MCA (COMPUTER APPLICATIONS)

LOCF SYLLABUS 2025

Department of Computer Science

School of Computing Sciences

St. Joseph's College (Autonomous)

Tiruchirappalli - 620002, Tamil Nadu, India

SCHOOLS OF EXCELLENCE WITH CHOICE BASED CREDIT SYSTEM (CBCS) POSTGRADUATE COURSES

St. Joseph's College (Autonomous), an esteemed institution in the realm of higher education in India, has embarked on a journey to uphold and perpetuate academic excellence. One of the pivotal initiatives in this pursuit is the establishment of five Schools of Excellence commencing from the academic year 2014-15. These schools are strategically designed to confront and surpass the challenges of the 21st century.

Each School amalgamates correlated disciplines under a unified umbrella, fostering synergy and coherence. This integrated approach fosters the optimal utilization of both human expertise and infrastructure. Moreover, it facilitates academic fluidity and augments employability by nurturing a dynamic environment conducive to learning and innovation. Importantly, while promoting collaboration and interdisciplinary study, the Schools of Excellence also uphold the individual identity, autonomy, and distinctiveness of every department within.

The overarching objectives of these five schools are as follows:

1. Optimal Resource Utilization: Ensuring the efficient use of both human and material resources to foster academic flexibility and attain excellence across disciplines.

2. Horizontal Mobility for Students: Providing students with the freedom to choose courses aligning with their interests and facilitating credit transfers, thereby enhancing their academic mobility and enriching their learning experience.

3. Credit-Transfer Across Disciplines (CTAD): The existing curricular structure, compliant with regulations from entities such as TANSCHE and other higher educational institutions, facilitates seamless credit transfers across diverse disciplines. This underscores the adaptability and uniqueness of the choice-based credit system.

4. Promotion of Human Excellence: Nurturing excellence in specialized areas through focused attention and resources, thus empowering individuals to excel in their respective fields.

5. Emphasis on Internships and Projects: Encouraging students to engage in internships and projects, serving as stepping stones toward research endeavors, thereby fostering a culture of inquiry and innovation.

6. Addressing Stakeholder Needs: The multi-disciplinary nature of the School System is tailored to meet the requirements of various stakeholders, particularly employers, by equipping students with versatile skills and competencies essential for success in the contemporary professional landscape.

In essence, the Schools of Excellence at St. Joseph's College (Autonomous) epitomize a holistic approach towards education, aiming not only to impart knowledge but also to cultivate critical thinking, creativity, and adaptability – qualities indispensable for thriving in the dynamic global arena of the 21st century.

Credit system

The credit system at St. Joseph's College (Autonomous) assigns weightage to courses based on the hours allocated to each course. Typically, one credit is equivalent to one hour of instruction per week. However, credits are awarded regardless of actual teaching hours to ensure consistency and adherence to guidelines.

The credits and hours allotted to each course within a programme are detailed in the Programme Pattern table. While the table provides a framework, there may be some flexibility due to practical sessions, field visits, tutorials, and the nature of project work.

For postgraduate (PG) courses, students are required to accumulate a minimum of 92 credits, as stipulated in the programme pattern table. The total minimum number of courses offered by the department is outlined in the Programme Structure.

OUTCOME-BASED EDUCATION (OBE)

OBE is an educational approach that revolves around clearly defined goals or outcomes for every aspect of the educational system. The primary aim is for each student to successfully achieve these predetermined outcomes by the culmination of their educational journey. Unlike traditional methods, OBE does not

prescribe a singular teaching style or assessment format. Instead, classes, activities, and evaluations are structured to support students in attaining the specified outcomes effectively.

In OBE, the emphasis lies on measurable outcomes, allowing educational institutions to establish their own set of objectives tailored to their unique context and priorities. The overarching objective of OBE is to establish a direct link between education and employability, ensuring that students acquire the necessary skills and competencies sought after by employers.

OBE fosters a student-centric approach to teaching and learning, where the delivery of courses and assessments are meticulously planned to align with the predetermined objectives and outcomes. It places significant emphasis on evaluating student performance at various levels to gauge their progress and proficiency in meeting the desired outcomes.

Here are some key aspects of Outcome-Based Education:

Course: A course refers to a theory, practical, or a combination of both that is done within a semester.

Course Outcomes (COs): These are statements that delineate the significant and essential learning outcomes that learners should have achieved and can reliably demonstrate by the conclusion of a course. Typically, three or more course outcomes are specified for each course, depending on its importance.

Programme: This term pertains to the specialization or discipline of a degree programme.

Programme Outcomes (POs): POs are statements that articulate what students are expected to be capable of by the time they graduate. These outcomes are closely aligned with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs outline the specific skills and abilities that students should possess upon graduation within a particular discipline or specialization.

Programme Educational Objectives (PEOs): PEOs encapsulate the expected accomplishments of graduates in their careers, particularly highlighting what they are expected to achieve and perform during the initial years postgraduation.

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The Learning Outcomes-Centric Framework (LOCF) places the learning outcomes at the forefront of curriculum design and execution. It underscores the importance of ensuring that these outcomes are clear, measurable, and relevant. LOCF orchestrates teaching methodologies, evaluations, and activities in direct correlation with these outcomes. Furthermore, LOCF adopts a backward design approach, focusing on defining precise and attainable learning objectives. The goal is to create a cohesive framework where every educational element is in harmony with these outcomes.

Assessment practices within LOCF are intricately linked to the established learning objectives. Evaluations are crafted to gauge students' achievement of these outcomes accurately. Emphasis is often placed on employing authentic assessment methods, allowing students to showcase their learning in real-life scenarios. Additionally, LOCF frameworks emphasize flexibility and adaptability, enabling educators to tailor curriculum and instructional approaches to suit the diverse needs of students while ensuring alignment with the defined learning outcomes.

Some important terminologies

Core Courses (CC): *These are compulsory courses that students must undertake as essential components of their curriculum, providing fundamental knowledge within their primary discipline. Including core courses is essential to maintain a standardized academic programme, ensuring recognition and consistency across institutions.*

Discipline Specific Elective Courses (ES): *Elective courses are offered within the main discipline or subject of study. They allow students to select specialized or advanced options from a range of courses, offering in-depth exposure to their chosen area of study. Typically, ES are more applied in nature and provide a deeper understanding of specific topics.*

Research Methodology (RM)*: It is a two-credit course offered in the third semester as a common program across disciplines within the school. It is designed to cultivate a strong research aptitude among postgraduate students. The course equips learners with essential skills for formulating research problems and pursuing impactful research.*

Open Elective Courses (OE): *These elective courses are chosen from disciplines unrelated to the student's main area of study, aiming to broaden their exposure and knowledge base. As per the Choice Based Credit System (CBCS) policy, students may opt for open elective courses offered by other disciplines within the college, enhancing the diversity of their learning experience.*

Ability Enhancement Course (AEC): *AE is designed to enhance skills and proficiencies related to the student's main discipline. It aims to provide practical training and hands-on experience, contributing to the overall development of students pursuing academic programmes.*

Skill Enhancement Course (SEC): *SE focus on developing specific skills or proficiencies relevant to students' academic pursuits. While it is open to students from any discipline, SE is particularly beneficial for those within the related academic programme.*

Self-Learning (SL): *A two-credit course designed to foster students' ability for independent and self-directed learning. There are* Three Self-Learning Courses:

- 'Global Citizenship Education' *a common online course offered to all PG students in Semester I on JosTEL.*
- *Compulsory MOOC on NPTEL-SWAYAM in Semester I or II*
- *A Department-Specific Self-Learning Course in Semester III on JosTEL*

Comprehensive Examination (CE): *These examinations cover detailed syllabi comprising select units from courses offered throughout the programme. They are designed to assess crucial knowledge and content that may not have been covered extensively in regular coursework.*

Extra Credit Courses: *To support students in acquiring knowledge and skills through online platforms such as Massive Open Online Courses (MOOCs), additional credits are granted upon verification of course completion. These extra credits can be availed across three semesters (1 - 4). In line with UGC guidelines, students are encouraged to enhance their learning by enrolling in MOOCs offered by portals like SWAYAM, NPTEL, and others. Additionally, certificate courses provided by the college are also considered for these extra credits.*

Outreach Programme (OR): *It is a compulsory course to create a sense of social concern among all the students and to inspire them to dedicated service to the needy.*

Course Coding

The following code system (10 alphanumeric characters) is adopted for Postgraduate courses:

25	**UXX**	**0**	**XX**	**00/X**
Year of Revision	PG Department Code	Semester Number	Course Specific Initials	Running Number/with Choice

Course Specific Initials

CC - Core Course

CP - Core Practical

ES - Discipline Specific Elective

AE - Ability Enhancement Course

SL - Self-Learning

OE – Open Elective

PW - Project and Viva Voce

CE - Comprehensive Examination

OR - Outreach Programme

IS – Internship

RM – Research Methodology

EVALUATION PATTERN (PG)

Continuous Internal Assessment

Sl No	Component	Marks Allotted
1	Mid Semester Test	30
2	End Semester Test	30
3	*Two Components (15 + 20)	35
4	Library Referencing	5
	Total	**100**

Passing minimum: 50 marks

* *The first component is a compulsory online test (JosTEL platform) for 15 marks comprising 7 questions (1 mark) at K1 level and 4 questions (2 marks) at K2 level;* The second component is decided by the course in-charge in accordance with the prescribed K levels.

Question Paper Blueprint for Mid and End Semester Tests

Duration: 2 Hours								**Maximum Marks: 60**
Section		**K levels**						**Marks**
		K1	**K2**	**K3**	**K4**	**K5**	**K6**	
A *(compulsory)*		7						7 × 1 = 7
B *(compulsory)*			5					5 × 3 = 15
C *(either…or type)*				3				3 × 6 = 18
D *(2 out of 3)*	Mid Sem				1(2)	1*		2 × 10 = 20
	End Sem					1(2)	1*	
							Total	**60**

***** *Compulsory*

Question Paper Blueprint for Semester Examination

Duration: 3 Hours						**Maximum Marks: 100**
Section	**K levels**					**Marks**
	K1	**K2**	**K3**	**K4**	**K5**	**K6**	
A *(compulsory)*	10						10 × 1 = 10
B *(compulsory)*		10					10 × 3 = 30
C *(either…or type)*			5				5 × 6 = 30
D *(3 out of 5)*				1(2)	1(2)	1*	3 × 10 = 30
						Total	**100**

***** *Compulsory*

Evaluation Pattern for One/Two-credit Courses

Title of the Course	CIA	Semester Examination	Final
• Ability Enhancement Course	20 + 10 + 20 = 50	50 *(Department)*	100
• Self - Learning Course (Dept. Specific) • Comprehensive Examination	25 + 25 = 50	50 *(CoE)*	100
• Internship • Self - Learning Course (Common) • Self - Learning Online Course (NPTEL / SWAYAM)	100	-	100
• Skill Enhancement Course: Soft Skills	100	-	100
• Project Work and Viva Voce	100	100	100

Grading System

The marks obtained in the CIA and semester for each course will be graded as per the scheme provided in Table - 1.

From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA), respectively. These two are calculated by the following formulae:

$$SGPA \ and \ CGPA = \frac{\sum_{i=1}^{n} C_i Gp_i}{\sum_{i=1}^{n} C_i}$$

$$WAM = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{i=1}^{n} C_i}$$

Where,

Ci - credit earned for the Course i

Gpi - Grade Point obtained for the Course i

Mi - Marks obtained for the Course i

*n - Number of Courses **passed** in that semester*

WAM - Weighted Average Marks

Table - 1: Grading of the Courses for PG

Mark Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
Below 50	0	RA

Table - 2: Grading of the Final Performance for PG

CGPA	Grade	Performance
9.00 and above	O	Outstanding*
8.00 to 8.99	A+	Excellent*
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
Below 5.00	RA	Re-appear

**The Candidates who have passed in the first appearance and within the prescribed duration of the PG programme are eligible. If the Candidates Grade is O/A+ with more than one attempt, the performance is considered "Very Good".*

Vision

Forming globally competent, committed, compassionate and holistic persons, to be men and women for others, promoting a just society.

Mission

- Fostering learning environment to students of diverse background, developing their inherent skills and competencies through reflection, creation of knowledge and service.

- Nurturing comprehensive learning and best practices through innovative and value- driven pedagogy.

- Contributing significantly to Higher Education through Teaching, Learning, Research and Extension.

Programme Educational Objectives (PEOs)

1. Graduates will be able to accomplish professional standards in the global environment.
2. Graduates will be able to uphold integrity and human values.
3. Graduates will be able to appreciate and promote pluralism and multiculturalism in working environment.

Programme Outcomes (POs)

1. Graduates will be able to apply assimilated knowledge to evolve tangible solution to emerging problems.
2. Graduates will be able to analyze and interpret data to create and design new knowledge.
3. Graduates will be able to engage in innovative and socially relevant research and effectively communicate the findings.
4. Graduates will become ethically committed professional and entrepreneurs upholding human values.
5. Graduates imbibed with ethical values and social concern will be able to understand and appreciate cultural diversity, social harmony and ensure sustainable environment.

Programme Specific Objectives (PSOs)

1. Graduates will be able to implement the logic for solving the real life problems by using the knowledge gained
2. Graduates will be able to understand, analyze, design, develop, test, implement and document software systems
3. Graduates will be able to use their creative skill to evolve new ideas, defend their findings at the peer level and able to manage IT and ITES organizations.
4. Graduates will be able to work in public and private sectors satisfying social and environmental obligations with multiple cultures.
5. Graduates will be able to act as socially responsible IT professionals or service minded entrepreneurs.

MCA				
Programme Structure				
Semester	**Specification**	**No. of Courses**	**Hours**	**Credits**
1 – 4	Core Course	9	36	32
1 - 4	Core Practical	6	28	17
1, 3 & 4	Discipline Specific Elective	3	12	9
1 – 2	Open Elective	2	8	4
1	Ability Enhancement Course	1	2	1
1 – 3	Self-Learning	3	-	4
2	Skill Enhancement Course	1	4	2
3	Research Methodology	1	4	2
3	Internship	1	-	2
4	Project	1	26	13
4	Comprehensive Examination	1	-	2
2 – 4	Outreach Programme (SHEPHERD)	-	-	4
1 – 4	Extra Credit Course	4	-	12
	Total	**33**	**120**	**92 (12)**

MCA PROGRAMME PATTERN								
Course Details								
Sem.	**Course Code**	**Course Type**	**Title of the Course**	**Hours**	**Credits**	**Scheme of Exams**		
						CIA	**SE**	**Final**
1	25PCA1CC01	**CC Major**	**Core Course - 1:** C++ and Data Structures	4	4	100	100	100
	25PCA1CC02		**Core Course - 2:** Digital Computer Architecture	4	4	100	100	100
	25PCA1CC03		**Core Course - 3:** Advanced Database Systems	4	3	100	100	100
	25PCA1CP01		**Core Practical - 1:** Data Structures using C++	5	3	100	100	100
	25PCA1CP02		**Core Practical - 2:** SQL & NoSQL	3	2	100	100	100
	25PCA1ES01A	**DSE**	**Discipline Specific Elective-1:** Accounting and Financial Management	4	3	100	100	100
	25PCA1ES01B		**Discipline Specific Elective -1:** Graph and Automata Theory					
	25PCA1AE01	**AEC**	**Ability Enhancement Course:** Programming in Java	2	1	100	-	100
	25PCA1OE01A	**OE**	**Open Elective – 1 (WS):** AI Tools & Applications	4	2	100	100	100
	25PCA1OE01B		**Open Elective – 2 (WS):** Internet of Things					
	25PGC1SL01	**SL**	Global Citizenship Education (Online)	0	1	100	-	100
			Extra Credit Course	0	(3)			
			Total	**30**	**23 (3)**			
2	25PCA2CC04	**CC Major**	**Core Course - 4:** Programming Smart Devices (Internship Embedded Course)	4	4	100	100	100
	25PCA2CC05		**Core Course - 5:** Software Engineering	4	4	100	100	100
	25PCA2CC06		**Core Course - 6:** Data Analysis using Python (Internship Embedded Course)	4	4	100	100	100
	25PCA2CP03		**Core Practical - 3:** Programming Smart Devices	5	3	100	100	100
	25PCA2CP04		**Core Practical - 4:** Data Analysis using Python	5	3	100	100	100
	25PCA2OE02A	**OE**	**Open Elective – 1 (BS):** Web Design	4	2	100	100	100
	25PCA2OE02B		**Open Elective – 2 (BS):** Cyber Security					
	25PSS2SE01	**SEC**	**Skill Enhancement Course:** Soft Skills	4	2	100	-	100
	25PCA2SL02	**SL**	Online Courses: NPTEL / SWAYAM	0	2	-	100	100
			Extra Credit Course	0	(3)	-	-	-
			Total	**30**	**24 (3)**			
3	25PCA3CC07	**CC Major**	**Core Course - 7:** Distributed Technologies	4	3	100	100	100
	25PCA3CC08		**Core Course - 8:** Computer Networks and Security	4	3	100	100	100
	25PCA3CC09		**Core Course - 9:** Operations Research	4	3	100	100	100
	25PCA3CP05		**Core Practical – 5:** Building Web Applications	5	3	100	100	100
	25PCA3CP06		**Core Practical - 6**: Web Application Development with MERN Stack	5	3	100	100	100
	25PCA3ES02A (**SSC/Q0501**)	**DSE**	**Discipline Specific Elective - 2:** Cyber Security and Identity Management (**NSQF**)	4	3	100	100	100
	25PCA3ES02B		**Discipline Specific Elective - 2:** Immersive Technologies					
	25PCA3ES02C		**Discipline Specific Elective - 2:** Human Computer Interaction					
	25SCS3RM01	**CC**	Research Methodology	4	2	100	100	100
	25PCA3SL03	**SL**	**Self -Learning:** Organizational Behaviour*	0	1	50	50	50
	25PCA3IS01	**IS**	Internship	0	2	100	-	100
			Extra Credit Course	0	(3)	-	-	-
			Total	**30**	**23 (3)**			
4	25PCA4ES03A	**DSE**	**Discipline Specific Elective - 3:** Artificial Intelligence Technologies #	4	3	100	100	100
	25PCA4ES03B		**Discipline Specific Elective - 3:** Advanced Computing Technologies #					
	25PCA4PW01	**PW**	Project Work and Viva Voce	26	13	100	100	100
	25PCA4CE01	**CE**	Comprehensive Examination*	0	2	50	50	50
			Extra Credit Course	0	(3)	-	-	-
			Total	**30**	**18 (3)**			
2-4	25PCW4OR01	**OR**	Outreach Programme	0	4			
1-4			**Total (Four Semesters)**	**120**	**92 (12)**			

1	25PCA1BC01	**Bridge Course****	30	2	100	-	100

Note:

***For Grade Calculation:** Marks obtained out of 50 will be converted into 100 in the mark statements.

****Mandatory Bridge Course**: All non-computer science stream students must complete a two-week bridge course (30 hours) conducted outside regular class hours. This course will be evaluated for 100 marks (purely internal assessment).

