probability basics: classical definition, sample space, favourable outcomes, Data Interpretation – Tables: reading and interpreting tabular data, calculating percentages and ratios, Data Interpretation – Pie Chart: angle and percentage-based calculations from pie charts, Data Interpretation – Bar Graph: comparative analysis using bar graphs, Data Sufficiency: determining whether given statements are sufficient to answer a question, Basics of Time Speed and Distance: formula and unit conversions, Relative Speed: same direction and opposite direction problems, Train problems: crossing poles, platforms and other trains, Boats and Streams: upstream and downstream speed problems, Race problems: lead, dead heat and time-based race calculations

Activities

1. Quantitative Aptitude Problem-Solving Workshop
2. Data Interpretation and Analytical Reasoning Challenge
3. Speed, Distance, and Probability Practice Test

Unit 5	FUNDAMENTALS OF PROGRAMMING – LOOPS AND ARRAYS			12	12	24		4,9
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Introduction to Java programming constructs and problem-solving approach, for loop: syntax, initialization, condition, update expression, Practical: program to print squares of numbers from 1 to 10 using for loop, while loop: condition-based iteration and use cases for unknown iteration count, Practical: program to find the sum of natural numbers up to a given limit using while loop, do-while loop: guaranteed single execution and its applications, Practical: program to repeatedly prompt the user until a valid number is entered using do-while loop, Loop control statements: break to exit a loop, continue to skip an iteration, Practical: demonstration of break and continue statements, One-dimensional (1D) arrays: declaration, creation, initialization and zero-based indexing, Practical: create an array of 5 integers, initialize and display the elements using a loop, Common 1D array

operations: accessing, traversing, updating and searching elements, Practical: program to find the largest and smallest elements in an array, Two-dimensional (2D) arrays: declaration, creation and initialization of matrices, Practical: create a 3×3 matrix and display its elements using nested loops, Two-dimensional array traversal: row-wise and column-wise access using nested loops, Practical: generate a multiplication table using a 2D array, Practical: calculate the sum of all elements in a 2D array.

Activities:

1. Looping Constructs and Control Statements Programming Lab
2. One-Dimensional Array Operations Challenge
3. Two-Dimensional Array and Matrix Programming Workshop

COURSE OUTCOMES:

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

CO1: Remember and recall key speed mathematics methods (SAW, Oz, Mirror, High 5, Minion's, King and Queen, Butterfly, Inception) and standard arithmetic shortcuts for rapid mental computation.

CO2: Understand and explain quantitative aptitude concepts including number systems, HCF/LCM, time and work, percentages, simple and compound interest, and their inter-relationships.

CO3: Apply advanced speed math techniques (Goldeneye, Base Multiplication, Crisscross, Super Power, Cast Away) and quantitative methods on profit-loss, permutation-combination, probability, and time-speed-distance problems.

CO4: Analyze problem structures in data interpretation, data sufficiency, and multi-step arithmetic scenarios to select optimal shortcut strategies and verify solutions using error-checking techniques.

CO5: Design and evaluate Python programs using looping constructs (for, while, do-while) and one-dimensional and two-dimensional arrays to solve computational problems efficiently.

Weightage: Continuous Assessment: 100%

Assessment Methodology:

Assessment Type	Weightage	Marks	Mode of Evaluation
Continuous Skill Assessment (CSA)	60%	60	Continuous evaluation through speed mathematics activities, aptitude problem-solving, and hands-on Java programming
Terminal Skill Assessment (TSA)	40%	40	Weekly assessment + aptitude test + Java programming practical + viva
Total	100%	100	—

A. Continuous Skill Assessment (CSA)

Component	Description	CO(s)	Marks
Daily Topical	Short assessment at the close of each session evaluating	CO1,	10

Assessment	speed mathematics techniques, quantitative aptitude concepts or Java programming tasks, recorded continuously.	CO3	
Speed Mathematics Activities & Participation	Rubric-based evaluation of Mental Math Marathon, Vedic Mathematics Workshop, Rapid Calculation Competition, Mental Calculation Mastery Challenge and other classroom activities.	CO1, CO2	10
Quantitative Aptitude Problem-Solving	Continuous evaluation through worksheets, analytical exercises and placement-oriented aptitude problems covering Number Systems, Time & Work, Percentages, Profit & Loss, Probability and Time-Speed-Distance.	CO3, CO4	10
Hands-on Programming Practice (Java Lab)	Continuous execution-based assessment of Java programs involving loops, loop control statements, one-dimensional arrays and two-dimensional arrays.	CO3, CO5	10
Programming Lab Record & Debugging	Evaluation of maintained programming lab record, program outputs, debugging exercises and code walkthrough sessions.	CO4, CO5	10
Timed Aptitude & Speed Mathematics Challenge	Placement-oriented timed assessments evaluating calculation speed, logical reasoning, shortcut application and time management.	CO2, CO5	10
Subtotal (CSA)			60

