

**Scheme & Syllabus**  
**of**  
**Master of Computer Applications (MCA)**  
(With effect from 2024-2026)

Outcome Based Education  
With  
Choice Based Education

**ಪಠ್ಯಕ್ರಮ**

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2024-2026)



**P.E.S. College of Engineering**

Mandya - 571 401, Karnataka

(An Autonomous Institution Affiliated to VTU, Belagavi  
Grant -in- Aid Institution (Government of Karnataka), World Bank Funded College  
(TEQIP) Accredited by NBA & NAAC and Approved by AICTE, New Delhi.)

**ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ**

**ಮಂಡ್ಯ 571401- ಕರ್ನಾಟಕ**

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# **Department of Master of Computer Applications (MCA)**

## **ABOUT THE DEPARTMENT**

The department of MCA was started in 1992 in PES College of Engineering Mandya, one among the earliest institutes in Karnataka to start MCA Programme and successfully completes 33 years with excellence. The department is run by highly qualified teaching staff. The Three years Programme became autonomous in the year 2008 and is affiliated to Visvesvaraya Technological University and approved by AICTE. The program duration became Two years from the academic year 2020-2021. The department has been actively involved in conducting workshops, Industry Visits, Technical Seminars from industry persons to provide a platform for sharing and spreading the latest developments in the field of Computer science and applications.

The curriculum for the Master of Computer Applications (MCA) program is designed to meet the need of the industry. Our alumni are placed across the world in MNC companies, Government and Private sectors.

## **VISION AND MISSION**

### **Vision of PESCE**

PESCE shall be a leading institution imparting quality engineering and management education developing creative and socially responsible professionals.

### **Mission of PESCE**

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.
- Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.
- Promote research, product development and industry-institution interaction.

### **Vision of the Department**

A Department of high repute imparting quality education to develop competent computer application software professionals and technocrats to serve the society.

### **Mission of the Department**

Committed to

- To provide state-of-the-art facilities with supportive environment for teaching and learning.
- To prepare the students with curricula of industry expectation.
- Train the students to be competent to solve the real-world problems in the field of computer Applications and nurturing the students with ethical values for well-being in the society.

## ACADEMIC PROGRAM

### PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1.** Deliver competence in a global environment as computer software professional with Practice of software engineering principles.
- PEO-2.** Exhibit Technical and managerial skills to provide solutions for societal acceptable problems and manage projects.
- PEO-3.** Excel in profession with effective communication skills, ethical attitude, teamwork and ability to relate computer applications to broader societal context.

### PROGRAMME OUTCOMES (POs)

- PO-1. (Foundation Knowledge):** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- PO-2. (Problem Analysis):** Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.
- PO-3. (Development of Solutions):** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
- PO-4. (Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- PO-5. (Individual and Teamwork):** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- PO-6. (Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
- PO-7. (Ethics):** Commit to professional ethics in managing software projects with financial aspects, learn to use new technologies for cyber security and insulate customers from malware.
- PO-8. (Life-long Learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

## **CREDIT PATTERN**

### **Professional Core Courses**

I Semester 10 Credits

II Semester 16 Credits

**Total credits for PCC are 26 credits**

### **Integrated Professional Core Courses**

I Semester 4 Credits

II Semester 4 Credits

**Total credits for IPCC are 08 credits**

### **Professional Core Courses Laboratory**

I Semester 1 Credits

II Semester 2 Credits

**Total credits for PCCL are 03 credits**

### **Professional Elective Courses (PEC)**

III Semester 09 Credits (**Specialization**)

IV Semester 03 Credits (**Online**)

**Total credits for PEC courses are 12 credits**

**Basic Science Course (Mathematics) : 03 (I Semester)**

**Project Work (Phase – 1 & Phase-2) : 15 Credits (III & IV Semester)**

**Industry Internship : 11 Credits (III Semester)**

**Technical Seminar : 02 Credit (IV Semester)**

**A total of 80 credits for 2 years MCA Programme**

**MASTER OF COMPUTER APPLICATIONS (MCA)  
SCHEME OF TEACHING AND EXAMINATION 2024-2026**

**I SEMESTER**

Sl. No	Course Code	Course Type	Course Title	L: T: P	Total Teaching Hours	Credits	Examination			
							Marks			
							CIE	SEE	Total	
1	P24MCA11	IPCC	Programming and Problem Solving in C	3 : 0 : 1	5	4	50	50	100	
2	P24MCA12	BSC	Discrete Mathematics and Graph Theory	2 : 1 : 0	4	3	50	50	100	
3	P24MCA13	PCC	Database Management Systems (DBMS)	4 : 0 : 0	4	4	50	50	100	
4	P24MCA14	PCC	Operating System	2 : 1 : 0	4	3	50	50	100	
5	P24MCA15	PCC	Web Technologies	3 : 0 : 0	3	3	50	50	100	
6	P24MCA16	PCCL	DBMS and Web Technologies Laboratory	0 : 0 : 1	2	1	50	50	100	
7	P24MCA17	NCMC	Research Methodology and IPR (Online Course)	-	-	PP	-	-	-	
8	P24MHU18	NCMC	Employability Enhancement Skills-1 (EES-1) *	-	2	PP	50	-	100	
9	P24MCA19	NCMC	Mathematics Bridge Course for MCA Program #	-	3	PP	50	-	100	
<b>Total</b>						<b>27</b>	<b>18</b>	<b>400</b>	<b>300</b>	<b>800</b>

Note: **BSC**-Basic Science Courses, **PCC**: Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB)**: Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab, **NCMC**- Non Credit Mandatory Course, L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities.

**24MCA17 Research Methodology and IPR (Online) - None Credit Mandatory Course (NCMC)** if students have not studied this course in their undergraduate program, then he /she has to take this course at <http://online.vtu.ac.in> and to qualify for this course is compulsory before completion of the minimum duration of the program (Two years), however, this course will not be considered for vertical progression.

# **Bridge Course** Non-Credit Mandatory Course 24MCA19-Mathematics for MCA Students: Students who have not taken Mathematics at the **10+2 or degree level** are required to study and pass this course in the 1st semester. However, this course/subject will not be considered for vertical progression.

\* Taught by Humanities Science and Management Department

## II SEMESTER

Sl. No	Course Code	Course Type	Course Title	L : T : P	Total Teaching Hours	Credits	Examination		
							Marks		
							CIE	SEE	Total
1	P24MCA21	IPCC	Machine Learning and Data Analytics using python	3 : 0 : 1	5	4	50	50	100
2	P24MCA22	PCC	Object Oriented Programming using JAVA	4 : 0 : 0	4	4	50	50	100
3	P24MCA23	PCC	Data Structure and Algorithms	4 : 0 : 0	4	4	50	50	100
4	P24MCA24	PCC	Software Engineering	3 : 1 : 0	5	4	50	50	100
5	P24MCA25	PCC	Web Application Development	3 : 1 : 0	5	4	50	50	100
6	P24MCAL26	PCCL	Object Oriented Programming using JAVA Laboratory	0 : 0 : 1	2	1	50	50	100
7	P24MCAL27	PCCL	Data Structure and Algorithms Laboratory	0 : 0 : 1	2	1	50	50	100
8	P24MHU28	NCMC	Employability Enhancement Skills-2 (EES-2)*	-	2	PP	50	-	-
9	P24MCA29	NCMC	Ability Enhancement Courses with Seminar-I	-	2	PP	50	-	-
		<b>Total</b>			<b>31</b>	<b>22</b>	<b>400</b>	<b>350</b>	<b>700</b>

Note: **BSC**-Basic Science Courses, **PCC**: Professional core. **IPCC**-Integrated Professional Core Courses, **PCC(PB)**: Professional Core Courses (Project Based), **PCCL**-Professional Core Course lab, **NCMC**- Non-Credit Mandatory Course, **L**-Lecture, **P**-Practical, **T/SDA**-Tutorial / Skill Development Activities

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**24MCA29- Ability Enhancement Courses with Seminar-I - None Credit Mandatory Course (NCMC)**, Students have to select the Topic like ERP, R Programming, Scripting language, Web Development Application, etc. They have to develop a small prototype and demonstrate to all the class.