#Blended Learning (Online & Offline): Students have the flexibility to choose from available options for **Discipline Specific Elective-3** courses, which may be pursued in either an online or offline mode.

Open Elective - 1 (WS): 1st Semester

School	Course Code	Title of the Course
SCS		
Artificial Intelligence	25PAI1OE01	Neural Networks and Fuzzy Logic
Computer Science	25PCA1OE01A	AI Tools & Applications
	25PCA1OE01B	Internet of Things
Information Technology	25PCS1OE01	Big Data Analytics
Data Science	25PDS1OE01	SQL and NoSQL for Data Science
Mathematics	25PMA1OE01	Mathematical Foundations

Open Elective – 2 (BS): 2nd Semester
Offered to students from other Schools

School	Course Code	Title of the Course
SBS		
Botany	25PBO2OE02	Sustainable Horticulture and Urban Landscaping
Biochemistry	25PBI2OE02	First Aid Management
Biotechnology	25PBT2OE02	Food Technology
SCS		
Artificial Intelligence and Machine Learning	25PAI2OE02	Cyber Security
Computer Science	25PCA2OE02A	Web Design
	25PCA2OE02B	Cyber Security
Information Technology	25PCS2OE02	Recent Trends in Computing
Data Science	25PDS2OE02	Discrete Mathematics
Mathematics	25PMA2OE02	Operations Research
Visual Communication	25PVC2OE02	Women and Media
SLAC		
English	25PEN2OE02	English for Digital Media
History	25PHS2OE02	Public Administration
Tamil	25PTA2OE02	விளம்பரக்கலை (Art of advertising)
SMS		
Commerce	25PCO2OE02	Basics of Tally Prime
Commerce Computer Application	25PCC2OE02	Behavioural Dynamics and Psychology
Counselling Psychology	25PCP2OE02	Artificial Intelligence in Psychology
Economics	25PEC2OE02	Managerial Economics
Human Resource Management	25PHR2OE02	Counselling and Guidance
SPS		
Chemistry	25PCH2OE02	Chemistry of Health and Nutrition
Electronics	25PEL2OE02	Computer Hardware and Networks
Physics	25PPH2OE02A	Physics for Competitive Exams
	25PPH2OE02B	Nanoscience

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1CC01	**Core Course – 1:** C++ and Data Structures	4	4

Course Objectives
To recall C++ fundamentals, control structures, arrays, and pointers.
To understand object-oriented programming, functions, operator overloading, and inheritance.
To explore polymorphism, exception handling, and file handling in C++.
To implement fundamental data structures like stacks, queues, linked lists, and trees.
To gain knowledge of hashing techniques, collision resolution, and advanced data structures like B-Trees and Disjoint Sets.

UNIT I: Fundamentals of C++ (12 Hours)

Writing C++ code - White space - Formatting code - Writing statements - Tokens - Operators - Control and Conditional statements - Converting between types - Type Conversions, Casting - Memory in C++ - Types of memory. Arrays: Multidimensional arrays - Passing multidimensional arrays to functions - Using arrays of characters. Pointers: Allocating memory in code - Allocating individual objects.

UNIT II: Object Oriented Programming and Functions (12 Hours)

Functions - Function Parameters - Function Features - Recursion - Overloading functions - Passing by Value and Passing by Reference - Overloaded operators. Defining classes: Defining Class Behavior - Creating Objects - Declaring Static Members - Nested Classes - Objects with Pointers - Operator Overloading - Managing resources - Object-Oriented Programming - Inheritance and Composition Inheriting from Class.

UNIT III: Polymorphism, Exception and File Handling (12 Hours)

Virtual Functions - The Virtual Attribute is Inherited - Virtual Functions are Hierarchical - Pure virtual Functions - Exception Handling Fundamentals - Handling Derived - Class Exceptions - Exception Handling Options - Understanding terminate ( ) and unexpected( ). Files: File system Basics.

UNIT IV: Fundamental Data Structures (12 Hours)

Simple array based data structures: Arrays - Matrices - Stacks - Queues. Linked lists: Singly linked lists - Doubly linked lists - Circular linked lists. Representing Rooted Trees - Tree traversal techniques - Applications of Stacks and Queues.

UNIT V: Hashing and Indexing Data Structures (12 Hours)

Hashing - Direct-address tables - Hash tables - Hash functions - Collision Resolution Techniques (Chaining, Open Addressing) - Practical considerations of Hashing. B-Trees: Structure and properties of B-Trees - B-Tree Operations (insertion, deletion, search) - Applications of B-Trees in databases and File Systems - Disjoint Set Data Structures.

Teaching Methodology	Demonstrative Lectures, Flipped Class, GD and Seminars.
Assessment Methods	MCQs, Seminar.

Books for Study:

1. Grimes, R. (2017). *Beginning C++ Programming*, (1st Ed.). Packt Publishing.
   Unit I*: Chapter 2 (Pg.: 48–76), Chapter 3 (Pg.: 132–148), Chapter 4 (Pg.: 149–170)*
   Unit II*: Chapter 5 (Pg.: 198–214, 231–234), Chapter 6 (Pg.: 247-277), Chapter 7 (Pg.: 295-306)*
2. Schildt, H. (2003). *The Complete Reference C++*, (4th Ed.). Tata McGraw - Hill.
   Unit III: *Chapter 19 (Pg.: 489-506), Chapter 17 (Pg.: 444-453), Chapter 9 (Pg.: 214-227)*
3. Cormen, T. H., Leiserson, C. E., & Rivest, R. L., and Stein, C. (2022). *Introduction to Algorithms*, (4th Ed.). MIT.
   Unit IV: *Chapter 10: (Sec: 10.1 to 10.3)*
   Unit V: *Chapter 11: (Sec: 11.1 to 11.5), (Sec: 18.1 to 18.3), Chapter 19: (Sec: 19.1 to 19.4)*

Books for Reference:

1. Salaria, R. S. (2018). *Data structures and algorithms Using C++*. (5th Ed.). Kanna Book Publishing.
2. Horowitz, E., Sahni, S., & Mehta. (2018). *Fundamentals of data structures in C++*. (2nd Ed.). Galgotia.

Websites and eLearning Sources:

1. https://www.geeksforgeeks.org/data-structures/
2. https://www.tutorialspoint.com/cplusplus/cpp_data_structures.htm
3. https://www.geeksforgeeks.org/hashing-data-structure/

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall fundamental C++ concepts, including syntax, data types, operators, control structures, and memory allocation techniques.	**K1**
CO2	Understand arrays, pointers, functions (including recursion and overloading), and object-oriented programming concepts.	**K2**
CO3	Apply object-oriented concepts, operator overloading and function overloading.	**K3**
CO4	Analyze the OOPs concepts and basic data structures such as stacks, queues, linked lists, and trees to solve computational problems.	**K4**
CO5	Evaluate and compare hashing techniques, collision resolution strategies, and advanced data structures like B-Trees and Disjoint Sets for efficient data management.	**K5**
CO6	Design and develop efficient C++ programs for real-world applications.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25PCA1CC01**		**Core Course - 1:** C++ and Data Structures							**4**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	2	1	2	2	1	2	3	3	3	**2.1**
CO2	2	2	1	2	3	2	2	3	2	3	**2.2**
CO3	2	2	1	2	3	3	2	2	3	2	**2.2**
CO4	1	2	2	2	3	2	2	3	2	3	**2.2**
CO5	2	2	3	3	2	2	3	2	3	3	**2.5**
CO6	2	2	3	2	2	2	2	3	3	3	**2.4**
										Mean Overall Score	**2.26 (High)**

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1CC02	**Core Course – 2:** Digital Computer Architecture	4	4

Course Objectives
To recall the fundamental concepts of logic gates, combinational logic circuits, and Boolean algebra.
To classify various data-processing circuits and explain different number systems, including their role in digital computing and the **Indian Knowledge System.**
To demonstrate the characteristics of arithmetic circuits and sequential circuits based on digital logic principles.
To analyse the design and operation of components in computer architecture and their instructions.
To learn the role of digital logic in central processing units (CPUs), including general register organization, instruction formats, and addressing modes.

UNIT I: Logic Gates and Combinational Logic Circuits (12 Hours)

Digital Logic: The Basic Gates - NOT, OR, AND. Universal Logic Gates: NOR, NAND - AND-OR-Invert Gates. Combinational Logic Circuits: Boolean Laws and Theorems - Sum-of-Products Method - Truth Table to Karnaugh Map - Pairs, Quads, and Octets - Karnaugh Simplifications - Don't-care Conditions - Product-of-sums Method - Product-of-sums Simplification.

UNIT II: Data-Processing Circuits and Number Systems (12 Hours)

Data-Processing Circuits: Multiplexers - Demultiplexers - 1-of-16 Decoder - BCD-to-decimal Decoders - Seven-segment Decoders - Encoders – Exclusive-OR Gates. Number Systems and Codes: Binary Number System - ***Acharya Pingala and Binary System*** - Binary-to-decimal Conversion - Decimal-to-binary Conversion - Octal Numbers - Hexadecimal Numbers - The ASCII Code - The Excess-3 Code - The Gray Code.

UNIT III: Arithmetic Circuits and Flip-Flops (12 Hours)

Arithmetic Circuits: Binary Addition - Binary Subtraction - Unsigned Binary Numbers - Sign-magnitude Numbers - 2's Complement Representation - 2's Complement Arithmetic - Arithmetic Building Blocks - The Adder- subtracter - Fast Adder - Arithmetic Logic Unit - Binary Multiplication and Division. Flip-Flops: RS Flip-Flops - Gated Flip-Flops - Edge-triggered RS Flip-Flops – Edge-triggered D Flip-Flops - Edge-triggered JK Flip-Flops - JK Master-slave Flip-Flops.

UNIT IV: Basic Computer Organisation and Design (12 Hours)

Basic Computer Organisation and Design: Instruction codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory Reference Instructions - Input/output and Interrupt – Complete Computer Description - Design of Basic Computer - Design of Accumulator Logic.

UNIT V: Central Processing Unit (12 Hours)

CPU: General Register Organisation - Stack Organisation - Instruction Formats - Addressing Modes - Data Transfer and Manipulation - Program Control - RISC.

Teaching Methodology	Lectures and Presentations, Interactive Discussions and Flipped.
Assessment Methods	MCQs, Quiz, and Group Work.

***5% of IKS included in Unit II**

Books for Study:

1. Leach, D.P., Malvino, A.P., & Saha, G. (2011). *Digital Principles and Application,* (7th Ed.). Tata McGraw-Hill.
   Unit I: *Chapter 1 (Sec: 2.1 to 2.3), Chapter 3 (Sec: 3.1 to 3.9)*
   Unit II: *Chapter 4 (Sec: 4.1 to 4.7), Chapter 5 (Sec: 5.1 to 5.8)*
   Unit III: *Chapter 6 (Sec: 6.1 to 6.11), Chapter 8 (Sec: 8.1 to 8.5, 8.8)*
2. Mano, M.M. (2003). *Computer System Architecture,* (3rd Ed.). Prentice Hall.
   Unit IV: *Chapter 5 (Sec: 5.1 to 5.10)*
   Unit V: *Chapter 8 (Sec: 8.1 to 8.8)*

Books for Reference:

1. Mano, M.M., & Ciletti, M.D. (2008). *Digital Design,* (4th Ed.). Pearson.
2. Rafiquzzaman. (2023). *Microprocessors Theory and Applications.* PHI.
3. Sarangi, S. R. (2014). *Computer Organisation and Architecture*. McGraw-Hill.

Websites and eLearning Sources:

1. https://nptel.ac.in/courses/108/105/108105113/
2. https://www.coursera.org/learn/digital-systems
3. https://www.udemy.com/course/digital-logic-design/
4. https://www.udacity.com/course/computer-architecture--ud007
5. https://nptel.ac.in/courses/106/106/106106166/
6. https://www.booksfact.com/science/ancient-science/pingala-inventor-of-binary-numbers-in-2nd-century-bce.html**(IKS)**
7. https://youtu.be/GPQ5PIiC_7Q?si=tHVNgu3sk1DMDez1**(IKS)**

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Understand the fundamental concepts of logic gates, Boolean algebra, and combinational logic circuits.	**K1**
CO2	Classify different types of data-processing circuits and explain number systems used in digital computing.	**K2**
CO3	Apply the characteristics of combinational and sequential circuits based on digital logic principles.	**K3**
CO4	Analyze the problems related to arithmetic circuits, flip-flops, and digital logic functions in computer architecture.	**K4**
CO5	Evaluate the design and functioning of computer organization, instruction cycle, and CPU operations.	**K5**
CO6	Design and propose optimized digital circuit solutions for computational problems, considering CPU architecture and performance.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25PCA1CC02**		**Core Course - 2:** Digital Computer Architecture							**4**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	2	3	2	2	**2.4**
CO2	3	3	3	2	1	3	3	3	2	2	**2.5**
CO3	2	3	3	2	1	2	3	3	2	2	**2.3**
CO4	3	3	3	2	1	3	3	3	2	2	**2.5**
CO5	3	3	3	1	1	2	3	3	2	2	**2.3**
CO6	3	3	3	2	1	3	3	3	2	2	**2.5**
										Mean Overall Score	**2.41 (High)**

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1CC03	**Core Course – 3:** Advanced Database Systems	4	3

Course Objectives
To provide a strong foundation in data modeling, database design, and relational database management.
To introduce transactions, concurrency and database recovery techniques for ensuring data integrity.
To explore indexing structures and query processing strategies to improve database performance.
To examine distributed database architectures and NoSQL databases for handling non-relational data.
To familiarize students with advanced databases, information retrieval techniques and database security.

UNIT I: Data Modeling and Database Design (12 Hours)

Data Models - Schemas and Instances – Three-Schema Architecture and Data Independence - Database Languages – Database System Environment – Centralized and Client/Server Architecture – Entity Types - Attributes - Keys – Relationship Types – ER Diagrams - Specialization and Generalization. Relational Data Model and SQL: Concepts, Constraints and Schemas – Basic and Complex SQL Queries – Procedures, Triggers and Views. Normalization: Functional Dependencies – Normal Forms.

UNIT II: Transaction and Database Recovery (12 Hours)

Transaction Processing – Transaction and System Concepts – Transaction Properties – Schedules based on Serializability - Transaction Support in SQL. Concurrency Control Techniques: Two-Phase Locking Techniques – Concurrency Control based on Time-Stamp ordering - Validation Techniques for Concurrency - Granularity and Multiple Granularity Locking – Locks for Concurrency Control. Database Recovery: Recovery Concepts. Recovery Techniques: Deferred Update, Immediate Update - Shadow Paging.

UNIT III: Indexing Structures and Query Processing (12 Hours)

Single-Level Indexes – Multilevel Indexes – B-Trees and B+ Trees – Indexes on Multiple Keys – Types of Indexes – General Issues on Indexing – Physical Database Design in Relational Databases. Query Processing: Translating SQL Queries into Relational Algebra and other operators – Algorithms for External Sorting - SELECT, JOIN, PROJECT and SET Operations - Implementing Aggregate Operations and Joins.

UNIT IV: Distributed Databases and NoSQL (12 Hours)

Distributed Database Concepts: Distributed Database Design - Data Fragmentation - Replication and Allocation Techniques – Distributed Database Architectures. NoSQL Databases: NoSQL Systems – CAP Theorem – Document-based Systems and MongoDB – Key-Value-Stores - Column-based or Wide-Column Systems – Graph Databases and Neo4j.

UNIT V: Advanced Database Models, Information Retrieval and Security (12 Hours)

Object-Oriented Database concepts - Temporal Database – Spatial Database – Multimedia Database. Information Retrieval: Concepts – Retrieval Models – Queries in IR Systems – Text Pre-processing. Database Security: Database Security Issues – Discretionary Access Control – Mandatory and Role-based Access Control – SQL Injection.

Teaching Methodology	Flipped Classes, Project-Based Learning, Gamification, Case Studies.
Assessment Methods	MCQ Test, Peer Review Presentations, Group Projects.

Books for Study:

1. Elmasri, R., & Navathe, S. B. (2023). *Fundamentals of Database Systems.* (7th Ed.). Pearson.
   Unit I: *Chapters 2 (Sec: 2.1 to 2.5), 3 (Sec: 3.3, 3.4, 3.7), 4 (Sec: 4.2), 5 (Sec: 5.1, 5.2), 6, 7, and 14*
   Unit II: *Chapters20 (Sec: 20.1 to 20.3, 20.5, 20.6), 21 (Sec: 21.1, 21.2, 21.4 to 21.6), 22 (Sec: 22.1 to 22.4)*
   Unit III: *Chapters 17, 18 (Sec: 18.1 to 18.6)*
   Unit IV: *Chapters 23 (Sec: 23.1, 23.2, 23.7), 24*
   Unit V: *Chapters 12 (Sec: 12.1), 26 (Sec: 26.2 to 26.4), 27 (Sec: 27.1 to 27.4), 30 (Sec: 30.1 to 30.4)*

Books for Reference:

1. Korth, H. F., Silberschatz, A., & Sudarshan, S. (2020). *Database System Concepts*, (7th Ed.). McGraw Hill.
2. Cattell, R. (2011). *Scalable SQL and NoSQL Data Stores*. Springer.

Websites and eLearning Sources:

1. https://online.stanford.edu/courses/soe-ydatabases0003-databases-modeling-and-theory
2. https://www.coursera.org/courses?query=database+design.
3. https://www.mongodb.com/resources/basics/databases/nosql-explained

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall fundamental database concepts, models, normalization techniques, transaction properties, indexing structures, and database security mechanisms.	**K1**
CO2	Explain the principles of relational databases, SQL queries, concurrency control techniques, NoSQL databases, and information retrieval models.	**K2**
CO3	Implement SQL-based relational queries, indexing strategies, concurrency control mechanisms, and security measures in database applications.	**K3**
CO4	Analyze query processing techniques, distributed database architectures, data retrieval models, and advanced database paradigms for efficient data management.	**K4**
CO5	Assess the effectiveness of database design, query optimization strategies, NoSQL models, and security techniques in different data management scenarios.	**K5**
CO6	Design and develop secure, scalable, and high-performance database solutions incorporating modern database technologies.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25PCA1CC03**		**Core Course – 3:** Advanced Database Systems							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	1	1	1	3	2	1	1	1	**1.6**
CO2	3	3	2	2	1	3	3	2	2	1	**2.2**
CO3	3	3	2	3	1	3	3	2	3	1	**2.4**
CO4	3	3	2	3	1	3	3	2	3	1	**2.4**
CO5	2	3	3	2	1	2	3	3	2	1	**2.2**
CO6	2	2	3	2	3	2	2	3	2	3	**2.4**
Mean Overall Score											**2.2 (Medium)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
1	**25PCA1CP01**	**Core Practical – 1:** Data Structures using C++	**5**	**3**

List of Exercises:

C++

1. Class and Objects
2. Functions and Polymorphism
3. Constructors
4. Inheritance
5. Pointers

Data Structures

6. Array
7. Stack
8. Queue
9. Linked List
10. Binary Tree Traversals

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1CP02	**Core Practical – 2:** SQL & NoSQL	3	2

List of Exercises:

SQL

1. DDL, DML and DCL Queries
2. Set Operations, Views and Joins
3. Sub Queries, Indexes, Sequence and Synonyms

PL/SQL

4. Cursors
5. Functions and Procedures
6. Packages and Triggers

NoSQL

7. Collections and Documents
8. Insert, Update, Delete on Documents
9. Querying Documents
10. Sorting and Filtering
11. Aggregation

Small Project

12. Create a database for the e-commerce platform and implement any three concepts from both SQL and PL/SQL

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1ES01A	**Discipline Specific Elective-1:** Accounting and Financial Management	4	3

Course Objectives
To understand the accounting fundamentals to record transactions and prepare financial statements.
To develop the financial statements and rectify errors.
To critically implement depreciation methods and utilize accounting software effectively.
To acquire the skills to prepare and interpret functional and flexible budgets for financial planning.
To evaluate capital investment decisions using strategic budgeting techniques.