B. Terminal Skill Assessment

Component	Description	CO(s)	Marks
Weekly Assessment	Cumulative score of weekly consolidation tests covering speed mathematics, quantitative aptitude and Java programming concepts learned during the week.	CO1, CO3	10
Programming Practical Examination	Hands-on Java examination requiring students to develop, compile and execute programs using loops, arrays and control statements for given problem statements.	CO3, CO5	15
Comprehensive Aptitude Assessment	Placement-oriented aptitude examination covering speed mathematics techniques and quantitative aptitude topics under timed conditions.	CO2, CO4	10
Programming Lab Record & Viva-Voce	Evaluation of programming lab record, coding approach, debugging strategy, mathematical reasoning and shortcut techniques through viva.	CO4, CO5	5
Subtotal (TSA)			40

C. Common Evaluation Rubrics (Speed Mathematics & Quantitative Aptitude Components)

Applied uniformly across all speed mathematics activities, aptitude workshops, analytical reasoning

exercises and placement-oriented tests. Each criterion is rated on a four-point scale (4 = Excellent, 3 = Good, 2 = Satisfactory, 1 = Needs Improvement).

Evaluation Criterion	Descriptor	Weight
Accuracy	Correctness of calculations, logical reasoning and final answers	30%
Speed & Time Management	Ability to solve problems efficiently within the stipulated time	25%
Application of Techniques	Effective use of speed mathematics shortcuts, Vedic Mathematics principles and aptitude-solving strategies	20%
Analytical Reasoning	Selection of appropriate methods, logical interpretation and systematic problem solving	15%
Presentation & Neatness	Organized calculations, clarity of solution steps and proper presentation	10%

D. Programming Evaluation Rubric (Hands-on Java Components)

Evaluation Criterion	Descriptor	Weight
Logic & Correctness	Program correctly solves the given problem and produces the expected output	35%
Syntax & Compilation	Correct Java syntax with successful compilation and execution	20%
Use of Programming Constructs	Appropriate use of loops, loop control statements, arrays and problem-solving techniques	20%
Code Readability	Meaningful variable names, indentation, comments and structured coding practices	15%
Execution & Testing	Correct handling of test cases, validation of outputs and debugging ability	10%

TEXT BOOKS:

1.	Arun Sharma, “ <i>Courseware on Quantitative Aptitude for CAT 2026</i> ”, 13th Edition, McGraw Hill, 2026.
2.	R.S. Aggarwal, “ <i>Quantitative Aptitude for Competitive Examinations</i> ”, (Fully Video Edition). Revised Edition (2024–25), S. Chand Publishing, 2024.
3.	Seema Kedar, “ <i>Programming in Java</i> ,”2nd Edition. Technical Publications, Pune, 2020.

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1.	Abhijit Guha, "Quantitative Aptitude for Competitive Examinations", 7th Edition, McGraw Hill Education, 2020.
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2.	Nishit K. Sinha, “Quantitative Aptitude for CAT”, 7th Edition, Pearson Education, 2025.
3.	James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley, "The Java Language Specification", Java SE 17 Edition, Addison-Wesley Professional, 2021.
4.	Herbert Schildt, “Java: The Complete Reference”, 13th Edition, McGraw Hill, 2025.
5.	Rajesh Verma, “Fast Track Objective Arithmetic”, Completely Revised Edition 2025–26, Arihant Publications, 2025
Web / Online Resources	
1.	Programming in Java – NPTEL Course (NPTEL) — https://nptel.ac.in/courses/106105191
2.	Java Programming and Software Engineering Fundamentals – Coursera (Coursera) — https://www.coursera.org/specializations/java-programming
3.	Quantitative Aptitude - https://www.geeksforgeeks.org/aptitude/aptitude-questions-and-answers/

Mapping of Course Outcomes to Program Outcomes & Program Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1	—	—	—	1	2	2	1	1
CO2	3	3	2	1	—	1	—	1	3	2	1	1
CO3	3	3	2	2	1	1	—	2	3	3	2	2
CO4	3	3	3	2	1	1	—	2	3	3	2	2
CO5	3	3	3	3	1	1	1	3	3	3	3	3