### I and II Semester Course Types Description

**BSC: Basic Science Courses:** Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide.

**PCC: Professional Core Course:** Courses related to the stream of engineering, which will have both CIE and SEE components, students have to qualify in the course for the award of the degree.

**Integrated Professional Core Course (IPCC):** Refers to a Professional Theory Core Course Integrated with practicals of the same course. The IPCC's theory part shall be evaluated by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

**PCCL: Professional Core Course Laboratory:** Practical courses whose CIE will be evaluated by the class teacher and SEE will be evaluated by the two examiners.

**Skill development activities:** Under Skill development activities in a concerning course, the students should

1. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
2. Involve in case studies and field visits/ fieldwork.
3. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
4. Handle advanced instruments to enhance technical talent.
5. Gain confidence in the modeling of systems and algorithms for transient and steady-state operations, thermal study, etc.
6. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc. Students and the course instructor/s are to be involved either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical activities that will enhance their skills. The prepared report shall be evaluated for CIE marks.

### III SEMESTER

Sl. No	Course Code	Course Type	Course Title	L : T : P	Total Teaching Hours	Credits	Examination		
							Marks		
							CIE	SEE	Total
1	P24MCAX311X	PEC	Specializations	3 : 0 : 0	3	3	50	50	100
2	P24MCAX311X	PEC	Specializations	3 : 0 : 0	3	3	50	50	100
3	P24MCAX311X	PEC	Specializations	3 : 0 : 0	3	3	50	50	100
4	P24MCA32	PROJ	Project Work Phase -1	0 : 0 : 4	3	5	100	-	100
5	P24MCA33	INT	Research Internship / Industry-Internship / Startup Internship	-	3	11	100	100	200
<b>Total</b>					<b>15</b>	<b>25</b>	<b>350</b>	<b>250</b>	<b>600</b>

Note: **PEC**-Professional Elective Courses, **PROJ**- Project, **L**-Lecture, **P**-Practical, **T/SDA**-Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students)

**Specializations:** Students can *opt* three specializations from the listed below

Sl. No.	Specialization	Data Science and Analytics (A)	Sl. No.	Specialization	Web Application Development (B)
	Course code	Course Title		Course code	Course Title
1	P24MCAA311A	Data Mining and Visualization	1	P24MCAB311A	Web Development using Full Stack open
2	P24MCAA311B	Big Data Analytics	2	P24MCAB311B	Rich Internet Application Development
3	P24MCAA311C	Business Data Analytics	3	P24MCAB311C	Web Development Using PHP and MySQL
4	P24MCAA311D	Enterprise Resource Planning	4	P24MCAB311D	Enterprise Application Programming
5	P24MCAA311E	Exploratory Data Analysis	5	P24MCAB311E	Advances in Web Technologies
6	P24MCAA311F	Social Media Analytics	6	P24MCAB311F	Web Programming using Java

Sl. No.	Specialization	Network and System Administration (C)	Sl. No.	Specialization	Software Development and Systems (D)
	Course code	Course Title		Course code	Course Title
1	P24MCAC311A	Computer Networks	1	P24MCAD311A	Management Information Systems
2	P24MCAC311B	Network and Linux Administration	2	P24MCAD311B	Database Design & Applications
3	P24MCAC311C	TCP/ IP	3	P24MCAD311C	Software Architectures
4	P24MCAC311D	Unix Shell Programming	4	P24MCAD311D	Computer Organization and Software Systems
5	P24MCAC311E	Cloud Essentials	5	P24MCAD311E	Software Design and Patterns
6	P24MCAC311F	Introduction to ERP and SAP Basis Administration	6	P24MCAD311F	Object-oriented Analysis & Design

Sl. No.	Specialization	Computer Networks and Cloud (E)	Sl. No.	Specialization	AI and ML (F)
	Course code	Course Title		Course code	Course Title
1	P24MCAE311A	Mobile Computing	1	P24MCAF311A	Introduction to Generative AI
2	P24MCAE311B	Data Storage Technologies and Networks	2	P24MCAF311B	Artificial Neural Networks
3	P24MCAE311C	Design and Operation of Data Centres	3	P24MCAF311C	Natural Language Processing
4	P24MCAE311D	Wireless and Mobile Communication	4	P24MCAF311D	Deep Learning Fundamentals
5	P24MCAE311E	Software Defined Networks	5	P24MCAF311E	Introduction to Machine Learning
6	P24MCAE311F	Cloud Computing	6	P24MCAF311F	Computer Vision

Sl. No.	Specialization	IoT (G)	Sl. No.	Specialization	Security (H)
	Course code	Course Title		Course code	Course Title
1	P24MCAG311A	Data Management for IoT	1	P24MCAH311A	Ethical Hacking
2	P24MCAG311B	Networked Embedded Applications	2	P24MCAH311B	Cyber Security
3	P24MCAG311C	Cross Platform Application Development	3	P24MCAH311C	Cryptography and Network Security
4	P24MCAG311D	IoT Technology and Applications	4	P24MCAH311D	Blockchain Technologies
5	P24MCAG311E	Communication and Networking Technologies in IoT	5	P24MCAH311E	Database & Web Application Security
6	P24MCAG311F	Software and Programming in IoT	6	P24MCAH311F	Mobile and Wireless Security

**Project work** is a significant component aimed at fostering research, practical application of knowledge, and innovation. In Project work phase – 1 students have to complete **Topic Selection, Approval of Project Work and Literature Survey** :

- Topic Selection: Students propose project topics, often in consultation with their faculty advisor.
- Approval Process: The proposed topic is submitted for approval by a project committee or department, ensuring alignment with academic standards and relevance.
- Complete Literature survey

**Industry Internship:** The main objective of the industry internship is to ensure that the intern is exposed to a real-world environment and gain practical experience. Often, it may be a practical exposure to the theory that has been learned during the academic period. The industry internship helps students understand of analytical concepts and tools, hone their skills in real-life situations, and build confidence in applying the skills learned.

**Research Internship:** A research internship is an opportunity for students or early career professionals to gain hands-on experience in conducting research under the guidance of a mentor or within a research team. These internships can take place in academic institutions, research organizations, government agencies, or private companies

**Research /Industry Internship:** In the third-semester Students have to be in touch with a guide/mentor/coordinator and regularly submit the report referred to the progress internship. Based on the progress report the Guide/Mentor/coordinator has to enter the CIE marks. he/she has to attend the SEE at the parent Institute.