UNIT I: The Principles of Accounting (12 Hours)

Basic Accounting Terms – Accounting Equation – Accounting Procedures – Rules of Debit and Credit – Transactions – Journals –Ledgers – Trial Balance.

UNIT II: Final Accounts (12 Hours)

Financial Statements – Trading Account - Profit and Loss Account – Balance Sheet - Adjustments - Error Rectification.

UNIT III: Depreciation (12 Hours)

Depreciation: Meaning of Depreciation - Need - Methods of Charging Depreciation (Straight-line method, Diminishing Balance Method). Accounting Packages**# :** General Framework - Accounting Applications.

UNIT IV: Budgeting (12 Hours)

Budget: Characteristics - Advantages - Classification. Preparation of Budgets: Functional Budgets and Flexible Budgets.

UNIT V: Capital Budgeting (12 Hours)

Meaning of Capital Budget - importance - Methods of Capital Investment. Decision making: Payback period method - Discounted Cash Flow Methods - Accounting or Average Rate of Return Method.

*# **Hands on Session**: Tally. ERP 9, QuickBooks India, Zoho Books, BUSY Accounting, AI Accounting: **Not for Assessment**.*

Teaching Methodology	Lecture-based Teaching, Case-Studies and Problem Solving, Problem based learning.
Assessment Methods	MCQs, Open Book Test, Quiz, Group Work.

Books for Study:

1. Grewal, T.S., (2021). *Double Entry Book Keeping-Solutions for Accountancy-Financial Accounting*. Sultan Chand Sons.
   Unit I: *Chapter 1, Chapter 2*
   Unit II: *Chapter 3*
2. Shukla, M. C., & Grewal, T. S. (1991). *Advanced Accounts*, (19th Ed.). S. Chand & Co.
   Unit III: *Chapter 6*
3. Ramachandran, R. & Srinivasan, S. (2017). *Management Accounting: Theories, Problems and Solutions,* (6th Ed.). Sriram Publications.
   Unit IV: *Chapter 7*
   Unit V: *Chapter 8*

Books for Reference:

1. Maheswari, S. N. (2021). *Principles of Management Accounting*. Sultan Chand Sons.
2. Gupta, R. L. & Radhaswamy, M. (1991). *Advanced Accounts.* Sultan Chand & Sons.

Websites and eLearning Sources:

1. https://online.hbs.edu/subjects/finance-accounting
2. https://www.edx.org/learn/financial-accounting

3. https://www.oxfordhomestudy.com/courses/accounting-courses-online/accounting-certificate-online-free

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall and comprehend the fundamental principles, concepts, and terminologies of accounting.	**K1**
CO2	Explain the purpose and significance of financial statements in business decision making.	**K2**
CO3	Solve accounting problems and make informed decisions based on financial data and analysis.	**K3**
CO4	Analyze the findings from financial analysis and provide insights and recommendations for management.	**K4**
CO5	Assess the effectiveness of the financial and management accounting processes adopted.	**K5**
CO6	Develop new accounting applications based on accounting principles.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
1	**25PCA1ES01A**	**Discipline Specific Elective-1:** Accounting and Financial Management								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	3	2	3	2	2	2	1	**2.2**
CO2	3	3	1	3	2	2	3	2	2	1	**2.2**
CO3	1	2	3	2	2	2	3	2	3	2	**2.2**
CO4	3	3	1	2	1	1	2	3	2	3	**2.1**
CO5	2	3	2	3	3	3	2	2	2	2	**2.4**
CO6	2	3	2	3	3	3	2	2	2	2	**2.4**
Mean Overall Score											**2.25 (High)**

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1ES01B	**Discipline Specific Elective-1:** Graph and Automata Theory	4	3

Course Objectives
To understand the fundamental concepts in graph theory.
To explore the various types of trees and its properties.
To learn the foundations of directed graphs.
To acquire knowledge in finite automaton and regular expression.
To familiarize the formal languages and grammars.

UNIT I: Graph Theory **(12 Hours)**

Paths and Circuits - Isomorphism, Connected and Disconnected Graphs - Walk – Path - Euler graphs - Operations on Graphs - Hamiltonian Paths and Circuits - Travelling Salesman Problem.

UNIT II: Trees **(12 Hours)**

Definition and Properties of Trees - Distance and Centers - Rooted and Binary Trees - Spanning trees. Matrix representation of Graphs: Incidence Matrix - Adjacency Matrix - Circuit Matrix - Fundamental Circuit Matrix.

UNIT III: Directed Graphs **(12 Hours)**

Types of digraphs - Digraph and Binary Relation - Directed Paths - Euler Digraphs - Trees with directed edges. Graph Theoretic Algorithms: Computer representation of a Graph - Algorithms for Spanning tree - Shortest Path from a specified vertex to another specified vertex.

UNIT IV: Automata Theory **(12 Hours)**

Definition of an Automaton – Description of a Finite Automaton (FA) – Transition Systems – Properties of Transition Functions – Acceptability of a string by a FA – Non-Deterministic Finite State Machines – Regular Expressions - Identities for Regular Expressions.

UNIT V: Formal Languages **(12 Hours)**

Basic Definition and Examples – Definition of a Grammar – Derivations and the Language generated by a Grammar - Chomsky Classification of Languages – Context Free Languages (CFL's) and Derivation Trees – Ambiguity in CFG - Chomsky Normal Form. Regular Expressions to Automata: Conversion of an NFA to DFA – Simulation of an NFA - Construction of an NFA from Regular Expression. Optimization of DFA: Minimizing the Number of states of DFA.

(Note: Preference can be given to problem solving instead of proof of theorems in Units III, IV and V)

Teaching Methodology	Lectures, Flipped Classes, Team Teaching.
Assessment Methods	MCQs, Snap Test, Open Book Test, Quiz.

Books for Study:

1. Deo, N. (2016). *Graph Theory with applications to Engineering and Computer Science,* (1st Ed.). Dover Publications.
   Unit I: *Chapter 1: (Sec: 1.1 to 1.5) Chapter 2: (Sec: 2.1, 2.2, 2.4 to 2.10)*
   Unit II: *Chapter 3: (Sec: 3.1 to 3.7) Chapter 7: (Sec: 7.1 to 7.4)*
   Unit III: *Chapter 9: (Sec: 9.1 to 9.6) Chapter 11: (Sec: 11.2, 11.5)*
2. Mishra, K. L. P., & Chandrasekaran, N. (2019). *Theory of Computer Science Automata, Languages and Computation*, (3rd Ed.). PHI Learning.
   Unit IV: *Chapter 3: (Sec: 3.1 to 3.6) Chapter 4: (Sec: 4.1, 4.2) Chapter 5: (Sec: 5.1)*
   Unit V: *Chapter 6: (Sec: 6.1, 6.2, 6.4.1, 6.5)*
3. Aho, A. V., Sethi, R. & Ullman, J.D. (2011). *Compilers Principles, Techniques and Tools*, (2nd Ed.). Pearson Education.
   Unit V: *Chapter 3: (Sec: 3.7.1, 3.7.2, 3.7.4)*

Books for Reference:

1. Douglas, B. W. (2015). *Introduction to Graph Theory*, (2nd Ed.). Pearson Education.
2. John, E. H. & Ullman, J.D. (2002). *Introduction to Automata Theory, Languages and Computation*, Narosa Publishing House.
3. Linz, P. (2011). *An Introduction to Formal Languages and Automata,* Bartlett Publication.

Websites and eLearning Sources:

1. https://www.vssut.ac.in/lecture_notes/lecture1423726104.pdf
2. https://swt.informatik.uni-freiburg.de/teaching/SS2012/AutomataTheory/Resources/Slides/graphAutomata-SeminarSlides-JanLeike.pdf
3. https://aits-tpt.edu.in/wp-content/uploads/2023/08/Automata-Theory-and-Compiler-Design.pdf

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall fundamental concepts of graph theory, automata, and formal languages.	**K1**
CO2	Explain principles of graph operations, automata, and the Chomsky hierarchy of languages.	**K2**
CO3	Apply graph theory, graph theoretical algorithms, automata, and formal language techniques to solve computational problems.	**K3**
CO4	Differentiate and compare graph and digraph types, automata, and parsing techniques while analyzing their impact.	**K4**
CO5	Evaluate different types of graphs, trees, automata and formal languages.	**K5**
CO6	Create simple applications using graphs, trees, graph algorithms, automata and formal languages.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**		**Credits**
1	**25PCA1ES01B**		**Discipline Specific Elective-1:** Graph and Automata Theory						**4**		**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	1	3	3	3	2	1	**2.2**
CO2	3	2	2	2	1	3	3	3	1	1	**2.1**
CO3	3	3	2	2	1	3	3	3	1	2	**2.3**
CO4	3	3	3	1	1	3	3	3	1	1	**2.2**
CO5	3	3	3	2	2	3	3	3	2	2	**2.6**
CO6	3	3	2	3	1	3	3	3	2	2	**2.5**
										Mean Overall Score	**2.31(High)**

Semester	Course Code	Title of the Course	Hours / Weeks	Credits
1	25PCA1AE01	**Ability Enhancement Course:** Programming in Java	2	1

Course Objectives
To understand the fundamentals of Java programming.
To familiarize yourself with Java syntax and control structures.
To gain knowledge of classes and objects.
To analyze the significance of different types of arrays and inheritance.
To explore interfaces and packages in Java.

Unit I: Foundations of Java **(6 Hours)**

Computer Systems - Programming Languages - Stage for Java - Origin of Java - Challenges of Java - Java Features - Java Program Development - Object-oriented Programming - Elements of a Java Program - Java API - Variables and Literals - Primitive Data Types - The String Class – Operators.

Unit II: Control Structures **(6 Hours)**

The If Statement - The If-Else Statement - Nested If Statements - The If-Else-If statement - Logical Operators - Comparing String Objects - The Conditional Operator - The Switch Statement - Increment and Decrement Operators - While Loop - Do-While Loop - For Loop.

Unit III: Classes and Objects **(6 Hours)**

Classes and Objects - Modifiers - Passing Arguments - Constructors - Overloaded Methods - Over loaded Constructors - Returning Objects from Method - The to String Method - Writing an equals method - This Reference Variable.

Unit IV: Arrays and Inheritance **(6 Hours)**

Introduction to Array - Processing Array Contents - Arrays of Objects - Two-dimensional Arrays. Basics of Inheritance - Inheriting and Overriding Superclass Methods - Calling Superclass Constructor Polymorphism - Classes that Inherit from Different Classes - Abstract Classes - Final Class

Unit V: Interface and Package **(6 Hours)**

Basics of Interface - Multiple Interfaces - Multiple Inheritance Using Interface - Multilevel Interface - Packages - Create and Access Packages in Net beans IDE - Static Import and Package Class - Access Specifiers.

Teaching Methodology	Lectures, Flipped Classes, Team Teaching.
Assessment Methods	MCQs, Seminar, Snap Test, Open Book Test, Quiz.

Books for Study:

1. Sagayaraj, Denis, Karthick & Gajalakshmi. (2018). *Java Programming for Core and Advanced Learners*. Universities Press.
   Unit I: *Chapters 1 (Sec: 1.1 to 1.8) 2: (Sec: 2.1 to 2.6)*
   Unit II: *Chapter 3 (Sec: 3.1 to 3.4 & 3.10 to 3.12)*
   Unit III: *Chapter 4 (Sec: 4.1 to 4.4, 4.8 to 4.12)*
   Unit IV: *Chapter 5 (Sec: 5.1, 5.2, 5.7 & 5.8) Chapter 7: (Sec: 7.1 to 7.7)*
   Unit V: *Chapter 8 (Sec: 8.1 to 8.8)*

Books for Reference:

1. Balagurusamy, E. (2014). *Programming with Java, (*5th Ed.). Tata McGraw Hill.
2. Muthu, C. (2011). *Programming with JAVA,* (2nd Ed.). Vijay Nicole Imprints.
3. Schildt, H. (2007). *The Complete Reference Java,* (7th Ed.). Tata McGraw Hill.

Websites and eLearning Sources:

1. https://www.tpointtech.com/java-tutorial
2. https://www.tutorialspoint.com/java/index.htm

3. https://www.sietk.org/downloads/javabook.pdf
4. https://www.cs.cmu.edu/afs/cs.cmu.edu/user/gchen/www/download/java/LearnJava.pdf
5. https://www.youtube.com/watch?v=5NQjLBuNL0I

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Analyze the fundamentals of Object-Oriented Programming (OOP) concepts and Java programming structures.	**K4**
CO2	Assess and implement Object-Oriented solutions using Java.	**K5**
CO3	Develop a Java program utilizing classes, objects, inheritance, interfaces, and packages, adhering to best coding practices.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**		**Credits**
1	**25PCA1AE01**		**Ability Enhancement Course:** Programming in Java						**2**		**1**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	1	1	3	3	3	2	1	**2.1**
CO2	3	3	2	2	1	3	2	3	2	1	**2.2**
CO3	3	3	3	2	2	3	3	2	2	1	**2.4**
										Mean Overall Score	**2.23 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
1	25PCA1OE01A	**Open Elective -1 (WS):** AI Tools & Applications	4	2

Course Objectives
To understand the evolution, impact, and challenges of Generative AI in society and business.
To boost productivity using AI tools for writing, communication, task management, and automation.
To enhance career growth through AI-driven skill development, job search, and content creation.
To apply AI in research, social media, branding, and creative tasks.
To master AI-driven multimedia creation, including video editing, design, and creative writing.

UNIT I: Generative AI (12 Hours)

Unveiling Generative AI: A New Frontier - Tracing the Evolutionary Blueprint of Generative AI - Revolutionizing Societies and Business Ecosystems - Risks and Challenges to Manage - Impact of Generative AI on Jobs.

UNIT II: AI Tools for Personal Productivity (12 Hours)

Types of AI Tools: Categorizing AI Tools - Personal Productivity AI Tools - AI for creativity - Business and Analytical AI Tools - Choosing the Right AI Tools. Writing and Communication Tools: Enhancing Writing Skills – E-Mail Composition and Management - Real Time Communication Aid - Collaborative writing and Editing. Personal Organisation and Planning: Task Management Tools - Scheduling Assistant. Time Saving AI Assistant: Virtual Personal Assistants - Workflow Automation Tools - Intelligent Search and Retrieval - Voice-Activated Productivity

UNIT III: AI Tools for Professional Growth (12 Hours)

Career Development Tools: Resume Optimization - Interview Preparation - Career Path Recommendations - Job Search Automation. Learning and Skill Development: Personalized Learning Platforms - Skill Assessment and Feedback - Language Learning with AI - Technical Skills and Certifications. Professional Writing and Content Creation: AI for Writing Assistance - Content Research and Ideation - Content Creation Tools - Visual Content Creation.

UNIT IV: AI Tools for Research, Social Media and Creative Works (12 Hours)

Research and Analysis: Data Collection Tools - Data Analysis and Insights - Market Research and Competitor Analysis. Networking and Personal Branding: Optimizing LinkedIn Profiles - Social Media Management - Building a Personal Brand with AI. Image Creation and Editing: AI-Powered Photo Editing Tools - Image Generation with AI - Enhancing Creativity with AI - Accessibility and Ease of Use. Music and Audio Tools: AI for Music Composition - Audio Editing with AI - AI in Sound Design - Personalization in Music.

UNIT V: AI Tools for Multimedia content Generation (12 Hours)

Video Creation and Editing: Video Generation with AI - AI-Driven Video Editing Platforms - Scriptwriting and Storyboarding - Enhancing Visual Effects - Accessibility for Beginners. Design and Visual Content: Logo and Branding Design - Layout and Presentation Tools - 3D and AR Design - Customizable Templates. Creative Writing Assistance: Idea Generation and Brainstorming - Drafting and Editing - Writing for Different Formats.

Teaching Methodology	Lectures with Multimedia Presentations, Hands-on Practical Sessions, Case Studies and Industry Applications, AI Tool Demonstrations, Interactive Workshops, Industry Collaboration and Guest Lectures.
Assessment Methods	Self-Assessment, ICT Tools based Automated Grading Assessment, Capstone Project, Activity based Assessment, Gamified Assessment.

Books for Study:

1. Marr, B. (2024). *Generative AI in practice: 100+ amazing ways generative artificial intelligence is changing business and society.* Wiley.
   Unit I: *Chapter 1*

2. Basu, A. (2025). *AI tools for everyone: Your guide to artificial intelligence.* Aditya Basu - Professional Books.
   Unit II: *Chapters 2 (sec: 2.2), Chapter 3 (Sec: 3.1, 3.2, 3.4)*
   Unit III: *Chapter 4* (*Sec: 4.1, 4.2, 4.3)*
   Unit IV: *Chapter 4 (Sec: 4.4, 4.5), Chapter 5(5.1, 5.2)*
   Unit V: *Chapter 5(5.3, 5.4, 5.5)*

Books for Reference:

1. Deshmukh, J. (2024). *AI Tools for Everyone: 119 Best AI Tools to Master Everyday Tasks.* Independent publisher.
2. Olson, P. (2024). *Supremacy: AI, Chat GPT, and the Race That Will Change the World* (1st Ed.). Financial Times Publishing.
3. Deshmukh, J. (2024). *Building a Career in AI: A Practical Guide for Aspiring Professionals*, (1st Ed.). Independent publisher.