PROFESSIONAL ELECTIVE I

MC26001	DIGITAL MARKETING	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	2,4,7,8,9
COURSE OBJECTIVES								
- To analyze the difference between Traditional Marketing and Digital Marketing. - To understand and analyze the working of search engine functions. - To develop a deep knowledge about the Digital marketing platforms and the theoretical aspects of creating a website. - To analyze built-in tools for digital Marketing.								
COURSE CONTENT								
Unit I	FUNDAMENTALS OF DIGITAL MARKETING	9	0	0	9	18		4,8
Introduction to Digital Marketing - Need for Digital Marketing, Digital Marketing Platforms - Understanding digital marketing process - Difference between Traditional Marketing and digital Marketing - tools of Digital marketing - Advantage of Digital Marketing - Digital Marketing Manager Role and functions - How we use both Digital & Traditional Marketing.								
Activities: Analyze a weekly/quarterly newsletter and identify its content and structure aid with the branding of the company.								
Unit II	WEBSITE & SEARCH ENGINE	9	0	0	9	18		8,9
Website – Hosting and Domain – Different platforms for website creation - Introduction to SERP - What are search engines- How search engines work - Major functions of a search engine - What are keywords - Different types of keywords - Google keyword planner tool.								
Activities:								

Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.								
Unit III	MISC TOOLS- GOOGLE WEBMASTER TOOLS	9	0	0	9	18		4,9
Site Map Creators- Browser-based analysis tools-Page Rank tools- Pinging & Indexing tools Dead links identification tools- Open site explorer, Domain information, who is tools- Quick sprout. Activities: Demonstrate how to use the Google Web Masters Indexing API.								
Unit IV	LEAD MANAGEMENT & DIGITAL MARKETING	9	0	0	9	18		7,8,9
Web to lead forms - Web to case forms - Lead generation techniques - Leads are everywhere Social media and lead gen Inbuilt tools for Digital Marketing - Ip Tracker - CPC reduction (in case of paid ads) Group posting on Social Media platforms. Activities: Discuss negative and positive impacts and ethical implications of using social media for political advertising.								
Unit V	TRENDING DIGITAL MARKETING SKILLS	9	0	0	9	18		2,7,9
Search Engine Optimization (SEO)-Search Engine Marketing(SEM).-Social Media Marketing/Optimization- Email Marketing. Website : Product Marketing- Content Writing. Marketing 68 the created content online Copywriting- Blogging- Local Marketing. Google Ad Words - Campaign Management- PPC Advertising- Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking. Activities: Discuss how Predictive analytics is impacting marketing automation.								
COURSE OUTCOMES								
At the end of the course, the students will be able to: CO1:Evaluate digital marketing concepts to analyze the role and functions of a digital marketing manager. CO2:Identify website management and search engine techniques to administer and optimize								

web platforms.	
CO3:Develop MISC tools and Google Webmaster tools to monitor and improve website performance.	
CO4: Apply lead management techniques and digital marketing strategies to generate and manage customer leads.	
CO5: Analyze current digital marketing trends and tools to develop effective online marketing strategies.	
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment Test: 70%, Activities: 30%	
REFERENCES	
1.	Dave Chaffey & Fiona Ellis-Chadwick, “Digital Marketing: Strategy, Implementation and Practice”, Eighth Edition, Pearson, 2022.
2.	Dave Chaffey & P. R. Smith, ”Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing”, Sixth Edition, Routledge (Taylor & Francis), 2023.
3.	Simon Kingsnorth, “Digital Marketing Strategy: An Integrated Approach to Online Marketing”, Third Edition, Kogan Page, 2022.
4.	Jason McDonald, “SEO Workbook: Search Engine Optimization in Seven Steps”, Latest Edition, JM Internet Group, 2021.
5.	Matt Bailey, “Internet Marketing: An Hour a Day”, Latest Edition, Wiley, 2020.
E resources/E materials	
1.	https://academy.hubspot.com/.
2.	https://www.simplilearn.com/resources/digital-marketing/tutorials.
3.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_mg139

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	1	1	-	-	2	2	1	3	2

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

MC26002	PROFESSIONAL ETHICS IN IT	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	3,5,8,10,16

COURSE OBJECTIVES:

- To understand the concepts of computer ethics in the work environment.
- To understand the threats in computing environment.
- To Understand the intricacies of accessibility issues.
- To ensure safe exits when designing the software projects.

COURSE CONTENT:

Unit 1	ETHICAL PRINCIPLES AND PRACTICES	9	0	0	9	18		5,8
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Definition of Ethics- Right, Good, Just- The Rational Basis of Ethics -Theories of Right: Intuitionist vs. End-Based vs. Duty-Based -Rights, Duties, Obligations -Theory of Value - Conflicting Principles and Priorities -The Importance of Integrity -The Difference Between Morals, Ethics, and Laws -Ethics in the Business World - Corporate Social Responsibility - Creating an Ethical Work Environment -Including Ethical Considerations in Decision Making

Activities:

Prepare a report of CSR activities of any three organizations.