## IV SEMESTER

Sl. No	Course Code	Course Type	Course Title	L : T : P	Total Teaching Hours	Credits	Examination		
							Marks		
							CIE	SEE	Total
1	P24MCA41	PEC	(Online Course) 12 weeks duration	-	-	3	100	-	100
2	P24MCA42	TS	Technical Seminar	-	3	2	100	-	100
3	P24MCA43	PROJ	Project Work Phase -2	0 : 0 : 6	3	10	100	100	200
<b>Total</b>				-	<b>6</b>	<b>15</b>	<b>300</b>	<b>100</b>	<b>400</b>

**Note:** PEC-Professional Elective Courses, TS – Technical Seminar, INT- Industry/ Research Internship leading to the project work /startup

**24MCA41:** One Online NPTEL course can be cumbersome so one research article may be accepted/Published. A patent can be also one option.

**TS: Technical Seminar:** Students can present the seminar based on the new technologies in the seminar by all postgraduate students of the program shall be mandatory. The CIE marks awarded for the Seminar shall be based on the evaluation of the Report, Presentation skill, and performance in the Question-and-Answer session in the ratio 50:25:25. Seminar shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/ complete shall be declared as fail in the seminar course and have to complete the same during the subsequent semester

**Project work** is a significant component aimed at fostering research, practical application of knowledge, and innovation. In Project work phase – 2, the evaluation process generally follows these steps:

### 1. Project Execution:

- Research and Development: Students carry out research, experiments, or development work as per the project plan.
- Periodic Reviews: Regular progress reviews are conducted by faculty to monitor the project's progress and provide feedback.
- Documentation: Students maintain a detailed record of their methodology, data, results, and analysis.

### 2. Submission of the Project Report:

- Format and Guidelines: The report must follow the prescribed format by the university or department.
- Plagiarism Check: The report is often checked for plagiarism to ensure originality.

### 3. Evaluation Process:

- Internal Evaluation: Faculty members from the department review the project report and presentation for content quality, innovation, and depth of research.
- External Evaluation: An external examiner, often an industry expert or academician from another institution, reviews the project.
- Viva Voce Examination: The student defends their project work before a panel comprising internal and external examiners. This assesses their understanding, analytical ability, and application of the project work.

### 5. Grading Criteria (Guidelines only)

- Report Quality: Depth of research, organization, and clarity of the document.
- Presentation Skills: Effectiveness in communicating key aspects of the project.
- Technical Merit: Innovation, accuracy, and the applicability of the research.
- Viva Performance: Understanding of the subject, responses to questions, and ability to discuss the work effectively.

### 6. Final Outcome:

- Marks Allocation: Typically, evaluation is a blend of internal (guided by the department) and external (examiner's input) assessments, distributed over the report, presentation, and viva.
- Pass Requirement: Students must meet a minimum threshold to pass, as per University / College/ Department.

This structured evaluation ensures a comprehensive assessment of the student's practical and research capabilities, preparing them for further research or professional practice.

### Assessment Details for I, II, III & IV Semester's Courses: (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

### Assessment Details for Integrated Professional Core Courses:

Assessment Details										
Assessment	Weightage	Marks	Event Break UP							
			Theory (A)				Practical (B)			
CIE	50%	50	CIE I	CIE II	Assignment/ Skill Development	Average of CIE I & CIE II + Assignment	CIE	Record of Experiment write-up & Execution	CIE + Record Marks	Average of both A and B
			40	40	10	50	40	10	50	50
SEE	50%	50	-							

### Assessment Details for Professional Core Courses, Specialization & Basic Science Course:

Assessment Details						
Assessment	Weightage	Marks	Event Break UP			
CIE	50%	50	CIE I	CIE II	Assignment	Average of CIE I & CIE II + Assignment
			40	40	10	50
SEE	50%	50	-			

## Scheme of SEE Question Paper

<b>Scheme of SEE Question Paper (100 Marks)</b>		
<b>Duration: 3hrs</b>	<b>Marks: 100</b>	<b>Weightage: 50%</b>
<ul style="list-style-type: none"><li>• The question paper should cover the entire contents of the syllabus.</li><li>• The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.</li><li>• Total questions to be set are FIVE (with a maximum of 3 sub-questions), which have internal choice for any THREE units and remaining TWO units' questions are compulsory.</li><li>• The students should answer 5 full questions</li><li>• Each unit carries equal marks of 20.</li></ul>		

## Assessment Details for Professional Core Laboratory Courses

<b>Assessment Details</b>						
<b>Scheme</b>	<b>Weightage</b>	<b>Marks</b>	<b>Event Break UP</b>			
<b>CIE</b>	<b>50%</b>	<b>50</b>	<b>CIE I</b>	<b>CIE II</b>	<b>Record of Experiment write-up &amp; Execution</b>	<b>Average of CIE I &amp; CIE II + Record</b>
			<b>40</b>	<b>40</b>	<b>10</b>	<b>50</b>
<b>SEE</b>	<b>50%</b>	<b>50</b>	15% - write-up 70% - Conduction procedure and result 15% - Viva voce			

## SEMESTER-I

<b>Programming and Problem Solving in C</b>			
Course Code	<b>P24MCA11</b>	CIE Marks	50
L:T:P	3:0:1	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Total Marks	100
Credits	04	Exam Hours	03

### Course Learning Objectives (CLOs)

- Implement the constructs of C Language.
- Construct C Programs using basic programming constructs
- Develop C programs using arrays and strings
- Organize modular applications in C using functions
- Integrate pointers and structures in C applications and Execute input/output and file handling in C

### UNIT-I

**08 Hours**

**Basics of C Programming** Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement – Looping statements – Preprocessor directives - Compilation process

### UNIT-II

**08 Hours**

**Arrays And Strings** Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

### UNIT-III

**08 Hours**

**Functions And Pointers** Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

### UNIT-IV

**08 Hours**

**Structural And Union** Structure - Nested structures – Pointer and Structures – Array of structures – Self-referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

### UNIT-V

**08 Hours**

**File Processing** Files – Types of file processing: Sequential access, Random access –Sequential access file - Random access file - Command line arguments.

## Lab Experiments

10 Hours

1. Simulation of a Simple Calculator.
2. Implement Binary Search on Integers
3. Sort the given set of N numbers using Bubble sort.
4. Implement Matrix multiplication and validate the rules of multiplication.
5. An electricity board charges the following rates for the use of electricity: for the first 200 units 80 paise per unit: for the next 100 units 90 paise per unit: beyond 300 units Rs 1 per unit. All users are charged a minimum of Rs. 100 as meter charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of total amount is charged. Write a program to read the name of the user, number of units consumed and print out the charges.
6. Write functions to implement string operations such as compare, concatenate, and find string length. Use the parameter passing techniques.
7. Implement structures to read, write and compute average- marks of the students, list the students scoring above and below the average marks for a class of N students.
8. Write a C program to copy a text file to another, read both the input file name and target file name.

## Text Books

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

## References

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second 5. Edition, Oxford University Press, 2013. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.
5. Anta Goel and Ajay Mittal, “Computer Fundamentals and Programming in C, 1<sup>st</sup> Edition Pearson Education, 2013.