Websites and eLearning Sources:

1. https://ai.gov.ae/wp-content/uploads/2023/04/406.-Generative-AI-Guide_ver1-EN.pdf
2. https://hbr.org/topic/artificial-intelligence
3. https://www.unesco.org/en/artificial-intelligence/education
4. https://www.retaildive.com/
5. https://towardsdatascience.com/

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall the fundamentals of AI, its evolution, impact on businesses and society, and associated risks and challenges.	**K1**
CO2	Understand various AI tools for personal productivity, creativity, business analytics, communication, task management, and automation.	**K2**
CO3	Apply AI tools for career development, learning, skill enhancement, job search, content creation, and professional writing.	**K3**
CO4	Analyze AI applications in research, data analysis, social media management, networking, branding, and creative domains like image and music generation.	**K4**
CO5	Evaluate AI-driven tools for multimedia content creation, including video generation, design, visual effects, and writing assistance.	**K5**
CO6	Design AI-based solutions to improve efficiency in productivity, research, career growth, content development, and multimedia generation.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25PCA1OE01A**		**Open Elective (WS):** AI Tools & Applications							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	2	2	2	3	2	2	2	2	**2.2**
CO2	3	3	2	2	1	3	3	2	2	3	**2.4**
CO3	2	3	3	2	2	2	3	3	2	2	**2.4**
CO4	3	3	3	2	2	2	3	3	3	2	**2.6**
CO5	2	2	2	3	3	2	2	2	3	3	**2.4**
CO6	3	3	3	2	2	2	3	3	2	2	**2.5**
									Mean Overall Score		**2.41 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
1	25PCA1OE01B	**Open Elective - 1(WS):** Internet of Things	4	2

Course Objectives
To grasp the core concepts and technologies behind the Internet of Things (IoT) and explore practical applications.
To learn the principles for creating connected devices, focusing on communication technologies and gateway-level data management.
To gain proficiency in communication protocols and web connectivity solutions for connected devices.
To analyze IP addressing, MAC layer, and application protocols for efficient data handling and processing.
To collect, store, and process data using cloud platforms in IoT applications, leveraging cloud computing paradigms and service models.

UNIT I: Internet of Things (12 Hours)

Internet of Things - IoT Conceptual Framework - IoT Architectural View - Technology Behind IoT - Sources of IoT - M2M Communication - Examples of IoT.

UNIT II: Design Principles for Connected Devices (12 Hours)

IoT/M2M Systems Layers and Design Standardisation - Communication Technologies - Data Enrichment - Data Consolidation and Device Management at Gateway.

UNIT III: Communication Protocols and Web Connectivity (12 Hours)

Web Communication Protocols for Connected Devices - Message Communication Protocols for Connected Devices - Web Connectivity for Connected Devices - Network using Gateway - SOAP - REST - HTTP - RESTful and Web Sockets.

UNIT IV: Internet Connectivity Principles (12 Hours)

Internet Connectivity - Internet Based Communication - IP Addressing in IoT - Media Access Control. - Application Layer Protocols: HTTP - HTTPS - FTP - Telnet and Others. Data Acquiring: Organising - Processing and Analytics - Data Acquiring and Storage - Organising the Data Analytics.

UNIT V: Data Collection, Storage and Computing using Cloud Platforms (12 Hours)

Cloud Computing Paradigm for Data Collection, Storage and Computing - Everything as a Service and Cloud Service Models. Sensor and Wireless Sensor Networks: Sensor Technology - Participatory Sensing, Industry IoT and Automative IoT - Actuator - Sensor Data Communication Protocols - Radio Frequency Identification Technology - Wireless Sensor Networks Technology.

Teaching Methodology	Flipped Classroom, Project-Based Learning, Gamification, Case Studies.
Assessment Methods	MCQ Test, Peer Review Presentations, Group Projects.

Books for Study:

1. Kamal, R. (2017). *Internet of Things: Architecture and Design Principles*, (1st Ed.). McGraw Hill Education.
   Unit I: *Chapter 1*
   Unit II: *Chapter 2*
   Unit III: *Chapter 3*
   Unit IV: *Chapter 4, Chapter 5*
   Unit V: *Chapter 6, Chapter 7*

Books for Reference:

1. Vasudevan, S. K., Nagarajan, A. S., & Sundaran, R. M. D. (2020). *Internet of Things*, (2nd Ed.). Wiley Publication.
2. Hassan, Q. F. (2018). *Internet of Things A to Z: Technologies and Applications*. Wiley Publication.
3. Hanes, D., Salgueiro, G., Grossetete, P., Barton, R., & Henry, J. (2017). *IoT fundamentals: Networking technologies, protocols, and use cases for the Internet of Things.* Cisco Press.

Websites and eLearning Sources:

1. https://www.shiksha.com/online-courses/industrial-internet-of-things-iiot-course-courl405
2. https://www.tinkercad.com/
3. https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
4. https://www.oracle.com/in/internet-of-things/what-is-iot/
5. https://www.ibm.com/topics/internet-of-things

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall the fundamental concepts, architecture, and technologies of the Internet of Things (IoT).	**K1**
CO2	Understand the design principles, layers, and communication technologies used in IoT systems.	**K2**
CO3	Apply knowledge of communication protocols and web connectivity to develop connected IoT applications.	**K3**
CO4	Analyze IP addressing schemes, MAC layer functionalities, and application protocols for effective data management in IoT networks.	**K4**
CO5	Synthesize data acquisition, organization and processing techniques for IoT Applications, showcasing advanced problem solving abilities.	**K5**
CO6	Design and implement practical IoT solutions by integrating sensors, wireless communication, and cloud platforms.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
1	**25PCA1OE01B**		**Open Elective (WS):** Internet of Things							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	3	2	1	3	2	3	2	2	**2.3**
CO2	3	3	3	3	2	3	3	3	2	2	**2.7**
CO3	2	3	2	2	1	3	3	2	2	1	**2.1**
CO4	3	3	3	2	2	3	3	3	3	2	**2.7**
CO5	3	3	3	3	2	3	3	3	3	2	**2.8**
CO6	3	3	2	2	2	2	3	3	2	3	**2.5**
										Mean Overall Score	**2.51 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
1	25PGC1SL01	**Self-Learning Course:** Global Citizenship Education	Online	1

Course Objectives
To develop an understanding of global governance structures, rights and responsibilities.
To recognize and respect differences, multiple identities and diversity.
To examine beliefs and perceptions about social justice, equality and civic engagement.
To develop attitudes of care and empathy for others and the environment.
To develop global competence and ethical considerations by enhancing communication and collaboration skills across cultures

UNIT I: Introduction to Global Citizenship

01. Historical and Philosophical Foundations of Global Citizenship
02 Rights and Responsibilities of Global Citizenship
03. Key Organizations and Movements Promoting Global Citizenship

UNIT II: Globalization and Its Impact on Society

04. Globalization and Its Key Drivers
05. Positive and Negative Impacts of Globalization
06. Role of Education in Fostering a Global Perspective

UNIT III: Human Rights, Social Justice, Equality and Diversity

07. Key Human Rights Treaties, Frameworks and Declarations
08. Advocacy, Activism, and Movements for Social Justice and Equality
09. Global Challenges to Human Rights, Equality and Diversity

UNIT IV: Sustainable Development and Environmental Responsibility

10. The Sustainable Development Goals and Their Relevance to Global Citizenship
11. Climate Change, Environmental Degradation and Sustainable Development
12. Strategies for Promoting Environmental Responsibility

UNIT V: Building Global Competence and Engagement

13. Effective Communication and Collaboration Across Cultures
14. Volunteering and Community Engagement in Global Initiatives
15. Ethical Considerations in Global Citizenship

Teaching Methodology	Recorded Lectures/Videos, Reading Materials, PPTs, Case Studies, Collaborative Projects, Quizzes and Polls
Assessment Methods	Seminars, Assignments, MCQs, Reflection Essays, Group Project Presentations, Problem-Solving Scenarios

Books for Study:

1. Clapham, A. (2007). *Human rights: A very short introduction.* Oxford University Press.
2. Desai, A. (2018). *Global citizenship and cultural diplomacy: India's role in a changing world*. Routledge India.
3. Gould, J. A. (2012). *The ethics of global citizenship*. Routledge.
4. Held, D., et al. (2022). *Globalization and its impact on the developing world*. Cambridge University Press.
5. Sen, A. (2009). *The idea of justice*. Penguin Books India.

Books for Reference:

1. Ghosh, A. (2007). *The global impact of Indian civilization*. HarperCollins India.
2. Krecker, E. (2008). *The global citizen: A guide to creating an international life and career*. Career Press.
3. Kumar, R. (2017). *Sustainable development and environmental justice in India*. Oxford University Press.

4. Nair, K. G. (2014). *Human rights: A socio-political perspective*. Orient Blackswan.
5. Patel, V. (2015). *Social justice and equality in India: Theories and practices*. Oxford University Press.
6. Pillai, V. (2016). *Globalization and its impact on Indian society*. SAGE Publications India.

Websites and eLearning Sources:

1. https://www.unesco.org/en/global-citizenship-peace-education/need-know
2. TEDxCincinnati: Global Citizenship in the Classroom: Jenny Buccos at TEDxCincinnati https://www.youtube.com/watch?v=6jjLHmyBs7o
3. Social justice -- is it still relevant in the 21st century? | Charles L. Robbins | TEDxSBU https://www.youtube.com/watch?v=Wtroop739uU
4. Are We the Last Generation — or the First Sustainable One? | Hannah Ritchie | TED https://www.youtube.com/watch?v=Kl3VVrggKz4
5. Diversity, Equity & Inclusion. Learning how to get it right | Asif Sadiq | TEDxCroydon https://www.youtube.com/watch?v=HR4wz1b54hw

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall the historical, philosophical and practical foundations of global citizenship.	**K1**
CO2	Explain the key drivers of globalization and the role of education in fostering a global perspective.	**K2**
CO3	Apply human rights frameworks, social justice principles, and advocacy strategies to real-world challenges.	**K3**
CO4	Analyze the relevance of the Sustainable Development Goals in addressing climate change and environmental degradation.	**K4**
CO5	Develop strategies for fostering global competence by enhancing communication and collaboration skills across cultures.	**K5**
CO6	Critically evaluate the effectiveness of current global strategies and policies in addressing social justice and environmental sustainability.	**K6**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2CC04	**Core Course - 4:** Programming Smart Devices (Internship Embedded Course)	4	4

Course Objectives
To provide a clear understanding of object-oriented programming concepts, libraries, and asynchronous programming techniques.
To explain the architecture, rendering process, and widget-based UI development to create cross-platform mobile applications.
To demonstrate interactive and responsive UIs using built-in and custom widgets while handling user input and gestures effectively.
To assess design and Cupertino styling, apply dynamic layouts, and implement smooth navigation and screen transitions.
To develop Firebase for authentication, cloud storage, Firestore database and machine learning, enhancing app functionality and performance.

UNIT I: Basics of Dart **(12 Hours)**

Getting started with Dart - Understanding Flutter using Dart - The structure of the Dart Language - OOP in Dart. Intermediate Dart Programming: Dart classes and constructors - Interfaces, abstract classes, and mixins - Understanding Dart Libraries and Packages.

UNIT II: Fundamentals of Flutter **(12 Hours)**

Async programming with Futures and Isolates - Unit testing with Dart - Comparisons with other mobile app development frameworks - Flutter Compilation (Dart) - Flutter rendering - Widgets - Hello Flutter.

UNIT III: Widgets **(12 Hours)**

Building Layouts in Flutter stateful versus stateless widgets - Built-in widgets - understanding built-in layout widgets - Creating a UI with widgets. Handling User Input and Gestures: Handling user gestures - Input widgets - Validating Input (Forms) - Custom input and Form Field.

UNIT IV: Theming and Styling **(12 Hours)**

Theme widgets - Material Design - iOS Cupertino - Using custom fonts - Dynamic styling with Media Query and Layout Builder. Routing: Navigating between screens - Understanding the Navigator widget - Named routes - Screen transitions - Hero animations.

UNIT V: Firebase plugins **(12 Hours)**

Firebase Overview - Firebase authentication - NoSQL database with Cloud Firestore - Cloud Storage with Firebase Storage - Ads with Firebase AdMob - ML with Firebase ML Kit.

Teaching Methodology	Lecture-based Teaching, Case-Studies and Problem Solving.
Assessment Methods	MCQs, Open Book Test, Quiz, Group Work.

Books for Study:

1. Biessek, A. (2019). *Flutter for Beginners*. Packt Publishing.
   Unit I: *Chapter 1, Chapter 2*
   Unit II: *Chapter 3*
   Unit III:*Chapter 4, Chapter 5*
   Unit IV: *Chapter 6, Chapter 7*
   Unit V: *Chapter 8*

Books for Reference:

1. Sade, J. & Galloway, M. (2020). *Dart Apprentice*. Razeware LLC.
2. Windmill, E. (2019). *Flutter in Action*. Manning Publications.
3. Biessek, A. (2021). *Flutter for Beginners: An Introductory Guide to Building Cross-Platform Mobile Applications with Flutter 2.5 and Dart*. Packt Publishing.

Websites and eLearning Sources:

1. https://www.udemy.com/course/learn-flutter-dart-to-build-ios-android-apps
2. https://Flutter Course for Beginners – 37-hour Mobile App Development Tutorial
3. https://docs.flutter.dev/get-started/install

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Identify features of Dart programming by understanding its syntax, object-oriented principles, and asynchronous programming techniques.	**K1**
CO2	Understand cross-platform mobile applications using Flutter, leveraging its widget-based architecture for efficient UI development.	**K2**
CO3	Apply user interfaces using stateful and stateless widgets, handling user inputs, gestures, and form validation.	**K3**
CO4	Analyze theming, styling, and navigation techniques to create visually appealing and user-friendly mobile applications with smooth transitions.	**K4**
CO5	Evaluate Firebase services, cloud storage using Firebase ML Kit.	**K5**
CO6	Design and develop mobile applications for real-time problems using Dart and Flutter.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**		**Credits**
2	**25PCA2CC04**		**Core Course - 4:** Programming Smart Devices (Internship Embedded Course)						**4**		**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	1	1	3	3	3	2	1	**2.1**
CO2	3	3	2	2	1	3	2	3	2	1	**2.2**
CO3	3	3	3	2	2	3	3	2	2	1	**2.4**
CO4	3	2	2	2	1	3	3	2	2	2	**2.2**
CO5	3	3	3	2	2	3	3	3	2	3	**2.7**
CO6	3	3	3	2	2	3	2	2	2	1	**2.3**
										Mean Overall Score	**2.31 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2CC05	**Core Course - 5:** Software Engineering	4	4

Course Objectives
To understand the fundamental principles, evolving nature, and various process models of software engineering.
To develop proficiency in requirements engineering, including elicitation, analysis, modeling, and validation of software requirements.
To acquire design concepts and skills, focusing on architectural design, user interface design, and software modeling techniques.
To learn diverse software testing strategies applicable to conventional, object-oriented, web, and mobile applications.
To gain knowledge of project management concepts and software quality metrics for efficient software development.

UNIT I: The Nature of Software and Process Models (12 Hours)

The Nature of Software -The Changing Nature of Software. Software Engineering: Defining the Discipline – The Software Process – Software Engineering Process – Software Development Myths. Process Models: Prescriptive Process Models – Specialized Process Models – The Unified Process – Personal and Team Process Models – Process Technology – Product and Process. Agile Development: Meaning of Agility and Cost of Change – Agile Process – Extreme Programming.

UNITII: Understanding Requirements and Requirements Modeling (12 Hours)

Requirements Engineering – Establishing Groundwork – Eliciting Requirements – Developing Use Cases – Building the Analysis Model – Negotiating Requirements – Requirements Monitoring – Validating Requirements – Avoiding common mistakes. Scenario-Based Methods: Requirements Analysis – Scenario-Based Modeling – UML models that supplement the use cases. Class-Based Methods: Identifying Analysis Classes – Specifying Attributes – Defining Operations – Class-Responsibility – Collaborator Modeling – Associations and Dependencies – Analysis Packages.

UNIT III: Design Concepts and Architectural Design (12 Hours)

The Design Process – Design Concepts – The Design Model. Architectural Design: Software Architecture – Architectural Genres – Architectural Styles – Architectural Considerations – Architectural Decisions – Architectural Design – Assessing Alternative Architectural Design. User Interface Design: The Golden Rules – User Interface Analysis and Design – Interface Analysis – Interface Design Steps – WebApp and Mobile Interface Design.

UNIT IV: Testing Strategies and Testing Conventional Applications (12 Hours)

A Strategic Approach to Software Testing – Strategic Issues - Test Strategies for Conventional Software – Test Strategies for Object-Oriented Software – Test Strategies for WebApp – Test Strategies for Mobile App – Validation Testing – System Testing – The Art of Debugging. Testing Conventional Applications: Software Testing Fundamentals – Internal and External Views of Testing – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing – Model Based Testing – Testing Documentation and help facilities – Testing for Real Time Systems – Pattern for Software Testing.

UNIT V: Managing Software Projects (12 Hours)

The Management Spectrum – People – The Product – The Process – The Project – W5H Principle – Critical practices. Process and Project Metrics: Metric in the Process and Project Domains – Software Measurement – Metrics for Software Quality – Integrating Metrics within the Software Process – Metrics for small Organizations – Establishing a Software Metrics Program.

Teaching Methodology	Lectures and Presentations, Interactive Discussions, Case Studies, Collaborative Learning and Flipped Method.
Assessment Methods	MCQs, Quiz, and Group Work.

Books for Study:

1. Pressman, R.S., & Maxim, B.R. (2019). *Software Engineering: A Practitioner's Approach,* (8th Ed.). McGraw Hill.
   Unit I: *Chapter 1 (Sec: 1.1 to 1.2), Chapter 2 (Sec: 2.1 to 2.4), Chapter 4 (Sec: 4.1 to 4.6), Chapter 5 (Sec: 5.1 to 5.4)*
   Unit II: *Chapter 8 (Sec: 8.1 to 8.9), Chapter 9 (Sec: 9.1 to 9.3), Chapter 10 (Sec: 10.1 to 10.6)*
   Unit III: *Chapter 12 (Sec: 12.2 to 12.4), Chapter 13 (Sec: 13.1 to 13.7) Chapter 15 (Sec: 15.1 to 15.5)*
   Unit IV: *Chapter 22 (Sec: 22.1 to 22.9), Chapter 23 (Sec: 23.1 to 23.10)*
   Unit V: *Chapter 31 (Sec: 31.1 to 31.7), Chapter 32 (Sec: 32.1 to 32.6)*

Books for Reference:

1. Sommerville, I. (2021). *Software Engineering,* (10th Ed.). Pearson.
2. Fairley, R. (2017). *Software Engineering Concepts*. McGraw Hill.

Websites and eLearning Sources:

1. https://nptel.ac.in/courses/106/105/106105087/
2. https://www.coursera.org/learn/software-processes
3. https://www.udacity.com/course/software-development-process--ud805
4. https://www.udemy.com/course/software-engineering-basics/
5. https://www.tutorialspoint.com/software_engineering/index.htm

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall the basic concepts of Software Engineering.	**K1**
CO2	Interpret the necessities to develop the Software.	**K2**
CO3	Apply the methods and techniques in practical projects.	**K3**
CO4	Compare the various software development methods and understand the context in which each approach might be applicable in real-world scenarios.	**K4**
CO5	Evaluate the effectiveness of an organization's software development practices and suggest improvements.	**K5**
CO6	Build the tools and techniques for large-scale software systems development.	**K6**

Relationship Matrix											
Semester	**Course Code**			**Title of the Course**						**Hours**	**Credits**
2	**25PCA2CC05**			**Core Course - 5:** Software Engineering						**4**	**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	1	3	2	3	2	3	**2.5**
CO2	2	3	3	2	2	2	3	2	1	3	**2.3**
CO3	3	2	3	2	2	3	2	2	2	2	**2.3**
CO4	3	3	2	2	2	3	3	3	2	3	**2.6**
CO5	2	3	3	2	1	3	3	2	2	3	**2.4**
CO6	2	3	3	2	1	3	3	2	2	3	**2.4**
									Mean Overall Score		**2.41 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2CC06	**Core Course - 6:** Data Analysis using Python (Internship Embedded Course)	4	4

Course Objectives
To understand the Data Science process, including data collection, processing, analysis, and visualization.
To acquire skills on NumPy and effectively working with NumPy structured arrays.
To import data manipulation skills using Pandas and perform vectorized string operations.
To enhance data visualizing skills using Matplotlib and Seaborn.
To provide a comprehensive understanding of the different types of machine learning—Supervised, Unsupervised, and Reinforcement Learning—and their respective applications.