Unit 2	ETHICS IN INFORMATION TECHNOLOGY, INTERNET CRIME	9	0	0	9	18		3,8
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IT Professionals - Are IT Workers Professionals- Professional Relationships That Must Be Managed -Professional Codes of Ethics - Professional Organizations - Certification – IT Professional Ethics, Three Codes of Ethics, Management Conflicts. The Reveton Ransomware Attacks -IT Security Incidents: A Major Concern - Why Computer Incidents Are So Prevalent - Types of Exploits -Types of Perpetrators-Federal Laws for Prosecuting Computer Attacks-Implementing Trustworthy Computing - Risk Assessment - Establishing a Security Policy - Educating Employees and Contract Workers.

Activities:

Study of the government rules and regulations for prosecuting Computer Attacks.

Do case study of two incidents that lead to IT Security breach in any of the organizations.

Unit 3	FREEDOM OF EXPRESSION, PRIVACY	9	0	0	9	18		8,10
First Amendment Rights -Obscene Speech-Defamation -Freedom of Expression: Key Issues-Controlling Access to Information on the Internet -Strategic Lawsuit Against Public Participation (SLAPP)-Anonymity on the Internet-Hate Speech- Privacy Protection and the Law- Information Privacy- Privacy Laws, Applications, and Court Rulings-Key Privacy and Anonymity Issues-Data Breaches -Electronic Discovery-Consumer Profiling- Workplace Monitoring -Advanced Surveillance Technology. Activities: Discuss the social and political implications Match laws (GDPR, CCPA, HIPAA, FERPA, ECPA, COPPA) to real-world scenarios.								
Unit 4	INTELLECTUAL PROPERTY RIGHTS	9	0	0	9	18		10,16
Intellectual Property Rights-Copyrights-Copyright Term - Eligible Works -Fair Use Doctrine - Software Copyright Protection –Copyright Laws and the internet-Copyright and Piracy–Patents- - Software Patents -Cross-Licensing Agreements -Trade Secrets-Trade Secret Laws-Employees and Trade Secrets-Key Intellectual Property Issues-Plagiarism -Reverse Engineering-Open-Source Code- Competitive Intelligence -Trademark Infringement -Cybersquatting. Activities: Recent cases (within last 5 years duration) of infringement of intellectual property rights A study on Creative commons and its effect on Open Educational Resources								
Unit 5	SOCIAL NETWORKING ETHICS AND ETIQUETTES	9	0	0	9	18		5,16
Social Networking Web Site- Business Applications of Online Social Networking-Social Network Advertising-The Use of Social Networks in the Hiring Process-Social Networking Ethical Issues – Cyber bullying- Online Virtual Worlds-Crime in Virtual Worlds-Educational and Business Uses of Virtual Worlds. Activities: A study on the role of social networking advertising in the development of Business and Educational Sectors								
COURSE OUTCOMES:								
At the end of the course, the students will be able to: CO1: Examine situations and to internalize the need for applying ethical principles, values to tackle various situations CO2: Develop a responsible attitude towards the use of computers as well as the technology. CO3: Analyze professional responsibility and empower access to information in the workplace. CO4: Analyze the IPR issues and the procedure to protect different forms of IPR.								

CO5: Apply social networking advertising in the development of Business and Educational Sectors	
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment Test :70%, Activities:30%.	
REFERENCES:	
1.	Penny Duquenoy, Simon Jones and Barry G Blundell, “Ethical, legal and professional issues in computing”, Middlesex University Press, First Edition 2008.
2.	Caroline Whitback, “Ethics in Engineering Practice and Research”, Cambridge University Press, Second Edition 2011.
3.	George Reynolds, “Ethics in Information Technology”, Cengage Learning, Sixth Edition 2018.
4.	Barger and Robert, “Computer ethics: A case-based approach”, Cambridge University Press, First Edition 2008.
5.	John Weckert and Douglas Adeney, “Computer and Information Ethics”, Greenwood Press, First Edition 1997.
6.	Sara Baase, “A Gift of Fire: Social, Legal, and Ethical Issues for Computing Technology”, Fourth Edition, Pearson India, 2018.
E resources/E materials:	
1.	http://www.infosectoday.com/Articles/Intro_Computer_Ethics.html

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PS O4
CO1	-	-	-	-	2	1	3	-	-	1	1	2
CO2	-	-	-	-	1	2	3	-	-	-	1	2
CO3	-	-	-	-	-	2	3	-	-	1	2	2
CO4	-	-	-	-	2	2	3	2	-	2	-	2
CO5	-	-	-	-	2	2	3	2	-	1	3	2

MC26003	INTELLECTUAL PROPERTY RIGHTS	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	1,2,3,7

COURSE OBJECTIVES:

- To introduce the foundational concepts, nature, and scope of Intellectual Property Rights (IPR).
- To provide knowledge on patents, copyrights, trademarks, industrial designs, and Geographical Indications along with their legal frameworks.
- To familiarize learners with the procedures for registration, protection, enforcement, and commercialization of IPR.
- To develop the ability to analyze infringement, remedies, and global IPR challenges.
- To sensitize learners to contemporary issues such as digital piracy, e-commerce, cyber laws, sustainable development, and protection of traditional knowledge.