## Skill Development Activities Suggested

The students with the help of the course teacher can take up technical activities which will enhance their skill, or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

**Note: The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.**

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Demonstrate** knowledge on C Programming constructs (L5)

**CO2: Develop** simple applications in C using basic constraints (L4)

**CO3: Design** and implement applications using arrays and strings (L5)

**CO4: Develop** and implement modular applications in C using functions (L4)

**CO5: Develop** applications in C using structures and pointers (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	-	-	3	2	-	-	-	-
CO3	-	-	3	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-
CO5	-	-	-	-	3	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

Discrete Mathematics and Graph Theory			
Course Code	P24MCA12	CIE Marks	50
L:T:P	2:1:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning Objectives (CLOs)

- Analyze basic concepts of mathematical logic for analyzing propositions and proving theorems
- Apply sets and their operations algebraically to solve real-world problems.
- Examine the basics of graph theory and their various properties.
- Model problems using graphs and to solve these problems algorithmically.
- Apply graph theory concepts to solve real world problems in Computer Networking, Telecommunication Infrastructure, Transportation etc.

### UNIT-I

**08 Hours**

**Basic Structures:** Sets, set operations, Principle of Inclusion, Exclusion and Pigeonhole principle, functions, matrices.

### UNIT-II

**08 Hours**

**The foundations of logic and proofs:** Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs

### UNIT-III

**08 Hours**

**Introduction to Graphs:** Application of graphs – finite, infinite and bipartite graphs – Incidence and Degree – Isolated vertex, pendant vertex and Null graph. **Paths and circuits** – Isomorphism, sub-graphs, walks, paths and circuits, connected graphs, disconnected graphs and components.

### UNIT-IV

**08 Hours**

**Eulerian and Hamiltonian graphs:** Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Travelling salesman problem. **Directed graphs** – types of digraphs, Digraphs and binary relation.

### UNIT-V

**08 Hours**

**Graph Colouring:** Chromatic number, Chromatic polynomial, Matchings, Coverings, Four colour problem

### Text books

1. Kenneth H Rosen, “Discrete Mathematics and its Applications”, McGraw Hill Publications, 6<sup>th</sup> edition
2. Narsingh Deo, Graph theory with the applications to engineering & Computer Science, Dovers Publications, 2016
3. J.A. Bondy and U.S.R. Murty. Graph theory with Applications, Springer, 1st edition, 2008.

## Reference Books

1. J. K Sharma “Discrete Mathematics”, Mac Millian Publishers India, 3<sup>rd</sup> edition, 2011
2. Garry Chartand and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
3. Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.
4. Discrete Mathematical Structures –by Dr. D.S. Chandrashekaraih.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** basic concepts of mathematical logic for analyzing propositions and proving theorems and Use sets and its operations algebraically for solving real world problems. (L2)

**CO2: Understand** the basics of graph theory and their various properties. (L2)

**CO3: Solve** problems using graph theory (L3)

**CO4: Analyze** Eulerian and Hamiltonian graphs, solve optimization problems like TSP, and explore directed graphs and binary relations. (L4)

**CO5: analyze** the chromatic polynomial for graphs, examining how colorings change with available colors. (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Database Management Systems (DBMS)</b>			
Course Code	<b>P24MCA13</b>	CIE Marks	50
L:T: P	4:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

### Course Learning Objectives (CLOs)

- Analyze the basic concepts and the applications of database systems.
- Evaluate the different issues involved in the design and implementation of Database System.
- Explain the basic concepts of relational data model, entity relationship model, relational database design, relational algebra and database language SQL .
- Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS
- Apply the Normalization concepts to normalize the database and describe the concepts of DBMS transactions, concurrency control and crash recovery.

### UNIT-I

#### Introduction

**10 Hours**

**Introduction:** Purpose of Database System, Views of data, data models, database management system, three schema architecture of DBMS, components of DBMS. E/R Model Conceptual data modelling motivation, entities, entity types, attributes relationships, relationship types, E/R diagram notation, examples.

**Data Models:** Introduction to the Relational Model Structure Database Schema, Keys Schema Diagrams. Database design Other Models, ER diagrams ER Model Entities, Attributes and Entity sets Relationships and Relationship sets ER Design Issues Concept Design Conceptual Design with relevant Examples. Relational Query Languages, Relational Operations

### UNIT-II

**10 Hours**

**Relational Algebra**-Selection and projection set operations renaming Joins Division Examples of Algebra overviews Relational calculus Tuple Relational Calculus (TRC) Domain relational calculus (DRC).

**Overview of the SQL Query Language**-Basic Structure of SQL Queries, Data types, Creating a database, create a table, drop the database, drop table, select table, insert a record, update record, delete a record, order by, group by, triggers, Set Operations, Aggregate Functions , Nested Sub queries, Views, Procedures.

### UNIT-III

#### Relational Model and Relational Algebra

**10 Hours**

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

### UNIT-IV

#### SQL

**10 Hours**

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL, Basic queries in SQL, more complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of

SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL / PSM.

### UNIT-V

**10 Hours**

**Recovery and Atomicity-** Log Based Recovery Recovery with Concurrent Transactions Check Points - Buffer Management Failure with loss of nonvolatile storage.

#### Text Books

1. Database System Concepts, Silberschatz, Korth, Mc Graw hill, 7th edition.
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition.
3. Fundamentals of Database Systems, Elmasri and Navathe, 6th Edition, 2011, Pearson Education, ISBN13: 9780136086208.

#### Reference Books

1. An Introduction to Database systems, C.J. Date, A.Kannan, S. Swami Nadhan, Pearson, Eight Edition.
2. Rob, Coronel, "Database Systems", Seventh Edition, Cengage Learning
3. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.

#### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the basic elements of a relational database management system.(L2)

**CO2: Ability to identify** the data models for relevant problems (L3)

**CO3: Design** entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data (L6)

**CO4: Develop** a database application using relation schema with the help of normalization (L3)

**CO5: Utilize** transaction processing, concurrency control and crash recovery.(L3)

#### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-
CO4	1	1	-	-	-	-	-	-
CO5	1	1	1	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Operating System</b>			
Course Code	<b>P24MCA14</b>	CIE Marks	50
L:T: P	2:1:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- Define operating systems and its concepts.
- Identify the services provided by the operating system and learning different operating structure.
- Understand process management and coordination with classic synchronization problems.
- Evaluate various CPU scheduling algorithm problems and analyze methods for handling deadlocks.
- Discuss different memory management techniques such as contiguous, paging, segmentation and virtual memory.
- Explain file system and its implementation, mass storage and its scheduling

### **UNIT-I**

**08 Hours**

Introduction to Operating Systems, System Structure What operating systems do, Operating System Operations, Computing Environments, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure, System Boot Process Concept Process Concept, Process Scheduling, Interprocess Communication

### **UNIT-II**

**08 Hours**

Process Scheduling Basic Concepts, Scheduling Criteria, Scheduling Algorithms Synchronization Background, The Critical Section Problem, Mutex Locks, Semaphores, Classic Problems of Synchronization: Readers-Writers Problem, Dining Philosophers Problem using Semaphores

### **UNIT-III**

**08 Hours**

Deadlocks: System model, Deadlock Characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection and Recovery from Deadlock

### **UNIT-IV**

**08 Hours**

Memory Management Strategies Basic Hardware, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Virtual Memory Management Background, Demand Paging, Page Replacement

### **UNIT-V**

**08 Hours**

File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection, File-System Structure, Directory Implementation, Allocation Methods, Disk Scheduling.