UNIT I: Fundamentals of Data Science (12 Hours)

Data Science: Data science Venn diagram - Basic terminology - Data science case studies - Types of data - levels of data. Types of Data Analytics: Descriptive Analytics - Diagnostic Analytics- Predictive Analytics - Prescriptive Analytics- Five steps of Data Science.

UNIT II: NumPy (12 Hours)

Numpy: Basics of NumPy Array-Computation on NumPy Array - Aggregations - Broadcasting - Comparisons - Masks and Boolean Logic- Sorting Arrays - NumPy Structured Array.

UNIT III: Pandas (12 Hours)

Data Manipulation with Pandas: Panda Objects - Data Indexing and Selection - Operating Data on Pandas - Handling Missing Data - Hierarchical Indexing - Combining Data Sets - Vectorized String Operations - Working with Time Series.

UNIT IV: Matplotlib (12 Hours)

Visualization with Matplotlib: Simple Line Plots - Simple Scatter Plots - Density and Contour Plots - Histograms - Binnings and Density - Customizing Plot Legends -Customising Colorbars - Multiple Subplots - Text and Annotation - Three Dimension Plotting in Matplotlib - Geographic Data with Base Map - Visualization with Seaborn.

UNIT V: Machine Learning (12 Hours)

Machine learning: Categories of Machine Learning. Scikit Learn: Data Representation in Scikit - Learn - Scikit – Learn's Estimator API - Applications. Hyperparameters and Model Validation: Naive Bayes Classification-Bayesian: Classification - Gaussian Naïve Bayes - Multinomial Naïve Bayes. Linear Regression: Simple Linear Regression - Basis Function Regression - Regularization.

Teaching Methodology	Lecture Based Instruction, Peer Learning, Group Discussion, Videos, Demonstration, and Hands on sessions.
Assessment Methods	MCQs, Seminar, Test, Quiz, Mini Project, Group Project, Peer Work,Group Work.

Books for Study:

1. Sinan, O. (2016). *Principles of Data Science*. Packt Publishing.
   Unit I: *Chapters 1, Chapter2 and Chapter3*
2. Plas, V. J. (2016). *Python Data Science Handbook: Essential Tools for Working with Data* (1st Ed.). O'Reilly Media.
   Unit II*: Chapter 2*
   Unit III*:Chapter 3*
   Unit IV*:Chapter 4*
   Unit V*: Chapter 5*

Books for Reference:

1. Chun, W. J. (2006). *Core Python Programming*, (2nd Ed.). Prentice Hall Publication.
2. Raschka.S., & Mirjalili, V (2019). *Python Machine Learning*, (3rd Ed.). Packt Publishing.

3. Boschetti, A., & Massaron, L. (2018). *Python Data Science Essentials*, (3rd Ed.). Packt Publishing.

Websites and eLearning Sources:

1. https://towardsdatascience.com/
2. https://jupyter.org/
3. https://pandas.pydata.org/pandas-docs/stable/
4. https://www.coursera.org/learn/machine-learning

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall the basic concepts, terminology, and principles of data science, NumPy, Pandas, Matplotlib, and machine learning.	**K1**
CO2	Explain the types of data analytics, data structures in NumPy and Pandas, visualization techniques in Matplotlib, and machine learning categories and algorithms.	**K2**
CO3	Apply NumPy for array computations, Pandas for data manipulation, Matplotlib for data visualization, and machine learning techniques to real-world datasets.	**K3**
CO4	Analyze datasets using different data manipulation techniques in Pandas, and evaluate various machine learning models based on their performance metrics.	**K4**
CO5	Assess the effectiveness of data science techniques, visualizations, and machine learning models by applying them to case studies and real-world problems.	**K5**
CO6	Design data manipulation techniques using Pandas, Matplotlib for data visualization and evaluate various machine learning models.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**						**Hours**		**Credits**
2	**25PCA2CC06**		**Core Course - 6:** Data Analysis using Python (Internship Embedded Course)						**4**		**4**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	3	2	2	2	**2.4**
CO2	3	3	2	2	1	3	3	3	2	3	**2.5**
CO3	3	3	2	2	2	3	3	2	2	3	**2.5**
CO4	3	3	3	2	1	3	3	3	2	3	**2.6**
CO5	3	3	3	2	1	3	3	3	2	3	**2.6**
CO6	3	3	3	2	1	3	3	3	2	3	**2.6**
										Mean Overall Score	**2.53 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2CP03	**Core Practical - 3:** Programming Smart Devices	5	3

List of Exercises:

1. Basic Programs in Dart
2. Classes and Constructors in Dart
3. Working with Dart Libraries and External Packages
4. Creating a Simple "Hello Flutter" Application
5. Building Interactive UI Using Flutter Widgets
6. State Management with Stateful and Stateless Widgets
7. Handling User Input Handling and Form Validation in Flutter
8. Implementing Theming, Custom Fonts, and Dynamic Styling
9. Navigation and Routing Between Multiple Screens
10. Asynchronous Programming and API Integration
11. Firebase Authentication and User Management
12. Cloud Firestore Integration for Data Storage and Retrieval

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2CP04	**Core Practical - 4:** Data Analysis using Python	5	3

List of Exercises:

Data Analysis - NumPy

1. NumPy Arrays,
2. Sorting and Searching on Arrays

Data Analysis - Pandas

3. Data Series
4. Data Frame
5. Combining and Merging Data Sets
6. Handling Missing Values, Filter, Grouping and Aggregation

Visualization – Matplot Lib & Seaborn

7. MatPlot Lib - Line Chart, Scatter Plot, Histogram
8. Seaborn - Boxplot, Heat Map

Machine Learning

9. Transforming Data for Machine Learning
10. Naive Bayes classification
11. Linear regression.

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2OE02A	**Open Elective – 2 (BS):** Web Design	4	2

Course Objectives
To understand the fundamental concepts of HTML together with their role in web development.
To develop responsive web pages using HTML.
To learn how to style web pages effectively using CSS selectors, properties and values.
To explore advanced CSS features like animations, transitions, and flex box for enhancing web design.
To implement web accessibility guidelines to make websites inclusive for all users.

UNIT I: HTML Structure (12 Hours)

Basics of HTML: Starting Web Page - Creating a Title - Creating Headings - Grouping Headings - Creating a Header - Marking Navigation - Creating an Article - Defining a Section - Specifying an Aside - Creating a Footer - Creating Generic Containers.

UNIT II: Text and Link (12 Hours)

Working with Text: Starting a New Paragraph - Creating a Figure - Specifying Time - Quoting Text - Highlighting Text - Explaining Abbreviations - Creating Superscripts and Subscripts - Creating a Line Break. Images: Inserting Images on a Page - Specifying Image Size. Link: Creating a Link to another Web Page - Creating Anchors - Linking to a Specific Anchor.

UNIT III: Working with Stylesheets (12 Hours)

Fundamentals of the Stylesheets: Creating an External Style Sheet - Linking to External Style Sheets - Creating an Embedded Stylesheet - Applying Inline Styles. Defining Selectors: Constructing Selectors - Selecting Elements by Name - Selecting Elements by Class or ID - Selecting Elements by Context - Combining Selectors.

UNIT IV: Formatting Text with Styles (12 Hours)

Font: Choosing a Font Family - Specifying Alternate Fonts - Creating Italics - Applying Bold Formatting - Setting the Font Size - Setting the Line Height - Setting All Font Values at Once - Setting the Color - Changing the Text's Background. Layout with styles: The Box Model - Changing the Background - Setting the Height or Width for an Element - Setting the Margins around an Element - Adding Padding around an Element - Setting the Border - Positioning Elements in 3D - Displaying and Hiding Elements.

UNIT V: List and Tables (12 Hours)

List: Creating Ordered and Unordered Lists - Styling Nested Lists - Creating Description Lists. Forms: Creating Forms - Processing Forms - Organizing the Form Elements - Creating Text Boxes - Creating Password Boxes - Creating Radio Buttons - Creating Select Boxes - Creating Checkboxes - Creating a Submit Button - Using an Image to Submit a Form. Video, Audio, and Multimedia: Video File Formats - Adding Video to Web Page - Adding Audio File Formats - Adding Audio File to Web Page - Getting Multimedia Files. Tables: Structuring Tables - Spanning Columns and Rows.

Teaching Methodology	Demonstration and Case-study
Assessment Methods	MCQs, Seminar.

Books for Study:

1. Elizabeth, C. & Bruce, H. (2012). *HTML5 & CSS3,* (7th Ed.). Peachp it Press.
   Unit I : *Chapter 1, Chapter 2, Chapter 3*
   Unit II: *Chapter 4, Chapter 5, Chapter 6*
   Unit III: *Chapter 8, Chapter 9*
   Unit IV: *Chapter 10, Chapter11*
   Unit V: *Chapter 15, Chapter 16, Chapter 17*

Books for Reference:

1. Alexis, G., Louis, L. & Estelle W. (2011). *HTML5 & CSS3 for the Real World*. Site Point.
2. Matthew, M. (2011). *HTML5: The Missing Manual*. Kogent Learning Solutions.

Websites and eLearning Sources:

1. www.developer.mozilla.org
2. www.w3schools.com
3. www.freecodecamp.org
4. www.css-tricks.com
5. www.frontendmentor.io

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall the basics structure of HTML and CSS documents and the core elements used in web development.	**K1**
CO2	Understand the various HTML tags and CSS attributes and their usage in creating web pages.	**K2**
CO3	Apply CSS styling techniques to style web pages, including layouts and colour schemes.	**K3**
CO4	Analyse and implement responsive design using CSS to make web pages adaptive across devices.	**K4**
CO5	Create well-structured and semantic HTML web pages using advanced HTML tags in Tables, Forms and Multimedia.	**K5**
CO6	Design interactive and visually appealing user interfaces using HTML and CSS.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**25PCA2OE02A**		**Open Elective - 2 (BS):** Web Design							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	1	2	1	3	3	3	2	2	**2.2**
CO2	3	3	1	2	1	3	3	3	2	2	**2.3**
CO3	3	2	2	3	2	3	3	3	2	3	**2.6**
CO4	3	2	2	3	1	3	3	3	2	3	**2.5**
CO5	3	3	2	3	1	3	3	3	2	3	**2.6**
CO6	3	3	2	3	1	3	3	2	2	3	**2.5**
										Mean Overall Score	**2.45 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PCA2OE02B	**Open Elective – 2 (BS):** Cyber Security	4	2

Course Objectives
To introduce the fundamentals of cyber security and its importance.
To analyze various cyber threats, vulnerabilities, and risks.
To understand security components, techniques, and defense mechanisms.
To explore defense strategies, and authentication techniques of cyber security.
To familiarize with the fundamentals of cryptography and cyber security mechanisms.

UNIT I: Basics of Cyber Security (12 Hours)

Cyber Security: The Need of the Hour - Changing Landscape of Cyber Security and Cyber Crimes - Cyber Crimes to Cyber Warfare – Cyber Security. The CIA Triad: Confidentiality - Integrity - Availability. Reasons for Cyber Crimes: Ease of Committing Crime - Reward to Risk Ratio - Anonymity - Hacktivism - Espionage.

UNIT II: Cyber Threats and Vulnerabilities (12 Hours)

Need for Cyber Security - Damage to Organizations. History of Cyber Crime: Evolution of Cyber Crimes - Cyber Crime Classification. Types of Cyber Crimes: Phishing Scams - Cyber Bullying - Identity Theft - Cyber Stalking - Hacking - Logic Bombs - DDoS Attack - Salami Attack - Email Bombing - Piracy - Malware.

UNIT III: Cyber Security Components and Mechanisms (12 Hours)

OSI Layer. Zero day attacks: Risks of zero day - Network Security - Basics of Networks - Network Terminology - Types of Network Attacks - Common Type of Network Attacks - Unauthorized Access - Man in the Middle Attacks - Code and SQL injection attacks - Privilege Escalation - Insider Threats.

UNIT IV: Defense Strategies of Cyber Attacks (12 Hours)

Application Security - Mobile Security - Data Security - Infrastructure Security. Defense in Depth: Physical Security - Authentication Techniques - Biometric - Password Security and Management.

UNIT V: Cryptography and Cyber Security Mechanisms (12 Hours)

Cryptography Fundamentals: History - RSA - Encryption Application and Protocols. Firewalls: History - Generations - Types. Data loss Prevention - Antivirus software - Virtual Private Network - Web Browsers - Data Backup.

Teaching Methodology	Blended Learning Method, Flipped Classroom Approach, Hands-on Practical Sessions, Case Study Analysis, Workshops & Seminars, Group Discussions & Peer Learning.
Assessment Methods	Online Quiz, Practical Assignment, Case Study Analysis Presentation and Seminars, and Viva Voce.

Books for Study:

1. Shinde, A. (2021). *Introduction to Cyber Security: Guide to the World of Cyber Security.* Notion Press.
   Unit I: *Chapter 1 (Sec: 1.1), Chapter 2 (Sec: 2.1 to 2.3)*
   Unit II: *Chapter 2(Sec: 2.4 to 2.7)*
   Unit III: *Chapter 3(Sec: 3.1 to 3.3)*
   Unit IV: *Chapter 3 (Sec: 3.4, 3.7, 3.8, 3.10), Chapter 4 (Sec: 4.1, 4.2)*
   Unit V: *Chapter 4 (Sec: 4.3 to 4.9)*

Books for Reference:

1. Stallings, W. (2018). *Network Security Essentials: Applications and Standards,* (6th Ed.). Pearson.
2. Pfleeger, C. P., & Pfleeger, S. L. (2015). *Security in Computing,* (5th Ed.). Pearson.
3. Whitman, M. E., & Mattord, H. J. (2021). *Principles of Information Security,* (7th Ed.). Cengage Learning.

4. Ross, J. (2020). *Cybersecurity: The Beginner's Guide.* Packt Publishing.

Websites and eLearning Sources:

1. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf
2. https://www.researchgate.net/publication/375075414_Cyber_Security_for_Beginners
3. https://www.ftc.gov/system/files/attachments/cybersecurity-small-business/cybersecuirty_sb_factsheets_all.pdf

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Explain the fundamental concepts of cyber security.	**K1**
CO2	Summarize the cyber threats, risks, and vulnerabilities.	**K2**
CO3	Apply security mechanisms and network defense strategies.	**K3**
CO4	Analyze cryptographic techniques and authentication methods for data protection.	**K4**
CO5	Evaluate modern cyber security challenges in emerging technologies.	**K5**
CO6	Design and develop ethical cyber security practices in professional environments.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**25PCA2OE02B**		**Open Elective – 2 (BS):** Cyber Security							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	2	2	2	3	2	2	2	2	**2.3**
CO2	3	3	3	2	1	3	3	2	2	2	**2.4**
CO3	3	3	3	2	2	3	3	3	2	2	**2.6**
CO4	3	3	3	2	1	3	3	3	2	2	**2.5**
CO5	3	3	3	2	2	3	3	3	2	2	**2.6**
CO6	3	2	2	3	3	2	2	3	3	3	**2.6**
										Mean Overall Score	**2.50 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
2	25PSS2SE01	**Skill Enhancement Course:** Soft Skills	4	2

Course Objectives
To provide a focused training on soft skills for students in colleges for better job prospects
To communicate effectively and professionally
To help the students take active part in group dynamics
To familiarize students with numeracy skills for quick problem solving
To make the students appraise themselves and assess others

Unit I: Effective Communication & Professional Communication (12 Hours)

Definition of communication - Barriers of Communication - Non-verbal Communication. Effective Communication - Conversation Techniques - Good manners and Etiquettes - Speech Preparations & Presentations - Professional Communication.

Unit II: Resume Writing & Interview Skills (12 Hours)

Resume Writing: What is a résumé? Types of résumés – Chronological - Functional and Mixed Resume - Purpose and Structure of a Resume - Model Resume.

Interview Skills: Types of Interviews - Preparation for an interview – Attire - Body Language - Common interview questions - Mock interviews & Practicum.

Unit III: Group Discussion & Personal effectiveness (12 Hours)

Basics of Group Discussion- Parameters of GD- Topics for Practice - Mock GD & Practicum & Team Building. *Personal Effectiveness*: Self Discovery - Goal Setting with questionnaires & Exercises.

Unit IV: Numerical Ability (12 Hours)

Introducing concepts - Average – Percentage - Profit and Loss - Simple Interest - Compound Interest - Time and Work - Pipes and Cisterns.

Unit V: Test of Reasoning (12 Hours)

Introducing Verbal Reasoning: Series Completion – Analogy - Data Sufficiency - Assertion and Reasoning and Logical Deduction. *Non-Verbal Reasoning*: Series - and Classification.

Teaching Methodology	Chalk and talk, PPT, Mathematical models, Video presentation

Books for Study:

1. Melchias G., Balaiah, J. & Joy, J. L. (Eds). (2018). Winner in the Making: A Primer on soft Skills. Trichy, India: St. Joseph's College.