COURSE CONTENT:

Unit 1	FOUNDATIONS OF INTELLECTUAL PROPERTY RIGHTS	9	0	0	9	18		1,2
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Meaning and characteristics of property—Concept and evolution of Intellectual Property. Overview of TRIPS and WTO. Types of IPR: Copyright, Patent, Trademark, Trade Secret, Design, Semiconductor Layout Design, Geographical Indications, Plant Varieties, and Traditional Knowledge. Importance of IPR in innovation and economic growth.

Activities:

Case discussion on “Patents vs Trade Secrets.”

Unit 2	PATENT RIGHTS AND COPY RIGHTS	9	0	0	9	18		3,7
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Patents: Meaning, scope, patentable and non-patentable inventions, types of patents, filing and registration procedure, rights and duties of patentee. Assignment and licensing - Revocation, surrender, restoration, infringement, remedies, and penalties.

Copyrights: Definition, types, ownership, licensing, assignment, term of protection - Registration procedure - Software copyright - Piracy, infringement, civil and criminal remedies.

Activities: Hands-on session: Patent search using Google Patents / IPO Patent Search.								
Unit 3	TRADEMARKS & INDUSTRIAL DESIGNS	9	0	0	9	18		2,3
Trademarks: Meaning, functions, types, registration procedure, absolute and relative grounds for refusal, infringement, passing off, penalties, and offences - Domain names and cyber misuse. Industrial Designs: Meaning, scope, registration and cancellation - International conventions - Semiconductor Integrated Circuit Layout Design Act, 2000. Activities: Design a dummy trademark logo and simulate the registration process.								
Unit 4	GEOGRAPHICAL INDICATIONS	9	0	0	9	18		1,7
History, meaning, and characteristics of geographical indications - GI Act 1999: Registration procedure, rights of authorized users, infringement, remedies, role of GI Registrar - Conflict between trademarks and GIs - Case studies from India. Activities: Case study: Darjeeling Tea, Kanchipuram Silk, AranmulaKannadi.								
Unit 5	EMERGING ISSUES IN IPR	9	0	0	9	18		2,7
IPR and sustainable development - Internet and IPR challenges - E-commerce and digital piracy - IT Act and amendments - Cybercrime, digital signature, and cyber forensics - Biopiracy - protection of traditional knowledge - Domain name disputes and cybersquatting. Activities: Demonstration of digital signature creation and verification.								
COURSE OUTCOMES:								

At the end of the course, the students will be able to:	
CO1: Apply basic concepts and global frameworks of IPR to simple real-world scenarios.	
CO2: Apply knowledge of patent and copyright laws to protect innovations.	
CO3: Apply procedures for registration and enforcement of trademarks and designs.	
CO4: Analyze geographical indication-related legal issues and conflict resolution mechanisms.	
CO5: Evaluate emerging challenges such as cybercrime, digital infringement, and protection of traditional knowledge.	
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment Test :70%, Activities: 30%	
REFERENCES:	
1.	G.B. Reddy, Intellectual Property Rights and the Law, Gogia Law Agency, 2020.
2.	B. L. Wadehra, <i>Law Relating to Intellectual Property</i> , Fifth Edition, Universal Law Publishing, Reprint 2025.
3.	Pandey, N., and Dharni, K., “Intellectual Property Rights”, Second Edition. PHI Learning, 2022.
4.	S.R. Myneni, Law of Intellectual Property, Thirteenth Edition, Asian Law House, 2026.
5.	P. Narayanan, Intellectual Property Law, Third Edition, Eastern Law House, 2025
6.	T. Ramappa, Intellectual Property Rights: Law in India, Asia Law House, 2025
E resources/E materials:	
1.	World Intellectual Property Organization (WIPO): https://www.wipo.int
2.	Intellectual Property India: https://ipindia.gov.in
3.	WIPO Academy: https://www.wipo.int/academy

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	2	2	3	1	1	1	2	3	1	2	1
CO2	3	3	2	3	1	1	1	2	3	2	2	1
CO3	3	3	3	3	1	1	1	2	3	3	3	1
CO4	2	3	3	3	1	1	1	3	2	3	3	2
CO5	3	3	3	3	1	1	1	3	3	3	3	2