### **Text Book**

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating Systems Principles, 10th Edition, Wiley – India, 2019.

## Reference Books

1. D M Dhamdhere: Operating Systems – A Concept Based Approach, 3rd Edition, Tata McGraw – Hill, 2017.
2. Harvey M Deital: Operating Systems, 3rd Edition, Addison Wesley, 1990.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Explain** The basics of Operating Systems, services and structure.(L2)

**CO2: Understand** Process concept, coordination and Synchronization, Methods for handling deadlocks.(L2)

**CO3: Utilize** Process Scheduling, Synchronization, deadlock avoidance, prevention and detection, disk scheduling, Memory management algorithms of operating system. (L3)

**CO4: Identify** Memory management techniques.(L3)

**CO5: Discuss** File concepts, allocation methods, Linux operating system. (L6)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	1	-	1	-	-	-
CO2	3	2	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-
CO4	3	3	-	-	-	-	1	-
CO5	3	2	-	-	-	-	2	-

**3-Strong; 2-Medium; 1-Low**

<b>Web Technologies</b>			
Course Code	<b>P24MCA15</b>	CIE Marks	50
L:T:P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- Creating the small web page using HTML and CSS
- Developing the interactive web pages using JavaScript
- Create web pages using angular JS framework

### **UNIT-I**

Web browsers, web servers, MIME, URL, HTTP **08 Hours**  
 Introduction to HTML5 tags, Basic syntax and structure, text markups, images, lists, tables, progress, Media tags-audio and video, forms, span and div tags.

### **UNIT-II**

**08 Hours**  
 Introduction to CSS, Levels of CSS, Selectors, Font, color and Text Properties, BOX Model, Introduction to JavaScript, JavaScript variables, operators, Conditional and loop statements in JavaScript, Functions and Arrays in JavaScript

### **UNIT-III**

**08 Hours**  
 Event Handling and Document Object model in JavaScript, handling strings and working with window object

### **UNIT-IV**

**08 Hours**  
 Introduction to AngularJS, Expressions, Modules, Directives, Model, Data binding, Controllers, Scopes, Filters

### **UNIT-V**

**08 Hours**  
 Services, Tables, Select box, Forms, Events, Validations

### **Text books**

1. Web Programming By Chris Bates , Wiley Publication
2. Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson education, 2015.
3. Angular JS By Krishna Rungta

### **Reference Book**

1. HTML5 Black Book by Dreamtech.

## Web links

- <https://www.w3schools.com/angular/default.asp>
- <https://www.tutorialspoint.com/angular8/index.ht>

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Explain** the fundamental concepts of web. (L2)

**CO2: Construct** the web pages using HTML and CSS. (L3)

**CO3: Develop** program using dynamic JavaScript for a given problem. (L3)

**CO4: Build** interactive web pages using AngularJS. (L3)

**CO5: Develop** the single window applications using AngularJS. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-
CO4	3	1	2	2	-	-	-	-
CO5	2	2	2	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>DBMS and Web Technologies Laboratory</b>			
Course Code	<b>P24MCAL16</b>	CIE Marks	50
L:T:P	0:0:1	SEE Marks	50
Total Hours of Pedagogy	10 Hours	Total Marks	100
Credits	01	Exam Hours	03

### Course Learning Objectives (CLOs)

- Create SQL queries for the small projects.
  - Create database objects that include tables, constraints, indexes, and sequences.
  - Demonstrate client/server application for a given problem
1. Create the following tables with properly specifying Primary keys, Foreign keys and solve the following queries. BRANCH (Branchid, Branchname, HOD)  
STUDENT (USN, Name, Address, Branchid, sem)  
BOOK (Bookid, Bookname, Authorid, Publisher, Branchid)  
AUTHOR (Authorid, Authurname, Country, age)  
BORROW (USN, Bookid, Borrowed\_Date)  
Execute the following Queries:
    - i. List the details of Students who are all studying in 2nd sem MCA.
    - ii. List the students who are not borrowed any books.
    - iii. Display the USN, Student name, Branch\_name, Book\_name, Author\_name, Books\_Borrowed\_Date of 2nd sem MCA Students who borrowed books.
    - iv. Display the number of books written by each Author.
    - v. Display the student details who borrowed more than two books.
    - vi. Display the student details who borrowed books of more than one Author.
    - vii. Display the Book names in descending order of their names.
    - viii. List the details of students who borrowed the books which are all published by the same publisher.
  2. Consider the following schema:  
STUDENT (USN, name, date\_of\_birth, branch, mark1, mark2, mark3, total, GPA)  
Execute the following queries:
    - i. Update the column total by adding the columns mark1, mark2, mark3.
    - ii. Find the GPA score of all the students.
    - iii. Find the students who born on a particular year of birth from the date\_of\_birth column.
    - iv. List the students who are studying in a particular branch of study.
    - v. Find the maximum GPA score of the student branch-wise.
    - vi. Find the students whose name starts with the alphabet “S”.
    - vii. Find the students whose name ends with the alphabets “AR”.
    - viii. Delete the student details whose USN is given as 1001
  3. Design an ER-diagram for the following scenario, Convert the same into a relational model and then solve the following queries .Consider a Cricket Tournament “ABC CUP” organized by an organization. In the tournament there are many teams are contesting each having a Teamid, Team\_Name, City, a coach. Each team is uniquely identified by using Teamid. A team can have many Players and a captain. Each player is uniquely identified by Playerid, having a Name, and multiple phone numbers, age. A player represents only one team. There are many Stadiums to conduct

matches. Each stadium is identified using Stadiumid, having a stadium\_name,Address ( involves city,area\_name,pincode). A team can play many matches. Each match played between the two teams in the scheduled date and time in the predefined Stadium. Each match is identified uniquely by using Matchid. Each match won by any of the one team that also wants to record in the database. For each match man\_of\_the match award given to a player.

Execute the following Queries:

- i. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament.
  - ii. List the details of the stadium where the maximum number of matches were played.
  - iii. List the details of the player who is not a captain but got the man\_of \_match award at least in twomatches.
  - iv. Display the Team details who won the maximum matches.
  - v. Display the team name where all its won matches played in the same stadium.
4. A country wants to conduct an election for the parliament. A country having many constituencies. Each constituency is identified uniquely by Constituency\_id, having the Name, belongs to a state,Number\_of\_voters. Aconstituency can have many voters. Each voter is uniquely identified by using Voter\_id, having the Name, age, address (involves Houseno,city,state,pincode). Each voter belongs to only one constituency. There are many candidates contesting in the election. Each candidates are uniquely identified by using candidate\_id, having Name, phone\_no, age, state. A candidate belongs to only one party.Thereare many parties. Each party is uniquely identified by using Party\_id, having Party\_Name,Party\_symbol. A candidate can contest from many constituencies under a same party. A party can have many candidates contesting from different constituencies. No constituency having the candidates from the same party. A constituency can have many contesting candidates belongs to different parties. Each voter votes only one candidate of his/her constituency.