Books for Reference:

1. Aggarwal, R. S. (2010). A Modern Approach to Verbal and Non- Verbal Reasoning. S. Chand.
2. Covey, S. (2004). 7 Habits of Highly effective people. Free Press.
3. Gerard, E. (1994). The Skilled Helper (5th Ed.). Brooks/Cole.
4. Khera, S. (2003). You Can Win. Macmillan Books.
5. Murphy, R. (1998). Essential English Grammar, (2nd Ed.). Cambridge University Press.
6. Sankaran, K., & Kumar, M. (2010). Group Discussion and Public Speaking (5th Ed.). M.I. Publications.
7. Trishna, K. S. (2012). How to do well in GDS & Interviews? (3rd Ed.). Pearson Education.
8. Yate, M. (2005). Hiring the Best: A Manager 's Guide to Effective Interviewing and Recruiting

Websites and eLearning Sources:

1. https://www.indeed.com/career-advice/resumes-cover-letters/communication-skills
2. https://www.seek.com.au/career-advice/article/50-communication-skills-for-the-workplace-your-resume
3. https://southeast.iu.edu/career/files/power-phrases.pdf
4. https://dese.ade.arkansas.gov/Files/20201209124449_Professional-Communication.docx

5. https://www.dol.gov/sites/dolgov/files/ETA/publications/00-wes.pdf
6. https://www.tmu.ac.in/other_websites/cdoe.tmu.ac.in.old/study-material/28-08-2024/COMMON/SEMESTER_2/MAIN_SOFT_SKILLS.pdf
7. https://byjus.com/maths/profit-and-loss-questions/
8. https://www.indiabix.com/

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall various soft skill sets	**K1**
CO2	Understand personal effectiveness in any managerial positions	**K2**
CO3	Apply verbal and non-verbal reasoning skills to solve problems	**K3**
CO4	Differentiate problems at work and home; and design solutions to maintain work-life balance	**K4**
CO5	Assess growth and sustainability and infuse creativity in employment that increases professional productivity	**K5**
CO6	Construct plans and strategies to work for better human society	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
2	**25PSS2SE01**		**Skill Enhancement Course:** Soft Skills							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	2	3	2	3	2	3	2.7
CO2	3	3	3	2	3	3	3	3	3	3	2.9
CO3	3	2	2	3	3	3	3	3	3	3	2.8
CO4	3	3	2	2	3	3	3	3	3	3	2.8
CO5	3	3	3	2	2	3	3	3	3	3	2.8
CO6	3	3	3	2	2	3	3	3	3	3	2.8
Mean Overall Score											**2.8 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25PCA3CC07	**Core Course - 7:** Distributed Technologies	4	3

Course Objectives
To learn the concept of Client Server computing and various architectures.
To study and experience the presentation and interaction concepts in distributed computing.
To understand the features of components with the implementation of EJBs.
To learn the database operations with MongoDB and to experience the development APIs with Node and Express.
To explore the features of React in developing the SPAs and the technique of its interaction.

UNIT I: Basics of Distributed Technologies (12 Hours)

Distributed Systems: Characteristics, Advantages, and Challenges – Client-Server computing - Classification of Client-Server systems - Advantages and disadvantages – Overview of DOTNET Framework- J2EE architecture- MVC architecture.

UNIT II: Presentation Services (12 Hours)

Presentation Technologies: Servlet - Lifecycle, Handling Requests and Responses. JSP: Directives, Scripting Elements. Javamail: Purpose with sample codes. Remote Interaction Services: RMI: Concept and Architecture. XML: Structure - DTD - Schema. XSLT: Transformation Techniques.

UNIT III: Component model (12 Hours)

EJB: Session Beans - Stateless and Stateful. Entity Beans: CMP and BMP – SOAP - Web Services Architecture – Micro-services Architecture – Concept and advantages.

UNIT IV: MERN (12 Hours)

Creation of application with Node.js and Express.js - Middleware and Routing in Express.js. MongoDB: Connecting Express Application to MongoDB using Mongoose. Data Model: Simple Mongoose Schema – MongoDB Shell to create MongoDB Database. REST API: Exposing MongoDB database via REST API - Setting up API in Express. GET Methods: Reading Data from MongoDB. POST Methods: Adding Data to MongoDB. Delete Method: Deleting Data from MongoDB.

UNIT V: React (12 Hours)

Working of React: Page Setup - React Elements - React DOM - React Components and Component Lifecycle. React with JSX: React Elements as JSX - Babel, Recipes as JSX - React Fragments - webpack. React State Management: use State Hook - Refactoring for Advanced Reusability - State in Component Trees - Building Forms - React Context - React Router – Single Page Application (SPA) Navigation.

Teaching Methodology	Lectures, GD and Demonstrations.
Assessment Methods	MCQs, Seminar, GD, Snap Test, Open Book Test, Quiz, Mini Project, Interviewing Experts, Group Project, Peer Work, Group Work, etc.,

Books for Study:

1. Yadav, C. S. (2009). *An Introduction to Client Server Computing*. New Age.
   Unit I: *Chapter1*
2. Couch, J. & Steinberg, D.H. (2002). *J2EE Bible.* Wiley.
   Unit I: *Chapter1*.
   Unit II: *Chapter* 3, *Chapter5*, *Chapter14* and *Chapter18.*
   Unit III: *Chapter16.*
3. Holmes, S. (2016). *Getting MEAN with Mongo, Express, Angular, and Node*. Manning Publications.
   Unit-IV: *Chapter2 (Sec: 5 to 6)*
4. Banks, A. & Porcello, E. (2020). *Learning React: Modern Patterns for Developing React Apps*, (2nd Ed.). O'Reilly.
   Unit V: *Chapter3* and *Chapter 4.*

Books for Reference:

1. Bodoff, S., Green, D. & Jendrock E. (2002). *The J2EE tutorial.* Addison-Wesley
2. Tremblett P. (2001). *Instant Enterprise Java - Beans.* Tata McGraw Hill.

Websites and eLearning Sources:

1. https://reactjs.org/
2. https://www.geeksforgeeks.org/what-is-a-distributed-system/
3. https://www.tutorialspoint.com/software_architecture_design/distributed_architecture.htm

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall the concepts of distributed systems.	**K1**
CO2	Understand the services required for distributed systems.	**K2**
CO3	Apply the mechanisms of distributed computing to implement Java-based server applications.	**K3**
CO4	Analyze the principles of distributed technologies.	**K4**
CO5	Evaluate and compare the technologies associated with presentation and interaction services.	**K5**
CO6	Design applications that involve presentation, interaction, persistence and component technologies.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
3	**25PCA3CC07**		**Core Course - 7:** Distributed Technologies							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	2	3	1	2	2	3	3	1	3	**2.2**
CO2	3	3	3	2	3	2	3	3	2	3	**2.7**
CO3	2	1	3	3	2	2	3	1	1	2	**2.0**
CO4	3	2	1	1	3	3	2	3	1	2	**2.1**
CO5	2	3	1	2	3	3	2	3	1	2	**2.2**
CO6	3	2	1	1	3	3	2	3	1	2	**2.1**
										Mean Overall Score	**2.21 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25PCA3CC08	**Core Course - 8:** Computer Networks and Security	4	3

Course Objectives
To make students understand the profound influence and importance of computer networks and the Physical Layers.
To study the design issues principles of Data Link Layer and MAC Sublayer.
To impart knowledge on various Routing and Congestion Control algorithms in Network Layer.
To learn the important concepts of Transport Layer and its protocols.
To give an overview of the applications of Network and network related Security issues.

UNIT I: Physical Layer (12 Hours)

Uses of Computer Networks - Network Hardware - Network Software - Reference Models (OSI and TCP/IP Models). Physical Layer: The Theoretical Basis for Data Communication - Guided Transmission Media - Wireless Transmission - Communication Satellites - The Public Switched Telephone Network (PSTN).

UNIT II: Data Link Layer & MAC (12 Hours)

Design Issues - Error Detection and Correction - Elementary Data Link Protocols - Sliding Window Protocols. MAC Sublayer Concepts: The Channel Allocation Problem - Multiple Access Protocols - Ethernet - Wireless LANS- Bluetooth - RFID.

UNIT III: Network Layer (12 Hours)

Design Issues - Routing Algorithms: The Optimality Principle - Shortest Path Algorithm - Flooding - Distance Vector Routing - Link State Routing - Hierarchical Routing - Broadcast Routing - Multicast Routing - Anycast Routing - Congestion Control Algorithms.

UNIT IV: Transport Layer (12 Hours)

The Transport Service - Elements of Transport Protocols -Congestion Control - The Internet Transport. Protocols: UDP - The Internet Transport Protocols: TCP.

UNIT V: Application Layer and Network Security (12 Hours)

DNS - Electronic Mail - The World Wide Web - Streaming Audio and Video. Network Security: Cryptography - Symmetric Key Algorithms - Public Key Algorithms - Digital Signatures.

Teaching Methodology	Lectures, Seminar, Flipped Classes.
Assessment Methods	MCQs, Seminar, Snap Test, Open Book Test, Quiz.

Books for Study:

1. Andrew, S. T., & David, J. W. (2019). *Computer Networks*, (5th Ed.). Pearson Education.
   Unit I: *Chapters 1 (Sec: 1.1 to 1.4), Chapter 2 (Sec :2.1 to 2.4, 2.6)*
   Unit II: *Chapter 3 (Sec :3.1 to 3.4), Chapter 4 (Sec :4.1 to 4.4, 4.6, 4.7)*
   Unit III: *Chapter 5 (Sec :5.1 to 5.3)*
   Unit IV: *Chapter 6 (Sec :6.1 to 6.5)*
   Unit V: *Chapter 7 (Sec :7.1 to 7.4), Chapter 8 (Sec :8.1 to 8.4)*

Books for Reference:

1. Ahuja, V. (1985). *Design and Analysis of Computer Communication Networks*. McGraw Hill
2. Andrew, S. T. (1999). *Computer Networks*. Prentice Hall of India.
3. Behrouz, A. F. (2006). *Data Communications and Networking*, (4th Ed.). McGraw Hill.
4. Gregory, B. W., Eric, A. F. & Udo, W. P. (2017). *Computer System and Network Security*. CRC Press.

Websites and eLearning Sources:

1. https://www.techtarget.com/searchnetworking/definition/network-security
2. https://www.geeksforgeeks.org/data-link-layer

3. https://www.geeksforgeeks.org/network-layer-services-packetizing-routing
4. https://www.geeksforgeeks.org/physical-layer-in-osi-model
5. https://www.javatpoint.com/computer-network-security

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Understand the fundamental concepts computer networks, network models, protocols and security.	**K1**
CO2	Explain the functions of OSI and TCP/IP models and security algorithms.	**K2**
CO3	Apply knowledge of addressing, subnetting and routing techniques to design small networks.	**K3**
CO4	Analyze the functions of network models, network security threats, vulnerabilities including cryptographic techniques.	**K4**
CO5	Examine the network designs, security issues and protocols.	**K5**
CO6	Develop network models, security policies, practices and tools.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	**25PCA3CC08**	**Core Course - 8:** Computer Networks and Security								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	2	1	2	2	2	2	1	**1.9**
CO2	3	2	3	2	1	3	2	2	2	1	**2.1**
CO3	3	2	3	2	1	3	3	3	2	1	**2.3**
CO4	3	3	3	3	2	3	3	3	2	1	**2.6**
CO5	3	3	3	2	1	3	3	3	3	2	**2.6**
CO6	3	3	3	2	1	3	3	3	3	2	**2.6**
										Mean Overall Score	**2.35 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25PCA3CC09	**Core Course - 9:** Operations Research	4	3

Course Objectives
To formulate and solve linear programming problems.
To impart knowledge in duality concept, transportation problem and assignment problem.
To build the capability of utilizing project scheduling techniques like PERT and CPM.
To gain insights into the principles of sequencing problems.
To provide a solid foundation in game theory.

UNIT I: Linear Programming (12 Hours)

Formulations and Graphical solution to L.P. Problem - Simplex method - Degeneracy, Unbounded and infeasible solution.

UNITII: Linear Programming (contd.) (12 Hours)

Duality - Primal and Dual Computations - Dual Simplex Method. Transportation problem: Finding initial solution and optimal solution - Assignment problem and its solution by Hungarian method.

UNIT III: PERT and CPM (12 Hours)

Phases of Project Scheduling - Arrow Diagram - Critical Path Method - Probability Considerations in Project Scheduling.

UNIT IV: Sequencing Problem (12 Hours)

Problem of Sequencing - Basic Terms used in sequencing - Processing n-jobs through two machines - Processing n-jobs through k-machines - Processing two jobs through k-machines.

UNIT V: Game Theory (12 Hours)

Two-Person Zero - Sum Games - Some Basic Terms - The Maximin - Minimax Principles - Games without Saddle points - Mixed Strategies - Graphic Solution of 2 x n and m x 2 Games Dominance Property.

Teaching Methodology	Lecture-based Instruction, PPT, Demonstration.
Assessment Methods	Seminar, Problem Solving and Quiz.

Books for Study:

1. Swarup, K., Gupta, P. K., & Man Mohan. (2013). *Operations Research*. Sultan Chand & Sons.
   Unit I: *Chapter 1 (Sec: 1:1 to 1:6, 1:10), Chapter 2, Chapter 3 (Sec: 3:1 to 3:5), Chapter 4 (Sec: 4:1, 4:3, 4:5).*
   Unit II: *Chapter 5 (Sec: 5:1 to 5:5, 5:7, 5:9), Chapter 10 (Sec: 10:1, 10:5 to 10:6, 10:8 to 10:10, 10:12 to 10:13, 10:15)*
   Unit III: *Chapter 25 (Sec 25:1 to 25:7)*
   Unit IV: *Chapter 12 (Sec: 12:1 to 12:6)*
   Unit V: *Chapter 17 (Sec: 17:1 to 17:7)*

Books for Reference:

1. Taha, A.H. (1987). *Operations Research-An Introduction*, (5th Ed.). Macmillan Publishing.
2. Gupta, P. K., Mohan, M. (1987). *Operations Research and Quantitative Analysis*, (1st Ed.). Sultan Chand & Sons.
3. Kalavathy, S. (2013). *Operations Research*. Vikas Publishing House.

Websites and eLearning Sources:

1. https://onlinecourses.nptel.ac.in/noc20_ma23/preview
2. https://www.geeksforgeeks.org/graphical-solution-of-linear-programming-problems/
3. http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=90042
4. http://ecoursesonline.iasri.res.in/mod/resource/view.php?id=90044

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall the basic concepts of LPP, TP, AP, CPM, PERT, Sequencing and game theory.	**K1**
CO2	Explain the characteristics and relationships in LPP, TP, AP, CPM, PERT, Sequencing and game theory.	**K2**
CO3	Apply the OR principles to solve the business problems.	**K3**
CO4	Analyze and apply the procedure for problem solving in LPP, TP, AP, CPM, PERT, Sequencing and game theory.	**K4**
CO5	Evaluate the suitable LPP, TP, AP, CPM, PERT, Sequencing and game theory to solve real-time problems.	**K5**
CO6	Construct the activities, models, methods and procedures using LPP, TP, AP, CPM, PERT, Sequencing and game theory.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
3	**25PCA3CC09**		**Core Course - 9:** Operations Research							**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	2	3	2	3	3	2	2	2	**2.4**
CO2	2	3	2	2	2	3	3	2	2	3	**2.4**
CO3	2	2	2	3	3	3	2	2	2	2	**2.3**
CO4	2	3	2	3	3	2	2	3	3	2	**2.5**
CO5	2	3	2	2	3	3	2	3	3	2	**2.5**
CO6	2	2	2	3	3	3	2	2	2	2	**2.3**
									Mean Overall Score		**2.40 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	**25PCA3CP05**	**Core Practical - 5:** Building Web Applications	**5**	**3**

List of Exercises:

1. RMI-Invocation of Server side methods.
2. Servlets and JDBC- Accessing a database.
3. JSP – Use of script let.
4. JSP-use of java beans.
5. EJB-Session Bean.
6. EJB-Entity Bean.
7. XML Document Creation.
8. Presentation with XSLT.
9. XML Quiz Creation
10. Developing a web based application using the concepts studied.

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
3	25PCA3CP06	**Core Practical - 6:** Web Application Development with MERN Stack	5	3

List of Exercises:

React

1. Single Page Application with Multiple components
2. Navigation and Event Handling
3. Services and Routing
4. Template driven and Reactive forms

Node and Express

5. Creation of Node server with APIs
6. Creation of APIs with different methods
7. Express based Routing

MongoDB and RDBMS

8. Data Modeling - CRUD Operations
9. Connecting APIs with MongoDB
10. Connecting APIs with Relational Database

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
3	25PCA3ES02A (SSC/Q0501)	**Discipline Specific Elective - 2:** Cyber Security & Identity Management (NSQF)	4	3

Course Objectives
To understand common cybersecurity vulnerabilities, exploitation techniques, and legal and regulatory considerations.
To explore the fundamentals of Identity and Access Management (IAM), including authentication, authorization, directory services, and cloud-based IAM solutions.
To analyse vulnerability management practices, including identification, assessment, and remediation strategies.
To develop practical skills in network and web penetration testing using industry-standard tools.
To examine advanced security topics such as mobile penetration testing, cloud security, compliance standards, and secure software development practices.

UNIT I: Introduction to Common Vulnerabilities (12 Hours)

Common Vulnerabilities – Exploitation Techniques – Tools and Techniques for Vulnerability Identification – Reporting and Documentation of Vulnerabilities – Legal and Regulatory Aspects of Cybersecurity.

UNIT II: Identity and Access Management (IAM) (12 Hours)

Fundamentals of Identity and Access Management – Authentication Basics: Passwords, Multi-Factor Authentication (MFA), Biometrics – Authorization and Access Control Models (RBAC, ABAC, MAC, DAC) – Directory Services (Active Directory, LDAP) – Identity Federation and Single Sign-On (SSO) – Identity Governance and Administration (IGA) – IAM in the Cloud: Security Challenges and Best Practices – IAM Best Practices for Organizations.

UNIT III: Vulnerability Management Practices (12 Hours)

Phases of Vulnerability Management – Vulnerability Management Lifecycle – Tools for Vulnerability Scanning and Assessment – Risk Analysis and Prioritization of Vulnerabilities – Patch Management and Remediation Strategies.

UNIT IV: Network and Web Penetration Testing (12 Hours)

Network Penetration Testing – Required Tools for Penetration Testing (Nmap, Metasploit, and Wireshark) – Web Application Security Fundamentals – HTTP vs HTTPS: SSL/TLS Basics – Web Application Penetration Testing Methodologies – Burp Suite Introduction and Usage.

Unit V: Advanced Security Topics (12 Hours)

Mobile Penetration Testing: Security Risks and Testing Techniques – Cloud Security: Threats, Vulnerabilities, and Best Practices – Compliance and Security Standards in Cloud Environments – Secure Software Development and DevSecOps Principles.

Teaching Methodology	Lectures, Flipped/Blended Classes, Group Work, Gamification, Activity Based, Case Based
Assessment Methods	MCQs, Snap Test, Assignment.

Books for Reference:

1. Stallings, W., & Brown, L. (2018). *Computer Security: Principles and Practice* (4thEd.). Pearson.
2. Goodrich, M. T., &Tamassia, R. (2014). *Introduction to Computer Security*. Pearson.
3. Viega, J., & McGraw, G. (2001). *Building Secure Software: How to Avoid Security Problems the Right Way*. Addison-Wesley.
4. Anderson, R. (2020). *Security Engineering: A Guide to Building Dependable Distributed Systems* (3rdEd.). Wiley.
5. Bishop, M. (2018). *Computer Security: Art and Science* (2ndEd.). Addison-Wesley.