MC26004	ACCOUNTING AND FINANCIAL MANAGEMENT	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	4,8,9, 12
COURSE OBJECTIVES:								
• Provide basic knowledge of computerized accounting systems and their application in modern business environments. • Enable students to understand the procedure for establishing an effective system of budgetary control in organizations. • Provide knowledge of cash from operations and develop skills to prepare the Cash Flow Statement. • Develop the ability to apply and evaluate capital budgeting techniques for project appraisal. • Provide knowledge of inventory, receivables, and cash management techniques, including Baumol and Miller–Orr models.								
COURSE CONTENT								
Unit I	FINANCIAL ACCOUNTING	9	0	0	9	18		4,8
Meaning and Scope – Principles – Concepts – Conventions. Journal – Ledger – Trial Balance - Trading Account – Profit and Loss Account – Balance Sheet - Accounting Ratio Analysis– Funds Flow Statement – Cash Flow Statement - Computerized Account.								
Activities:								

Case Study- Accounting principles, concepts, and preparation of final accounts.								
Unit II	BUDGET AND BUDGETARY CONTROL	9	0	0	9	18		8,12
Concept of Budget and Budgetary Control – Nature and Objectives of budgetary control – Establishing a system of Budgetary control – Advantage and Limitations – Types of Budgets – Preparation of sales budget, selling & distribution cost budget, production budget, purchases budget, cash budget, fixed and flexible budget – Master budget – Zero Base Budget. Activities: Collaborative workshop on cost classification, break-even analysis, and budget preparation.								
Unit III	FUNDS FLOW AND CASH FLOW STATEMENT	9	0	0	9	18		8,12
Funds Flow Analysis – Funds from Operation, Sources and Uses of Funds, Preparation of Schedule of Changes in Working Capital – Construction of Funds Flow Statement – Marginal Uses of fund flow analysis and its Limitations – Cash Flow Analysis – Cash From operation – Preparation of Cash Flow Statement – Uses and Limitations – Distinction between Funds Flow and Cash Flow. Activities: Analyze the concepts of Funds Flow and Cash Flow by preparing statements from real or simulated financial data.								
Unit IV	CAPITAL BUDGETING DECISIONS	9	0	0	9	18		9,8
Objectives and significance - Capital budgeting process - Capital budgeting decisions - Information required for capital budgeting - Techniques and evaluating projects - Risks in capital budgeting - Independent projects and capital rationing - Mutually exclusive projects - Capital budgeting and price level adjustments. Activities: Collaborative workshop on evaluating investment projects using capital budgeting techniques.								
Unit V	DIVIDEND POLICY AND WORKING CAPITAL MANAGEMENT	9	0	0	9	18		8,12

Dividend policy formulation- Dividend Types - Dividend models - Relevance Vs irrelevance of - Theory of relevance. Working capital management- Operating cycle - Working capital policy - Estimation of working capital requirements - sources of working capital financing - Inventory management, Receivables management, Cash management – Baumol, Miller & Orr Model.

Activities:

Case Study- Dividend policy models and working capital management strategies.

COURSE OUTCOMES

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

- CO1:** Apply accounting principles to prepare financial statements.
- CO2:** Apply budgetary control techniques to prepare various budgets.
- CO3:** Analyze changes in working capital using funds flow and cash flow statements.
- CO4:** Apply the capital budgeting techniques and analyze the feasibility of investment proposals.
- CO5:** Evaluate and select the best investment alternatives using capital budgeting methods.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Internal Assessment test: 70%, Activities: 30%

REFERENCES

- | | |
|----|---|
| 1. | Chandra P, “Financial Management”, Latest Revised Edition, Tata McGraw Hill, New Delhi, 2021. |
| 2. | Brigham, E. F., & Ehrhardt, M. C. “Financial Management: Theory and Practice. Latest”, Revised Edition, Cengage Learning, 2020. |
| 3. | Sehgal, A., & Sehgal, D. “Accounting for Management”, Revised Edition. Taxmann Publications Pvt. Ltd., New Delhi, 2020. |
| 4. | Dr. Ashok Sehgal and Dr. Deepak Sehgal, “Accounting for Management”, Taxmann Publications (P) Ltd., New Delhi, 2020. |
| 5. | Pillai, R. S. N., & Bagavathi, “Fundamentals of Advanced Accounting”, Revised Edition. Sultan Chand Publications, 2020. |

E resources/E materials:

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/110101131 |
|----|---|

2.	https://www.investopedia.com
3.	https://ndl.iitkgp.ac.in

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	2	-	1	-	2	-	1	2	1	-	3
CO2	2	3	1	-	-	3	-	1	2	2	-	3
CO3	2	3	1	-	-	3	-	1	2	2	-	3
CO4	2	3	3	1	-	3	-	1	2	3	1	3
CO5	1	2	2	-	-	3	1	2	2	3	1	3