Queries:

- i. List the details of the candidates who are contesting from more than one constituency which are belongs to different states.
  - ii. Display the state name having maximum number of constituencies.
  - iii. Create a stored procedure to insert the tuple into the voter table by checking the voter age. If voter's age is at least 18-year-old, then insert the tuple into the voter else display the "Not an eligible voter msg"
  - iv. Create a stored procedure to display the number\_of\_voters in the specified constituency. Where theconstituency name is passed as an argument to the stored procedure.
  - v. Create a TRIGGER to UPDATE the count of "Number\_of\_Voters" of the respective constituency in Constiency table , AFTER inserting a tuple into the "VOTERS"table.
5. Design an ER-diagram for the following scenario, Convert the same into a relational model, normalize Relations into a suitable Normal form and then solve the following queries. A country can have many Tourist places . Each Tourist place is identified by using tourist\_place\_id, having a name, belongs to a state, Number of kilometers away from the 02.03.2021 updated 52/ 104 capital city of that state, history. There are many Tourists visits tourist places every year. Each tourist is identified uniquely by using Tourist\_id, having a Name, age, Country and multiple emailids. A tourist visits many Tourist places, it is also required to record the visted\_date in the database. A tourist can visit a Tourist place many times at different dates. A Tourist place can be visited by many tourists either in the same date or at different dates.

Queries:

- i. List the state name which is having maximum number of tourist places.

- ii. List details of Tourist place where maximum number of tourists visited.
  - iii. List the details of tourists visited all tourist places of the state “KARNATAKA”
  - iv. Display the details of the tourist place visited by the tourists of all country. Details of the tourists visited at least one tourist place of the state, but visited all states tourists places.
  - v. Display the details of the tourist place visited by the tourists of all country.
6. Create an XHTML page that provides information about your department. Your XHTML page must use the following tags: a) Text Formatting tags b) Horizontal rule c) heading d) Links e) Images f) Tables (Use of additional tags encouraged).
  7. Develop and demonstrate a XHTML file that includes Javascript script for the following problems:
    - a) Input : A number n obtained using prompt Output : The first n Fibonacci numbers
    - b) Input : A number n obtained using prompt Output : A table of numbers from 1 to n and their squares using alert
  8. Develop and demonstrate, using JavaScript script, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible. Modify the above document so that when a text is moved from the top stacking position, it returns to its original position rather than to the bottom
  9. Develop, test and validate an XHTML document that includes text box, checkboxes and radio button along with submit and reset button.
  10. Develop dynamic JavaScript code to create a html page to create online exam paper format with 4 optional answers.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Design** entity-relationship diagrams to solve given database applications.(L6)

**CO2: Interpret** SQL queries for data retrieval based on requirements.(L2)

**CO3: Formulate** SQL queries for the given problem (L6)

**CO4: Construct** the web pages using HTML and CSS (L3)

**CO5: Develop** program using dynamic JavaScript for a given problem (L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	1	-	-	-	-
CO2	3	2	2	1	-	-	-	-
CO3	2	1	1	1	-	-	-	-
CO4	3	1	2	2	-	-	-	-
CO5	2	2	2	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Employability Enhancement Skills -1</b>			
Course Code	<b>P24MHU19</b>	CIE Marks	50
L:T:P	-	SEE Marks	-
Total Hours of Pedagogy	32 Hours	Total Marks	100
Credits	PP	Exam Hours	03

### Course Learning Objectives (CLOs)

- Introduction to basic quantitative aptitude concepts and problem-solving techniques.
- Advanced quantitative aptitude topics and practice.
- Enhance reasoning and analytical skills through verbal reasoning exercises.
- Develop effective communication skills and understanding of professional etiquettes.
- Focus on personal branding and future career planning.

### UNIT - I

**Introduction to basic quantitative aptitude concepts and problem-solving techniques** **06 hours**

#### Agenda Points:

1. Introduction to Quantitative Aptitude
  - Definition and importance
  - Topics overview (numbers, geometry, algebra)
2. Number Systems
  - Types of numbers, prime numbers, factors
  - Activities: Solving basic number system problems
3. Arithmetic
  - Percentages, ratios, and proportions
  - Activities: Real-life application problems

#### Hands-On Practice:

- Group exercises on problem-solving on the above concepts

#### Expected Outcomes:

- Understanding of basic numerical concepts
- Ability to solve arithmetic problems accurately

### UNIT - II

**Advanced quantitative aptitude topics and practice** **6 hours**

#### Agenda Points:

1. Algebra
  - Basic equations and inequalities
  - Activities: Solving equations as a team
2. Geometry
  - Basic shapes, area, and volume calculations
  - Activities: Geometry problem sets
3. Data Interpretation
  - Understanding graphs and tables
  - Activities: Analyzing data sets for insights

#### Hands-On Practice:

- Problem-solving competition
- Group discussions on different approaches to problems

#### Expected Outcomes:

- Enhanced skills in solving algebraic and geometric problems
- Ability to interpret and analyze data

**Deliverables:**

- Problem-solving competition results and worksheets
- Aptitude Assessment – 45 min – google form based MCQ's

**UNIT - III****Enhance reasoning and analytical skills through verbal reasoning exercises****06 hours****Agenda Points:**

1. Introduction to Verbal Reasoning
  - Importance in exams and interviews
  - Types of verbal reasoning problems
2. Practice Exercises
  - Analogies, syllogisms, and critical reasoning
  - Activities: Pair work for solving reasoning puzzles

**Hands-On Practice:**

- Group discussions on reasoning strategies
- 45 minutes - Mock verbal reasoning tests – Google form based

**Expected Outcomes:**

- Improved analytical thinking and reasoning capabilities

**Deliverables:**

- Results from mock tests and group discussions

**UNIT – IV****Develop effective communication skills and understanding of professional etiquettes****07 hours****Agenda Points:**

1. English Communication Basics
  - Importance of effective communication
  - Key elements of verbal and non-verbal communication
2. Written Communication Etiquettes
  - Email etiquette and formal writing skills
  - Activities: Drafting professional emails
3. Professional Etiquettes
  - Understanding workplace behavior
  - Activities: Role-playing scenarios

**Hands-On Practice:**

- Practicing written communication through peer feedback
- Role-playing to demonstrate professional etiquettes

**Expected Outcomes:**

- Ability to communicate effectively in English
- Understanding of professional behavior in workplace settings

**Deliverables:**

- Drafted emails and feedback from peers
- Students will be able to write an effective email to the department about various topics related to their career
- Students will be able to write an effective email to HR department seeking a job opportunity

**UNIT - V****English Communication and Professional Skills****07 hours****Agenda Points:**

1. SWOT Analysis
  - Understanding personal strengths, weaknesses, opportunities, and threats
  - Activities: Group SWOT analysis discussions

2. Goal Setting
  - Setting SMART goals for personal and professional growth
  - Activities: Individual goal-setting exercises
3. Resume Building and LinkedIn Profile Creation
  - Key components of impactful resumes
  - Tips for optimizing LinkedIn profiles
  - Activities: Drafting a resume and LinkedIn profile

**Hands-On Practice:**

- Group sharing of personal goals and SWOT analysis
- Peer reviews of resumes and LinkedIn profiles

**Expected Outcomes:**

- Clarity on personal and professional goals
- Comprehensive resume and LinkedIn profile ready for use