Websites and eLearning Sources:

1. https://www.cybrary.it/
2. https://learn.microsoft.com/en-us/training/paths/identity-access-microsoft-security/

3. https://tryhackme.com/
4. https://csrc.nist.gov/publications/sp800
5. https://www.coursera.org/professional-certificates/ibm-cybersecurity-analyst

Course Outcomes		
CO No.	**CO-Statements** On successful completion of this course, students will be able to	**Cognitive Levels (K-Level)**
CO1	Recall common security vulnerabilities, exploitation techniques, IAM fundamentals, penetration testing tools, and cybersecurity regulations.	**K1**
CO2	Understand the IAM principles, vulnerability management lifecycle, network security, and secure software development concepts.	**K2**
CO3	Apply authentication models, vulnerability scanning techniques, risk analysis methods, and penetration testing tools to assess security threats.	**K3**
CO4	Analyze security risks in networks, web applications, mobile, and cloud environments to identify vulnerabilities and mitigation strategies.	**K4**
CO5	Evaluate security compliance frameworks, IAM governance, penetration testing results, and remediation strategies for organizational security.	**K5**
CO6	Create security reports, vulnerability documentation, and effective cybersecurity strategies for real-world implementation.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	**25PCA3ES02A (SSC/Q0501)**	**Discipline Specific Elective - 2:** Cyber Security & Identity Management (NSQF)								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	2	1	1	1	3	3	2	1	1	**1.8**
CO2	3	3	2	1	1	3	3	3	2	1	**2.2**
CO3	3	3	3	1	2	3	3	3	3	2	**2.6**
CO4	3	3	3	1	2	3	3	3	3	2	**2.6**
CO5	3	3	3	2	2	3	3	3	3	2	**2.7**
CO6	3	3	3	2	2	3	3	3	3	3	**2.8**
										Mean Overall Score	**2.45(High)**

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
3	25PCA3ES02B	**Discipline Specific Elective - 2:** Immersive Technologies	4	3

Course Objectives
To establish fundamental concepts and potential of immersive technologies.
To explore the psychology of presence and its impact on user experience.
To understand design principles for creating immersive experiences.
To analyze VR hardware evolution and the role of AI in AR/VR.
To gain experience in developing AR and VR applications.

UNIT I: Immersive Technologies (12 Hours)

Knowing Immersive Technologies – Augmented Reality – Virtual Reality – Extended Reality. Overview of Immersive Technologies. Milestones and breakthroughs: AR Milestones – VR Milestones. Current State of Immersive Technologies: Statistical data - Potential of Immersive - Technologies - Limitations of Immersive Technologies.

UNIT II: Presence in Immersive Technologies (12 Hours)

Knowing Presence – Definition and explanation - Importance of Presence for Immersion and User Experience. Theories of Presence: Overview of different theories and models - Experience of Presence – Factors contributing to presence. Measuring Presence: Self-report measures – Physiological measures – Behavioral measures – Experience sampling – Hybrid approaches - Advantages and Limitations of Measuring Presence - Application of Presence – Importance for different applications (Training, Therapy).

UNIT III: Designing Immersive Experiences (12 Hours)

Immersive Design: Understanding the importance of immersion - Immersive Experience Psychology and Impact. Designing for Sensory Immersion: Engaging user senses (Spatial design, Sound design, Haptic feedback). Designing for Emotional Immersion: Creating powerful emotional impact - Role of Design in an Impactful User Experience. Designing for Narrative Immersion: Storytelling and user engagement - Best Practices for User Interface and Experience Design.

UNIT IV: Virtual Reality Hardware (12 Hours)

Virtual Reality Hardware: Evolution of Virtual Reality Hardware – Early Systems – Modern Era. Recent Advances: First Head-Mounted Displays – The Rise of Consumer Virtual Reality - Role of Technology Advancement in the Virtual Reality Industry – Virtual Reality Hardware Design Challenges – The Future of Virtual Reality Hardware – Emerging Technologies - Impact of Emerging Virtual Reality Technologies on Industries. Haptic Feedback: Role of Haptic Feedback in Virtual Reality Hardware - Evolution of Haptic Feedback – Types of Haptic Feedback. Benefits and Limitations of Haptic Technology.

UNIT V: Developing AR and VR Applications (12 Hours)

3D Modeling: Key Concepts – Modeling Techniques – Artistic and Technical Balance – Animating 3D Models – Importance of Animation – Challenges in Animating for Immersive Environments. Real-Time 3D and Game Engines: Understanding Real-Time 3D Graphics - Game Engines - The Heart of Immersive Environments – Applications of Game Engines. User Interface Design Principles: UI Design for 3D Environments – Tools and Workflow. Building VR Applications with Unity: Unity – Unity Architecture – Integration with 3D Modeling –VR Development in Unity – Creating Scenes and Environments – Scene Optimization Techniques.

Teaching Methodology	Lectures, Case Studies, Hands-on sessions & Workshops, Gamification, Field Visit.
Assessment Methods	MCQs, Quiz, Group Project, Peer Work & Group Work.

Books for Study:

1. Suman S. (2024). *Immersive Realm of Extended Reality Navigating the future of virtual and augmented reality,* (1st Ed). BPB Publications.
   Unit I: *Chapter 1*

Unit II: *Chapter 2*
Unit III: *Chapter 3*
Unit IV*: Chapter 4*
Unit V: *Chapters 10, 11*

Books for Reference:

1. Sherman W.R. & Craig, A. B. (2018). *Understanding Virtual Reality Interface, Application, and Designs,* (1st Ed). Springer.
2. Craig, A. B. (2013)**.** *Understanding Augmented Reality: Concepts and Applications,* (1st Ed). Morgan Kaufmann.

Websites and eLearning Sources:

1. https://docs.unity.com/ (Unity & Unreal Engine official documentation)
2. https://github.com/seckincengiz/xr
3. https://www.udemy.com/course/unity-vr-dev-no-coding-required/
4. https://www.udemy.com/course/learn-webxr/
5. https://www.udemy.com/course/virtual-reality-storytelling/

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall and describe the core concepts of immersive technologies, their evolution, and impact.	**K1**
CO2	Explain and summarize the psychology of presence and its significance in immersive experiences.	**K2**
CO3	Apply and implement design principles to create effective and engaging immersive experiences.	**K3**
CO4	Analyze and differentiate the components of VR hardware evolution and the role of AI in AR/VR.	**K4**
CO5	Assess and critique the ethical considerations and real-world applications of immersive technologies.	**K5**
CO6	Design and develop basic AR and VR applications using industry-standard tools.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	**25PCA3ES02B**	**Discipline Specific Elective - 2:** Immersive Technologies								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	1	1	1	1	**2.0**
CO2	3	3	3	2	2	3	2	1	1	1	**2.1**
CO3	3	3	2	2	2	3	3	2	1	1	**2.2**
CO4	3	3	2	2	2	3	3	3	1	1	**2.3**
CO5	3	3	2	2	2	1	2	3	3	3	**2.4**
CO6	3	3	2	2	2	3	3	3	1	1	**2.3**
									Mean Overall Score		**2.21(High)**

Semester	Course Code	Title of the Course	Hours/Weeks	Credits
3	25PCA3ES02C	**Discipline Specific Elective - 2:** Human Computer Interaction	4	3

Course Objectives
To understand human cognitive capabilities, perception, memory, and reasoning, to design effective and user-friendly interactive systems.
To learn various input and output devices, including text entry, pointing devices, and display technologies, to optimize user interactions.
To familiar different interaction models, frameworks, and styles to enhance usability and user engagement in interactive systems.
To explain the design principles, navigation, screen layout, and prototyping, to create intuitive and accessible interfaces.
To provide knowledge in engineering practices, iterative design, and design rules in software development.

UNIT I: The Human (12 Hours)

Input-Output Channels - Design Focus - Human Memory - Cashing - 7 ± 2 revisited – Thinking: Reasoning and Problem Solving - Human Error and False memories – Emotion – Individual Differences – Psychology and the Design of Interactive Systems.

UNIT II: The Computer (12 Hours)

Text Entry Devices – Design Focus - Numeric keypads – Positioning - Pointing and Drawing – Display Devices – Hermes a Situated Display – Devices for Virtual Reality and 3D Interaction – Physical Control - Sensors - Special Devices – Feeling Road - Smart - Using Sensors. Paper: Printing and Scanning – Readability of text – Memory – Processing and Networks – Myth of the Infinitely Fast Machine.

UNIT III: The Interaction (12 Hours)

Models of Interaction – Design Focus - Video Recorder – Frameworks and HCI –Ergonomics – Industrial Interfaces – Interaction Styles – Navigation in 3D and 2D – Elements of the WIMP Interface - Learning Toolbars – Interactivity – The Context of the Interaction – Experience, Engagement and Fun.

UNIT IV: Interaction Design Basics (12 Hours)

Design - The Process of Design – User Focus – Design Focus - Cultural Probes – Scenarios – Navigation design – Beware the Big Button Trap - Modes – Screen Design and Layout – Alignment and Layout Matter - Checking Screen Colours – Iteration and Prototyping.

UNIT V: Software Process and Design Rules (12 Hours)

The Software Life Cycle – Usability Engineering – Iterative Design and Prototyping – Design Focus - Prototyping in Practice – Design Rationale. Design Rules: Principles to Support - Usability - Standards – Guidelines – Golden Rules and Heuristics.

Teaching Methodology	Chalk and talk, Lecture based Teaching with PPT.
Assessment Methods	Seminar, Snap Test, Open Book Test, Quiz.

Books for Study:

1. Dix, A., Finlay, J., Abowd, G. D., & Beale, R. (2004). *Human-computer interaction* (3rd Ed.). Pearson.
   Unit I: *Chapter 1 (Sec: 1.1 to 1.7)*
   Unit II: *Chapter 2 (Sec: 2.1 to 2.9)*
   Unit III: *Chapter 3 (Sec: 3.1 to 3.9)*
   Unit IV: *Chapter 5 (Sec: 5.1 to 5.8)*
   Unit V: *Chapter 6 (Sec: 6.1 to 6.5) Chapter 7:(Sec: 7.1 to 7.5)*

Books for Reference:

1. Scott, M. I. (2024). *Human-Computer Interaction an Empirical Research Perspective*, (2nd Ed.). Morgan Kaufmann.
2. Meena, K. Siva Kumar, R. (2015). *Human computer interaction* (1st Ed.). PHI Learning.

Websites and eLearning Sources:

1. https://paragnachaliya.in/wp-content/uploads/2017/08/HCI_Alan_Dix.pdf
2. https://archive.nptel.ac.in/courses/106/106/106106177/
3. https://www.youtube.com/watch?v=m3EzxNfpsr0&t=2s

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Define and describe fundamental concepts of human cognition, perception, and memory in HCI.	**K1**
CO2	Understand different input and output devices, their usability aspects, and interaction frameworks.	**K2**
CO3	Apply principles of interaction design to create intuitive user interfaces with a focus on ergonomics.	**K3**
CO4	Analyze the effectiveness of different interaction styles, design frameworks, and usability heuristics.	**K4**
CO5	Evaluate user interface designs using usability engineering methods and heuristic principles.	**K5**
CO6	Develop and prototype interactive systems by applying iterative design, usability standards, and human-centered approaches.	**K6**

Relationship Matrix											
Semester	**Course Code**	**Title of the Course**								**Hours**	**Credits**
3	**25PCA3ES02C**	**Discipline Specific Elective - 2:** Human Computer Interaction								**4**	**3**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	2	3	3	3	1	2	**2.5**
CO2	3	3	3	2	2	3	3	3	2	2	**2.6**
CO3	3	3	2	2	2	3	3	3	1	2	**2.4**
CO4	3	3	2	2	2	3	3	3	2	2	**2.5**
CO5	3	3	2	2	2	3	3	3	2	2	**2.5**
CO6	3	3	2	2	2	3	3	3	1	2	**2.4**
Mean Overall Score											**2.48 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25SCS3RM01	Research Methodology	4	2

Course Objectives
To comprehend the fundamental concepts, objectives, significance, and challenges of research, along with techniques for defining research problems.
To understand the principles of research design, experimental design, and various sampling techniques for effective data collection.
To explore different methods of primary and secondary data collection and develop the ability to select appropriate data-gathering techniques.
To analyze and interpret research data using statistical measures, regression analysis, and correlation techniques.
To gain knowledge of Intellectual Property Rights (IPR), patents, and legal frameworks related to research innovations and their protection.

UNIT I: Basics of Research (12 Hours)

Meaning of Research – Objectives – Motivation – Type of Research – Research Approaches – Significance– Research Methods Versus Methodology – Research and Scientific Method – Importance - Research Process – Criteria of Good Research – Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem – Selecting the Problem – Necessity of Defining the Problem – Technique Involved in Defining a Problem.

UNIT II: Research Design (12 Hours)

Meaning of a Research Design – Need for Research Design – Features of a Good Design – Important Concept Relating to Research Design – Different Research Design – Basic Principles of Experimental Design. Sampling Design: Census and Sample Survey – Implication of a Sample Design – Steps in Sampling Design – Criteria of Selecting a Sampling Procedure – Characteristics of a Good Sample Designs – Different Type of Sample Designs – Select a Random sample – Random Sample from an Infinite Universe – Complex Random Sampling Designs.

UNIT III: Methods and Data Collection (12 Hours)

Collection of Primary Data – Observation Method – Interview Method – Collection of Data Through Questionnaires - Collection of Data Through Schedules – Different Between Questionnaires and Schedules – Some Other Method of Data Collection – Collection of Secondary Data – Selecting of Appropriate Methods for Data Collection.

UNIT IV: Processing and Analysis of Data (12 Hours)

Processing Operations – Some Problems in Processing – Elements Type of Analysis – Statistics in Research – Measures of Central Tendency – Measures of Dispersion - Measures of Asymmetry (Skewness) – Measures of Relationships – Simple Regression Analysis – Multiple Correlation and Regression – Partial Correlation – Association in Case of Attributes – Other Measures.

UNIT V: IPR and Patents (12 Hours)

The need for Intellectual Property Right (IPR). Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret. IPR in India: Genesis and development – IPR in abroad. Elements of Patentability: Novelty - Non Obviousness (Inventive Steps), Industrial Application - Non-Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentees.

Teaching Methodology	Lectures, Flipped Classes.
Assessment Methods	MCQs, Snap Test.

Books for Study:

1. Kothari, C. R. (2004). *Research Methodology – Methods and Techniques*, (Revised 2nd Ed.). New Age.
   Unit I: *Chapter 1, Chapter 2.*

Unit II: *Chapter 3 Chapter 4.*
Unit III: *Chapter 6*
Unit IV: *Chapter 7*

2. Nithyananda, K, V. (2019). *Intellectual Property Rights: Protection and Management*. Cengage Learning.
Unit V: *Chapters: 1, 2*

Books for Reference:

1. David. Evans, Paul Gruba., & Justin Zobel. (1995). *How to write a better thesis*. (3rd Ed.). Springer.
2. Neeraj, P., & Khusdeep, D. (2014). *Intellectual Property Rights.* PHI learning.

Websites and eLearning Sources:

1. https://www.scribbr.com/dissertation/thesis/
2. https://kostochk.web.illinois.edu/math412-10/
3. https://vemu.org/uploads/lecture_notes/18_01_2024_914828712.pdf

Course Outcomes		
CO No.	**CO-Statements**	**Cognitive Levels (K-Level)**
	On successful completion of this course, students will be able to	
CO1	Recall key research concepts, types of research, research methodologies, and intellectual property rights (IPR), including patents and copyrights.	**K1**
CO2	Explain the significance of research design, sampling methods, data collection techniques, and statistical measures used in research.	**K2**
CO3	Demonstrate the ability to formulate research problems, design research studies, and select appropriate data collection methods.	**K3**
CO4	Evaluate different research approaches, sampling techniques, and statistical tools to identify their relevance in solving research problems.	**K4**
CO5	Assess research findings, interpret data using statistical methods, and examine the impact of IPR laws on research and innovation.	**K5**
CO6	Develop well-structured research proposals, design experiments, and formulate strategies for protecting intellectual property rights.	**K6**

Relationship Matrix											
Semester	**Course Code**		**Title of the Course**							**Hours**	**Credits**
3	**25SCS3RM01**		**Research Methodology**							**4**	**2**
Course Outcomes	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	2	1	3	3	2	2	2	**2.4**
CO2	3	3	3	2	2	3	3	3	1	1	**2.4**
CO3	3	3	2	2	1	2	3	2	2	2	**2.2**
CO4	3	3	3	2	2	3	2	3	2	2	**2.5**
CO5	3	3	3	2	2	3	3	3	1	1	**2.4**
CO6	3	3	3	2	1	3	3	3	2	2	**2.5**
										Mean Overall Score	**2.4 (High)**

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25PCA3SL03	**Self - Learning:** Organizational Behaviour	0	1

Course Objectives
To understand the basic concepts of organization and Organisational Behaviour.
To develop the Attitudes and Formulate factors for attitude change.
To analyse Build the Perceptual Interpretation and Motivation.
To impart Leadership skills through various activities.
To create new organizational structure and projects.

UNIT I: Nature of Organization and Organisational Behaviour

Nature of Organisation – Features – Types – Goals. Nature of Organisational Behaviour (OB): Role of OB – Foundations of OB.

UNIT II: Human Behaviour

Nature of Human Behaviour: Nature and causes of individual differences – Models of man. Perception: Concept – Process – Perceptual selectivity and distortion – Developing perceptual skills. Attitudes: Concept – Theories – Formation Factors – Measurements – Attitude Change.

UNIT III: Personality

Personality: Concept – Theories – determinants of Personality - Personality and Behaviour. Motivation: Definition – Motivation and Behavior – Theories – Approaches – Incentives. Interpersonal Behaviour: Transactional analysis – Ego states – Life scripts – Life positions – Transactions – Stroking – Psychological games – Benefits of TA.

UNIT IV: Group Dynamics

Group Dynamics: Concepts and features of group – Types of Groups – Group Behavior – Group Decision Making – Committee – Task group – Inter Group Behavior. Leadership: Definitions – Types – Importance Theories – Styles. Communication: Basics of Communication – Communication Network – Factors affecting Communication – Business writing – Office Management – Presentation Strategies.

UNIT V: Organizational Structure

Organization Theory: Classical Organizational Theory - Neoclassical Organization Theory. Designing of Organizational Structure: Need – Planning and Process – Departmentation Span of management – Delegation of authorities – Centralization and decentralization. Forms of Organizational Structures: Line and Staff – Functional – Divisional – Project – Matrix – Free form.

Books for Study:

1. Prasad, L.M. (2014). *Organisational Behavior*. Sultan Chand and Sons.
   Unit I: *Chapter 1, Chapter 2.*
   Unit II: *Chapter 3, Chapter 4, Chapter 7*
   Unit III: *Chapter 8, Chapter 11*
   Unit IV: *Chapter 12, Chapter 14, Chapter 15*
   Unit V: *Chapter 18, Chapter 20, Chapter 21*

Books for Reference:

1. Aswathappa, L. (2021). *Organisational Behavior*. Himalaya Publishing house.
2. Khanka, S.S. (2001). *Organisational Behavior*. Sultan Chand.

Websites and eLearning Sources:

1. https://www.jaroeducation.com/blog/organizational-behavior
2. https://onlinecourses.nptel.ac.in/noc25_hs73/preview
3. https://www.bing.com/search?q=organizational+behaviour&qs

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
3	25PCA3IS01	Internship	0	2

In the third semester of the MCA program, students have the opportunity to undertake a one-month industry internship. This initiative enables them to apply theoretical knowledge in a practical setting, effectively bridging the gap between academic learning and professional experience. The internship serves as a vital component of the curriculum, offering hands-on exposure that enhances their technical and problem-solving skills. By engaging in real-world projects, students gain valuable industry insights, fostering a well-rounded education that equips them for successful careers in Computer Science.