MC26005	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	TW/ SL	Total	C	SDG
		45	0	0	45	90	3	4, 5, 8, 9, 10, 11, 12, 16
COURSE OBJECTIVES:								
• To develop an entrepreneurial mindset and understand the role of entrepreneurship in economic and social development. • To identify, analyze, and evaluate business opportunities through systematic business planning and feasibility analysis. • To acquire knowledge of entrepreneurial finance, funding mechanisms, and financial decision-making for startups. • To understand business operations, legal aspects, intellectual property rights, and ethical practices in entrepreneurship. • To apply modern tools, technologies, and innovative strategies to design sustainable and socially responsible entrepreneurial ventures.								
COURSE CONTENT:								
Unit 1	ENTREPRENEURIAL FUNDAMENTALS	9	0	0	9	18		4, 5, 8

Entrepreneurship – Entrepreneurial mindset – Characteristics of successful entrepreneurs – Types of entrepreneurs – Role of entrepreneurship in economic development – Innovation and creativity – Intrapreneurship – Barriers to entrepreneurship – Entrepreneurship ecosystem – Entrepreneurial process – Startup India initiative – Women entrepreneurship – Rural entrepreneurship – Social entrepreneurship – Difference between entrepreneur and a manager. Activities: Quiz on basics concepts and scope of entrepreneurship.								
Unit 2	BUSINESS PLANNING	9	0	0	9	18		8, 9,12
Business plan – Purpose of business planning – Components of a business plan – Feasibility analysis – Market analysis – Financial feasibility – Technical feasibility – Project identification – Project selection – Project appraisal – SWOT analysis – Business model canvas – Value proposition – Revenue models – Elevator pitch – Cost estimation – Risk analysis – Pre-feasibility study. Activities: Poster Presentation: Develop a visual risk matrix for a business idea.								
Unit 3	ENTREPRENEURIAL FINANCE AND FUNDING	9	0	0	9	18		8, 9, 10
Sources of finance – Angel investors – Venture capital – Seed funding – Crowdfunding – Bootstrapping – Bank loans – Government schemes and subsidies – Financial institutions supporting entrepreneurship – Working capital management – Break-even analysis – Cash flow management – Budgeting for startups – Income statement – Balance sheet basics – Investment pitching – Return on investment – Cost-benefit analysis. Activities: Field visit to a bank or financial institution to understand startup loan options.								
Unit 4	BUSINESS OPERATIONS	9	0	0	9	18		9, 12, 16
Operations planning – Supply chain management – Inventory management – Quality control – Vendor management – Business scalability – Intellectual property rights – Patents and trademarks – Licensing – Business process automation – Lean startup methodology – Minimum viable product (MVP) – Time management – Human resource planning – Organizational structure – Customer relationship management (CRM). Activities: Flipped Classroom: Analyze how a startup scaled its operations.								
Unit 5	TECHNICAL ASPECTS AND ETHICS IN ENTREPRENEURSHIP	9	0	0	9	18		8, 9, 11, 16

Business ethics – Corporate social responsibility – Legal compliance- Ethical decision making – Global entrepreneurship trends – Technology and entrepreneurship – E-commerce startups – Digital marketing for entrepreneurs – Artificial intelligence in business – Blockchain and entrepreneurship – Social media strategies – Mental health and well-being of entrepreneurs – Work-life balance – Resilience and leadership – Future of entrepreneurship Activities: Industrial visit to a startup incubator or legal consultancy..	
COURSE OUTCOMES:	
At the end of the course, the students will be able to: CO1: Apply the fundamental concepts, principles, and processes of entrepreneurship to develop and execute venture creation activities. CO2: Analyze business opportunities, market conditions, and entrepreneurial challenges. CO3: Evaluate business models, financial plans, and entrepreneurial strategies. CO4: Design business plans and innovative entrepreneurial solutions. CO5: Demonstrate ethical responsibility, sustainability awareness, and leadership in entrepreneurial activities.	
Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%	
Assessment Methodology: Internal Assessment test :70%, Activities :30%.	
REFERENCES:	
1.	S. S. Khanka, “Entrepreneurial Development”, Fifth Edition, S. Chand Publishing, 2026.
2.	Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, “Entrepreneurship”, Twelfth Edition, McGraw-Hill Education, 2022.
3.	R. D. Hisrich, M. P. Peters & D. A. Shepherd, “Entrepreneurship”, Eleventh Edition, McGraw-Hill, 2020.
4.	Bruce R. Barringer and R. Duane Ireland, “Entrepreneurship: Successfully Launching New Ventures”, Seventh Edition, Pearson Education, 2024 (Global Edition).
5.	Donald F. Kuratko, “Entrepreneurship: Theory, Process, and Practice”, Twelfth Edition, Cengage Learning, 2023.
6.	Tapan Panda, “Entrepreneurship Development”, Oxford University Press, 2021.
E resources/E materials:	
1.	Startup India Learning Program (Invest India): https://www.startupindia.gov.in/

2.	WIPO (World Intellectual Property Organization) for Startups: https://www.wipo.int/portal/en/index.html
3.	NPTEL - Entrepreneurship and IP Strategy (IIT Kharagpur): https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_hs116
4.	Harvard Business Review (HBR) - Entrepreneurship Section: https://hbr.org/topic/entrepreneurship