**Deliverables:**

- Completed SWOT analysis, personal goals, resume, and LinkedIn profile drafts

**Reference Books**

1. “Word Power Made Easy New Revised and Expanded Edition”, First Edition, Norman Lewis, GoyalPublisher.
2. “Essential English Grammar”, Raymond Murphy, Cambridge University Press, new edition

**Course Outcomes**

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** understanding of basic numerical concepts by accurately solving arithmetic problems.(L2)

**CO2: Apply** advanced skills to solve algebraic and geometric problems effectively.(L3)

**CO3: Develop** analytical thinking and reasoning capabilities to evaluate complex problems and construct logical solutions. (L3)

**CO4: Demonstrate** the ability to communicate effectively in English through written, verbal, and non-verbal methods (L2)

**CO5: Create** a comprehensive resume and LinkedIn profile tailored for professional opportunities (L6)

**Mapping with Program Outcomes**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	2	-	3
CO2	-	3	-	-	3	-	-	2
CO3	-	3	-	-	3	-	-	1
CO4	-	-	2	-	3	2	-	2
CO5	-	-	2	2	3	-	2	2
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Mathematics Bridge Course for MCA Program</b>			
Course Code	<b>P24MCA19</b>	CIE Marks	50
L:T:P	-	SEE Marks	-
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	PP	Exam Hours	-

### **Course Learning Objectives (CLOs)**

The mandatory learning course, Mathematics Bridge Course for MCA aims to provide basic concepts of Sets, Relations, Logic, Matrices & Determinants, Sequences & Series and Probability Theory.

### **Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- The lecture method (L) need not be only the traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
- Use of Video/Animation to explain the functioning of various concepts.
- Encourage collaborative (Group Learning) Learning in the class.
- Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
- Adopt Problem-Based Learning (PBL), which fosters students' Analytical skills, and develops design thinking skills such as the ability to design, evaluate, generalize, and analyse information rather than simply recall it.
- Show the different ways to solve the same problem and encourage the students to come up with creative ways to solve them.
- Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

### **UNIT - I**

#### **Set Theory**

**08 Hours**

Introduction. Representation of sets, Types of Sets, Finite set, Infinite set, equivalent set, disjoint set, Subset, Power set. Venn diagram. Set operations: Union, Intersection, Complement of a set, Difference, Symmetric Difference. Laws of set theory. Cartesian product of sets, Relations and properties.

### **UNIT - II**

#### **Logic and Propositions**

**08 Hours**

Logic Statement, Propositions, Connectives, Basic Logic Operations: Conjunction, Disjunction, Negation, Implication and Double Implication. Truth table, Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.

### **UNIT - III**

#### **Matrices and Determinants**

**08 Hours**

Matrix Introduction, Types of matrices, Scalar multiplication, Addition of matrices, Product of matrices. Transpose of a matrix, Symmetric and Skew Symmetric matrix, Rank of a matrix, Determinant of a matrix. Singular matrix.

### **UNIT - IV**

#### **Sequence and Series**

**08 Hours**

Introduction, Sequences, Series, Arithmetic Progression, Sum of Finite number of terms in A.P, Arithmetic Means, Geometric Progression, sum to n terms of G.P, Geometric Mean, relation between A.M and G.M.

## UNIT – V

### Probability Theory

08 Hours

Probability: Introduction, random experiments, sample space, events and algebra of events. Definitions of Probability – classical, and axiomatic. Conditional Probability, laws of addition and multiplication, independent events, theorem of total probability, Bayes' theorem and its applications.

### Reference Books

1. “Kenneth H Rosen, “Discrete Mathematics and its Applications”, McGraw Hill publications, 7th edition.
2. Walpole Myers Ye “Probability and Statistics for engineers and Scientist” Pearson Education, 8th edition.
3. Richard A Johnson and C. B Gupta “Probability and statistics for engineers” Pearson Education.
4. J.K Sharma “Discrete Mathematics”, Mac Millan Publishers India, 3rd edition,2011.
5. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 43rd Edition, 2015.

### Web links and Video Lectures (e-Resources)

- <http://.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- VTU EDUSAT PROGRAMME-20

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Elaborate** the knowledge of Basic concepts in Set Theory and **Apply** the fundamentals of set theory and Relations to the given problem (L3, L6)

**CO2: Understand** mathematical reasoning to read, comprehend and construct mathematical arguments (L2)

**CO3: Understand** the Basic Concepts in Matrices and Formulate the problems in Matrix expression (L2)

**CO4: Conclude** the sum of the first n terms of an arithmetic and Geometric series (L5)

**CO5: Understand** the basic concepts of probability and **find** the probability of simple and compound Events (L1, L2)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	1	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-
CO4	3	2	2	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

## SEMESTER – II

<b>Machine learning and Data analytics using Python</b>			
Course Code	<b>P24MCA21</b>	CIE Marks	50
L:T:P	3:0:1	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10 hours Lab	Total Marks	100
Credits	04	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- Understand foundational concepts in machine learning and data analytics.
- Gain proficiency in Python for data analysis and machine learning tasks.
- Learn and apply various machine learning algorithms and techniques.
- Develop skills in data preprocessing, visualization, and model evaluation.
- Prepare students for industry roles involving data-driven decision making and predictive modeling.

### **UNIT – I**

#### **Introduction to Machine Learning and Python**

**8 Hours**

**Introduction to Machine Learning:** Definition and importance of machine learning, Types of machine learning: Supervised, unsupervised, and reinforcement learning, Applications of machine learning in various domains.

**Python for Data Analysis:** Introduction to Python programming, Python libraries for data analysis: NumPy, Pandas, Matplotlib, Data manipulation and visualization using Pandas and Matplotlib.

**Data Preprocessing:** Data cleaning and transformation, Handling missing values and outliers, Feature scaling and normalization.

### **UNIT – II**

#### **Supervised Learning**

**8 Hours**

**Regression:** Linear regression, Polynomial regression, Model evaluation metrics: MAE, MSE, RMSE. **Classification:** Logistic regression, K-Nearest Neighbors (KNN), Decision Trees and Random Forests, Model evaluation metrics: Accuracy, precision, recall, F1-score, ROC-AUC.

**Model Training and Evaluation:** Train-test split and cross-validation, Hyper parameter tuning using GridSearchCV, Overfitting and underfitting.

### **UNIT – III**

#### **Unsupervised Learning**

**8 Hours**

**Clustering:** K-Means clustering, Hierarchical clustering, Evaluation of clustering results. **Dimensionality Reduction:** Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) t-Distributed Stochastic Neighbor Embedding (t-SNE).

**Association Rule Learning:** Apriori algorithm, Market Basket Analysis, Evaluation metrics for association rules

### **UNIT – IV**

#### **Advanced Machine Learning Techniques**

**8 Hours**

**Ensemble Methods:** Bagging and Boosting, Gradient Boosting Machines (GBM), Extreme Gradient Boosting (XGBoost).

**Support Vector Machines (SVM):** Linear and non-linear SVM, Kernel trick, Model evaluation and tuning.

**Neural Networks and Deep Learning:** Introduction to neural networks, Building and training neural networks using TensorFlow and Keras, Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN).

## UNIT – V

### Data Analytics and Real-World Applications

**8 Hours**

**Exploratory Data Analysis (EDA):** Data visualization techniques, Statistical analysis and hypothesis testing, Identifying patterns and insights from data.