Internship Process

1. Internship Duration

In the third semester, students must complete a one-month internship at an organization capable of facilitating MCA internships. The internship begins immediately after the second semester examinations.

2. Organization Selection

Students are responsible for selecting a suitable organization and providing relevant details to their project guide and the Head of the Department (HoD).

3. Requisition Letter

A requisition letter, endorsed by the HoD, must be sent to the chosen organization to seek approval for the internship. Students may submit only one requisition letter at a time.

4. Letter of Acceptance

Prior to beginning the internship, students must obtain a formal letter of acceptance from the selected organization.

5. Approval Criteria

The project guide and HoD hold the authority to approve or recommend changes to the selected organization, particularly if it lacks the necessary computing infrastructure.

6. **Commencement of Internship**

Students may leave the College and commence their internship only after receiving the acceptance letter, which serves as confirmation of the organization's commitment to facilitating the internship.

7. External Guide Evaluation

An evaluation conducted by the external guide at the organization contributes ten percent to the final assessment.

8. Joining Report and Progress Updates

Students must join the organization within a week of acceptance and submit a joining report by the specified deadline. Additionally, they are required to email progress reports to their guides every fifteen days.

9. Review and Report Submission

At the conclusion of the internship, project guides will conduct a review. Students must submit a comprehensive internship report in the prescribed format.

10. Viva-Voce Examination

A viva-voce examination will be conducted by both internal and external examiners on the date specified by the Head of the Department.

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25PCA4ES03A	**Discipline Specific Elective - 3:** Artificial Intelligence Technologies	4	3

Course Objectives
To understand the fundamentals of AI, including its history, theoretical foundations, and evolution.
To explore machine learning and deep learning, covering different types, tools, and real-world applications.
To gain insights into Natural Language Processing (NLP) by studying text processing, vectorization, and NLP tasks.
To examine Generative AI, its development, societal impact, and associated risks and challenges.
To learn the principles of computer vision, including image processing, feature extraction, and real-world applications.

UNIT I: Artificial Intelligence (12 Hours)

Artificial Intelligence: Definition, Historical Overview, Current Landscape and Future. Theoretical Foundation: Early development, Logic based approach, Machine Learning approach and Integration of Logic and Machine Learning in Artificial Intelligence.

UNIT II: Machine Learning and Deep Learning (12 Hours)

Machine Learning: Machine Learning - Types of Machine Learning - Applications of Machine Learning - Tools in Machine Learning - Issues in Machine Learning. Deep Learning: Understanding Biological Neuron - Exploring Artificial Neuron - Deep Learning.

UNIT III: Natural Language Processing (12 Hours)

NLP A Primer: NLP- NLP Tasks - Building Blocks of Language - Approaches to NLP. NLP Pipeline: Data Acquisition- Text Extraction and cleanup – Pre-Processing. Text Representation: Vector space models - Basic Vectorization Approaches.

UNIT IV: Generative AI (12 Hours)

Unveiling Generative AI: A New Frontier - Tracing the Evolutionary Blueprint of Generative AI Revolutionizing Societies and Business Ecosystems - Risks and Challenges to Manage - Impact of Generative AI on Jobs.

UNIT V: Computer Vision (12 Hours)

Machine Vision: Applications – Basic Principles of Vision – Cognition and Classification – From Image to Scene – Inversion by Fixing Scene Parameters – Inversion by Restricting the Problem Domain – Inversion by Acquiring Additional Images – Machine Vision Techniques – Low-Level Vision – Local Edge Detection – Middle-Level Vision – High-Level Vision – Indexing and Geometric Hashing – Object Representation and Tracking – Feature Selection and Object Detection – Object Detection – Supervised Learning for Object Detection.

Teaching Methodology	Lecture-Based Learning, Flipped Classroom, Problem-Based Learning Collaborative Learning, Gamification, Blended Learning, Hands-on Demo, Peer Teaching, AI-Driven Personalized Learning.
Assessment Methods	Online Quiz, System Analysis and Presentation, Peer and Self-Assessment.

Books for Study:

1. Santiago, G., & Sathish. (2024). *Artificial intelligence: Theory and applications*. Scientific International Publishing House.
   Unit I: *Chapter 1, Chapter 2*
2. Dutt, S., Chandramouli, S., & Das, A. K. (2023). *Machine learning* (11th Ed.). Pearson.
   Unit II*: Chapter 1, Chapter 10 (10.2, 10.3, 10.9)*
3. Vajjala, S., Majumder, B., Gupta, A., & Surana, H. (2020). *Practical Natural Language Processing* (1st Ed.). O'Reilly Publications.
   Unit III: *Chapter 1, Chapter 2 and Chapter 3*

4. Marr, B. (2024). *Generative AI in practice: 100+ Amazing ways Generative Artificial Intelligence is changing business and society.* Wiley.
   Unit IV: *Chapter 1*
5. Chowdhary, K. R. (2020). *Fundamentals of artificial intelligence*. Springer India.
   Unit V: *Chapter 21 (Sec: 21.1 to 21.10)*

Books for Reference:

1. Chandra, V. S. S., & Hareendran, A. S. (2014). *Artificial intelligence and machine learning*. PHI Learning.
2. Müller, A. C., & Guido, S. (2016). *Introduction to machine learning with Python: A guide for data scientists* (1st Ed.). O'Reilly Media.
3. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT Press.
4. Bird, S., Klein, E., & Loper, E. (2009). *Natural language processing with Python* (1st Ed.). O'Reilly Publications.
5. Krishna, R. (2017). *Computer vision: Foundations and applications*. Stanford University.

Websites and eLearning Sources:

1. https://cdn-dynmedia-1.microsoft.com/is/content/microsoftcorp/microsoft/final/en-us/microsoft-brand/documents/2024-wttc-introduction-to-ai.pdf
2. https://www.geeksforgeeks.org/machine-learning/
3. https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
4. https://www.ltimindtree.com/wp-content/uploads/2023/01/DeepPoV-Generative-AI.pdf?pdf=download
5. https://www.assemblymag.com/ext/resources/White_Papers/Sep16/Introduction-to-Machine-Vision.pdf

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25PCA4ES03B	**Discipline Specific Elective - 3:** Advanced Computing Technologies	4	3

Course Objectives
To learn the concepts of green computing and its future.
To understand the fundamental concepts and roots of cloud computing.
To enlighten the concepts, types, functions and applications of Blockchain Technology.
To explore the evolution, categories, applications, and impact of wearable technologies.
To familiarize with the architecture, advancements, and applications of quantum computing.

UNIT I: Green Computing (12 Hours)

Reputation as Motivation - Avoiding Green Wash - Social License to Operate - Green Computing - Saving Money is Green - Getting Focused on Money - Saving Efforts - Implementing Energy Efficiency - Changing Current Devices - Moving to Cloud Services - Digitizing Non - IT Functions - Environmental Drivers for Green Computing - Drives the Green Agenda - Key Roots of Environmentalism - Environmentalism and IT - Green Computing and the Future - Megatrends for Green Computing.

UNIT-II: Cloud Computing (12 Hours)

Roots of Cloud Computing - Layers and Types of Cloud – Features of a cloud - Infrastructure Management - Cloud Services - Challenges and Risks. Migrating into a Cloud: Broad Approaches – Seven Step Model - Integration as a Service - Integration Methodologies - SaaS.

UNIT III: Blockchain Technology (12 Hours)

Origin of Blockchain - Blockchain Solution - Components of Blockchain - Block in a Blockchain. Blockchain Types: Decentralization and Distribution - Types of Blockchain. Applications of Blockchain: Blockchain in Banking and Finance - Blockchain in Finance - Blockchain in Energy - Blockchain in Healthcare - Blockchain in Real-Estate - Blockchain in Supply Chain – The Blockchain and IoT.

UNIT IV: Wearable Technologies (12 Hours)

The Concept of Wearable Technology - History - Categories - Usage Areas of Wearable Technologies - Healthcare – Military - Sports - Advantages and Disadvantages - Features.

UNIT V: Quantum Computing (12 Hours)

The Quantum Foundation - Quantum Computing Architecture - Different Approaches - Creating Scalable Quantum Networks - Technical Challenges and Advancements - Evaluating Economic Factors, Power Capabilities and Prevalence - Quantum Hardware and Ecosystem - Material Sciences - Molecular Quantum Mechanics - Quantum Software - Quantum Software vs. Classical Software - Software-Hardware Interface - Driving Quantum Computing Forward - Power and Practice of Quantum Simulation.

Teaching Methodology	Lectures, Demonstrations, GD, Blended/Flipped classes
Assessment Methods	MCQs, Quiz, Group Work.

Books for Study:

1. Smith, B. D. (2014). *Green computing Tools and Techniques for Saving Energy, Money, and Resources.* (1st Ed.). CRC Press.
   Unit I: *Chapter 1: Sec. (1.1 to 1.4), Chapter 2: Sec. (2.1 to 2.6), Chapter 3: Sec. (3.1 to 3.4) Chapter 12: Sec. (12.1 to 12.2)*
2. Buyya, R., Broberg, J. & Goscinski, A. (2011). *Cloud Computing Principles and Paradigms,* (1st Ed.). John Wiley & Sons.
   Unit II: *Chapter*
3. Chandramouli, S., George, A.G., Abhilash, K.A., & Karthikeyan, M. (2021). *Blockchain Technology*. Universities Press.
   Unit III: *Chapter 1: (Sec: 1.1 to 1.5), Chapter 2: (Sec: 2.2 to 2.3), Chapter 10: (Sec: 10.1 to 10.8)*

4. Acar, E. & Unal, Z. (2023), *Wearable Technologies.* Iksad Publishing House.
   Unit IV: *Chapter 1 to 9*
5. Pantheon Space Academy (2023)**,** *Quantum Computing Explained for Beginners: The Science, Technology, and Impact.* Pantheon Global Publishing LLC.
   Unit V: *Chapter 2*

Books for Reference:

1. Murphy, Eamonn, and Mulligan & Conor (2016). *Green IT: Challenges and Opportunities* (1st Ed.). Wiley.
2. Bahga, A. & Madisetti, V., (2013*). Cloud Computing: A Hands-On Approach (1stEd.)*. McGraw-Hill Education.
3. Tapscott, Don, Tapscott& Alex (2016). *Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World* (1st Ed.). Penguin.
4. Kwon, B. (2016). *Wearable Technologies: Concepts, Methodologies, Tools, and Applications* (1st Ed.*).* IGI Global.
5. Raad, H. (2020). *Fundamentals of IoT and Wearable Technology Design* (1st ed). CRC Press.
6. Montanaro, A. (2021). *Quantum Computing: A Gentle Introduction* (2nd Ed.). MIT Press.

Websites and eLearning Sources:

1. https://www.researchgate.net/publication/330601659_Green_Computing_Turns_Green_IT
2. https://www.coursera.org/learn/cloud-computing
3. https://onlinecourses.nptel.ac.in/noc25_cs12/preview (Cloud Computing)

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25PCA4PW01	Project	-	13

Objective of the Course

The Project Work is an essential component of the MCA curriculum, designed to provide hands-on experience in software development and research. It enables students to apply theoretical knowledge to real-world challenges, aligning with industry needs and leading to the development of complete software solutions.

Scope

The industry-based project should encompass all phases of software development, including problem identification, analysis, design, development, testing, and documentation. The project must:

- Address a real-world problem using appropriate technologies.
- Follow standard software development practices.
- Be implemented within an industry environment.

Project Requirements

- The project must be undertaken individually, adhering to departmental guidelines.
- It should be domain-specific and aligned with emerging trends in computing.
- A project report must be submitted in the format specified by the department.

Process to be followed

1. Duration of the Project

The fourth semester is dedicated to a four-month industry project, commencing in December. Students must undertake the project in an IT/ITES organization located in any city in India.

2. Selection of the Organization

Students are responsible for selecting an organization before December and submitting relevant details to their class in-charge. A requisition letter, endorsed by the Head of the Department (HoD), must be sent to the chosen organization for project approval.

3. Receiving Letter of Acceptance

Before commencing the project, students must obtain a formal letter of acceptance from the organization, confirming its commitment to facilitate the project. The class in-charge and HoD retain the right to approve or suggest changes to the selected organization. If changes are recommended, students must be prepared to find an alternative organization. Students may proceed with their project only after receiving the acceptance letter.

4. Guide Allotment and Receiving Instructions

On the first day of the fourth semester, the class in-charge will assign project guides to students and provide necessary guidelines for project execution.

5. Joining Report and Progress Updates

- Students must join the organization within the first week of December and submit a joining report via email by the specified deadline.
- Weekly progress reports must be emailed to the assigned guide.
- Students must also meet their guide in person once every 15 days to discuss project progress

6. Synopsis Submission

Students must submit a **synopsis** of their project work to the class in-charge, HoD, and respective internal guide in the first week of January.

7. Project Reviews

- Two project reviews will be conducted by the internal guide, as scheduled by the class in-charge.
- The first review takes place two months after joining the organization.
- The second review is conducted before manuscript submission.
- Students must be present in the department for both reviews. Failure to attend either review will result in ineligibility for the viva-voce examination.

- During the first review, students must submit the original acceptance letter, joining report, and synopsis to the class in-charge.

8. External Guide Evaluation
The external guide from the organization will evaluate the student's performance, contributing 10% of the final assessment.

9. Manuscript Submission
Following the second review, students must submit a manuscript in the prescribed format to the internal guide for corrections. After incorporating feedback, two bound copies of the final report must be submitted to the class in-charge.

10. Viva-Voce Examination
The viva-voce examination will be conducted by both internal and external examiners on the date specified by the HoD.

Assessment and Evaluation Procedure
The project will be evaluated by both Internal and External Examiners, with each assessing the project for 100 marks.

Internal Examiner Evaluation
The internal evaluation consists of multiple assessment components. The total score will be converted to 75 marks, while the viva-voce will account for 25 marks.

	Max. Marks	Presentation	Content	Answering Questions	Total
Review - I	**20**	**/10**	**/5**	**/5**	**/20**
Review - II	**30**	**/15**	**/10**	**/5**	**/30**

	Max. Marks	Content	Format	Chart & Figures	Total
Manuscript	**40**	**/25**	**/10**	**/5**	**/40**
External Guide	**10**				**/10**

External Examiner Evaluation

- Before the viva-voce examination, the external examiner will review the project report and allot 75 marks based on its quality and content.
- The remaining 25 marks will be awarded based on the student's performance in the viva-voce.

This project work serves as the **culmination of the MCA program**, equipping students with practical experience and preparing them for professional roles in software development, research, and innovation.

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
4	25PCA4CE01	Comprehensive Examination	0	2

Course Objectives
To understand the fundamental concepts of database systems and their architecture.
To study tree structures, including binary trees, binary search trees, and tree traversals.
To learn how to gather, analyze, and define software requirements.
To analyze data communication in local and wide area networks (LAN/WAN).
To stay updated on emerging trends in computer science and technology that shape the future.

UNIT I: Database Management Systems

Database System Concepts and Architecture - Data Modelling - SQL - Normalization - Transaction Processing and Concurrency Control - Database Recovery Techniques -Data Warehousing and Data Mining - Big Data and NoSQL.

UNIT II: Data Structures

Array and its Applications - Stack – Queue - Linked List – Trees - Binary Tree - Sets and Graphs.

UNIT III: Software Engineering

Software Process Models - Software Requirements - Software Design - Software Testing.

UNIT IV: Computer Networks

Data Communication - Network Models - OSI - TCP/IP Layers.

UNIT V: Recent Trends in Computer Science

Cloud Computing - Internet of Things - Artificial Intelligence - Machine Learning.

Teaching Methodology	--
Assessment Methods	Online Test.

Semester	Course Code	Title of the Course	Hours/ Weeks	Credits
1	25PCA1BC01	Bridge Course	30	2

Course Objectives
To provide the basic concepts in Information Technology.
To explain the concepts of mathematical logic and discrete structures.
To explore problem-solving techniques.
To understand the fundamental syntax and concepts of C programming, Control statements and Looping structures.
To write programs using various control structures, strings, arrays and pointers.

UNIT I: Fundamentals of Information Technology

Computers - Generation of Computers - Classification of Digital Computer - Anatomy of Digital Computer - CPU and Memory - Secondary Storage Devices - Input Devices - Output Devices - Computer Software - Programming Language - Operating Systems - Database Management System.

UNIT II: Mathematical Foundations for Computer Science

Mathematical Logic: Statements and Notation - Connectives-Statement - Formulas and Truth Tables - Tautologies - Equivalence of Formulas - Duality Law - Tautological implications.

UNIT III: Problem Solving Techniques

Algorithms - Flow charts - Developing algorithms and flowcharts for solving simple problems using sequential, selection and iterative programming Structures.

UNIT IV: Programming in C

Structure of a C program - Data Types - Constants and Variables - Operators and Expressions - Control structures - Looping structures - Arrays - Functions - Built-in-functions - User defined functions - Scope of Variables - String Handling Functions.

UNIT V: Coding Practices

Simple Programs using Operators - Branching structures - Looping structures. Arrays: One dimensional and Two dimensional Arrays - Strings - User defined Functions - String Functions.

Teaching Methodology	PPT, Flipped Classroom.
Assessment Methods	MCQ, Snap Test.

Books for Study:

1. Leon, A. & Leon, M. (2009). *Fundamentals of Information Technology*, (2nd Ed.). Vikas Publishing House.
   Unit I: *Chapter 1.*
2. Tremblay, J. P., & Manohar, R. (2008). *Discrete Mathematical Structures with Applications to Computer Science*, (1st Ed.). McGraw-Hill.
   Unit II: *Chapter 1.*
3. Jaiswal, S. (2009). *Information Technology Today*, (4th Ed.). Galgotia Publications.
   Unit III: *Chapter 20 and 21.*
4. Balagurusamy, E. (2016). *Programming in ANSI C*, (7th Ed.). Tata McGraw Hill.
   Unit IV, V: *Chapters: 1 to 7, 9.*

Books for Reference

1. Kanetkar, Y. (2021). *Let Us C*, (18th Ed.). BPB Publications.
2. Gottfried, B., & Schaum. (2018). *Outline Programming with C*, (4th Ed.). Tata McGraw Hill.
3. Kernighan, & Ritchie. (1998). *The C Programming Language*, (2nd Ed.). Prentice Hall.

Websites and eLearning Sources:

1. https://teachmint.storage.googleapis.com/public/224619601/StudyMaterial/35957954-ed0c-4c03-9772-f1b2a3dfc756.pdf

2. https://karadev.net/uroci/filespdf/files/Programming-in-ANSI-C.pdf
3. https://books.google.co.in/books?id=AOPqEj22L0MC&pg=PR3&source=gbs_selected_pages&cad=1#v=onepage&q&f=false =