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	-	-	3	2	-	-
CO3	-	-	3	1	-	2	-	-	-	2	-	-
CO4	-	2	3	2	2	2	-	-	3	2	2	2
CO5	-	-	1	1	2	-	3	3	-	1	3	2

MC26006	E-COMMERCE TECHNOLOGIES	L	T	P	TW/SL	Total	C	SDG
		45	0	0	45	90	3	1,3,4, 8,9
COURSE OBJECTIVES:								

- To know the goals of Electronic commerce
- To understand the various Business models in emerging E-commerce areas.
- To understand the internet marketing technologies.
- To understand the real-world business environments.
- To know the security strategies for scalable online applications.

COURSE CONTENT:

Unit 1	BASICS OF E-COMMERCE	9	0	0	9	18		1,3,4
Defining E - Commerce; Main Activities of Electronic Commerce; Benefits of E-Commerce; Broad Goals of Electronic Commerce; Main Components of E-Commerce; Functions of Electronic Commerce - Process of E-Commerce - Types of E- Commerce; The World Wide Web, The Internet and the Web: Features, Role of Automation & Artificial Intelligence in E-Commerce Activities: Draw a block diagram of e-commerce architecture.								
Unit 2	E-COMMERCE BUSINESS MODELS	9	0	0	9	18		3,8,9
E-commerce Business Models, Major Business to Consumer (B2C) Business Models, Major Business to Business (B2B) Business Models, Business Models in Emerging E-Commerce Areas - E-tailing: Traditional Retailing and E- retailing, Benefits of E-retailing, Models of E-retailing, Features of E-retailing. Activities: Case Study-A traditional retail store moves online to compete with large platforms.								
Unit 3	E-COMMERCE MARKETING CONCEPTS	9	0	0	9	18		1,4
The Internet Audience and Consumer Behavior, Basic Marketing Concepts, Internet Marketing Technologies – Marketing Strategy - E services: Categories of E-services, Web-Enabled Services, Information Selling on the Web. Activities: Design a simple online advertisement campaign								
Unit 4	MOBILE COMMERCE AND TECHNOLOGIES	9	0	0	9	18		8,9
E- Business Portals. Issues – Wireless– Cellular– Wireless Spectrum. – Success Stories. Technologies – mobile commerce- WAP Wireless Generations. Portals – Different Types– benefits– features. Requirements for Intel. Activities: Case Study-Compare WAP-based browsing vs modern mobile web.								
Unit 5	ERP & EDI	9	0	0	9	18		3,4,8

Introduction – ERP and E2RP – Business Problems– New Paradigm– Drivers – Business processes and supporting processes. Architecture- Implementation– ERP Processes. ERP – Cloud and Open Sources. EDI– Concepts and Technology.
Activities:Design ERP system for an organization.

COURSE OUTCOMES:

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

CO1: Apply the features and technologies of the World Wide Web to develop web-based solutions.

CO2: Apply e-retailing models and strategies to solve real-world business problems.

CO3: Apply web-enabled services to design and deliver online applications.

CO4: Apply concepts of real-world business environments in developing web-based systems.

CO5: Apply e-commerce tools and technologies to build and manage digital business applications.

Weightage: Continuous Assessment: 40%, End Semester Examinations: 60%

Assessment Methodology: Internal Assessment test :70%, Activities :30%.

REFERENCES:

- | | |
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| 1. | P. T. Joseph S.J, “E Commerce – An Indian Perspective”, 7th Edition, PHI Learning Private Limited, 2023. |
| 2. | Kenneth C. Laudon & Carol Guercio Traver, “E Commerce: Business – Technology – Society”, 17 th Edition, Pearson, 2021. |
| 3. | Sandeep Desai & Abhishek Srivastava, “ERP to E2RP – A Case Study Approach”, 1 st Edition (Eastern Economy), PHI Learning Private Limited, 2013. |
| 4. | Kenneth C. Laudon & Carol Guercio Traver, <i>E-Commerce: Business, Technology, Society</i> , Pearson, 16th Edition, 2020. |
| 5 | Kenneth C. Laudon & Carol Guercio Traver, <i>E-Commerce: Business, Technology, Society</i> , Pearson, 17th Edition, 2023. |

Mapping of Course Outcomes to Programme Outcomes and Programme Specific Outcomes

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO 1	PSO 2	PSO 3	PS O4
CO1	3	2	1	2	-	-	2	-	2	1	1	2
CO2	2	3	2	1	1	3	2	2	2	2	2	3
CO3	2	2	3	3	1	1	2	3	3	3	2	2
CO4	2	3	2	1	2	3	2	2	2	2	2	3