**Time Series Analysis:** Introduction to time series data, Time series forecasting using ARIMA and Prophet, Evaluating time series models.

**Integrating Machine Learning Models:** Deployment of machine learning models, Building web applications with Flask and Django, Case studies on real-world applications of machine learning.

### Lab Experiments

**10 Hours**

1. Python programs to show the usage of Python Libraries for ML application such as Pandas, Matplotlib and Seaborn. Read the training data from a .CSV file.
2. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3. Write a program to implement the binary logistic Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
4. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.
5. Write a program to implement SVM algorithm to classify the iris data set. Print both correct and wrong predictions.
6. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
7. Write a program to demonstrate Regression analysis with residual plots on a given data set.
8. Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.
9. Write a program to implement k-Means clustering algorithm to cluster the set of data stored in .CSV file.

### Text Books

1. Practical Machine Learning for Data Analysis Using Python Abdulhamit Subasi.
2. Advance Machine Learning with Python by John Hearty.

### Reference Books

1. Machine Learning using Python, Manaranjan Pradhan, U Dinesh Kumar, Wiley India Pvt. Ltd., 2019
2. Practical Programming: An introduction to Computer Science Using Python, second edition, Paul Gries, Jennifer Campbell, Jason Montojo, The Pragmatic Bookshelf, 2013.
3. Learning with Python: How to Think Like a Computer Scientist Paperback – Allen Downey , Jeffrey Elkner, 2015.
4. Jake Vander plas, “Python Data Science Handbook: Essential tools for working with data”, O’Reilly Publishers, I Edition.
5. Hands-On Machine Learning with Scikit-Learn and TensorFlow Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, O'Reilly Publisher , I edition, 2017

### Web links and Video Lectures (e-Resources)

- <https://youtu.be/7eh4d6sabA0?si=JWHNJRVS6NhQOPYe>
- <https://youtu.be/kqtD5dpn9C8?si=LBep4HWaMFRrAPsD>
- <https://youtu.be/4SJ7bEILPjk?si=5LurvzUOuCew1W9>

### Skill Development Activities Suggested

The students with the help of the course teacher can take up technical activities which will enhance their skill or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

### Course outcome

**After completion of this course the student will be able to:**

**CO1: Understanding** of machine learning concepts and techniques. (L2)

**CO2: Perform** data preprocessing and exploratory data analysis using Python. (L4)

**CO3: Develop** and evaluate learning models using Python libraries. (L5)

**CO4: Apply** learning model machine for real-world data problems. (L3)

**CO5: Integrate** data analytics and machine learning models into practical applications. (L5)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	-	-	2
CO2	-	2	3	-	-	-	-	-
CO3	-	-	3	2	-	-	-	-
CO4	-	-	3	2	-	-	-	2
CO5	-	-	3	2	-	-	-	2
<b>3-Strong;2-Medium;1-Low</b>								

Object Oriented Programming using Java			
Course Code	<b>P24MCA22</b>	CIE Marks	50
L:P:T	4:0:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	3

### Course Learning Objectives (CLOs)

- This subject will help to improve the analytical skills of object-oriented programming Formal introduction to Java programming language
- Overall development of problem solving and critical analysis

### UNIT - I

**10 hours**

**The History and Evolution of Java:** The Byte code, Features of Java An overview of Java: Object Oriented Programming, Structure of a Java program, Data Types and Variables, Type conversion and casting, Arrays

**Classes:** Fundamentals, Declaring Objects, Assigning Object Reference Variables, Methods, Constructors, this Keyword, Garbage Collection, Stack application

**Methods and Classes:** Overloading Methods, Using Objects as Parameters, Argument Passing, Returning Objects, Access Control, static, final, Command-Line Arguments

### UNIT - II

**10 hours**

**Inheritance:** Basic concepts, Member Access and Inheritance, Practical Example Inheritance types, super, constructors, Method Overriding, Dynamic Method Dispatch, Abstract Classes, final with inheritance.

**String Handling:** String Constructor, String length, Special string Operations, CharacterExtraction, String comparison, Modifying a string, String Buffer

**Generics:** About Generics, A simple Generic Example, General class with Two Type Parameters, General form of generic class

### UNIT - III

**10 hours**

**Packages and Interfaces:** Packages, Packages and member access, importing packages, Interfaces, Default interface methods, Use static methods in an interface, Private Interface methods.

**Exception handling:** Fundamentals, Exception types, uncaught exceptions, try and catch, multiple catch clauses, nested try statements, throw, throws, finally, Java's built-in exceptions, User-defined exceptions.

### UNIT - IV

**10 hours**

**Multithreaded Programming:** Java thread model, main thread, creating thread, creating multiple threads, isalive( ) and Join( ), thread priorities, synchronization

**Input/Output:** Exploring java.io - The I/O Classes and Interfaces, The Byte Streams

### UNIT - V

**10 hours**

**Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model, EventsEvent Sources, Event Listeners, Event Classes- The MouseEventClass, Event Listener Interfaces-The MouseListener Interface, the MouseMotionListener Interface, Delegation Event Model – Handling Mouse Events.

AWT: Working with Windows, Graphics and Text

AWT Classes, Window Fundamentals, Working with Frame Windows, Graphic

### Text Book

1. Java the Complete Reference Eleventh Edition by Herbert Schildt ,TataMcGraw-hill Edition, 2019

### Reference Books

1. Introduction to JAVA Programming 9<sup>th</sup> Edition by Y. Daniel Liang , Pearson education, 2012
2. Programming in JAVA 5.0 1<sup>st</sup> Edition by James P Cohoon, Jack W Davidson, TATA McGrawhill,2006

### Web links and Video Lectures (e-Resources)

- <https://ia800303.us.archive.org/26/items/JavaJavaJavaObjectorientedProblemSolving/jjj-os.pdf>
- <http://people.reed.edu/~jerry/121/materials/artsciencejava.pdf>
- [https://upload.wikimedia.org/wikipedia/commons/e/e7/Java\\_Programming.pdf](https://upload.wikimedia.org/wikipedia/commons/e/e7/Java_Programming.pdf)
- [https://onlinecourses.swayam2.ac.in/aic20\\_sp13/preview](https://onlinecourses.swayam2.ac.in/aic20_sp13/preview)
- [https://onlinecourses.swayam2.ac.in/aic20\\_sp1](https://onlinecourses.swayam2.ac.in/aic20_sp1)
- <https://www.classcentral.com/course/coursera-object-oriented-programming-in-java-4212>

### Skill Development Activities Suggested

The students with the help of the course teacher can take up technical activities which will enhance their skill or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the basic principles of the object-oriented programming (L2)

**CO2: Demonstrate** an introductory understanding of graphical user interfaces, multi-threaded programming (L2).

**CO3: Apply** the knowledge of Java concepts to find the solution for a given problem (L3).

**CO4: Analyze** the given Java application for correctness/functionalities (L4).

**CO5: Develop** Java programs / applications for a given requirement (L3).

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	3	-	-	-	-	
CO2	2	-	-	-	-	-	-	3
CO3	2	-	-	3	-	-	-	-
CO4	-	2	3	-	-	-	-	-
CO5	-	2	-	3	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Data Structure and Algorithms</b>			
Course Code	<b>P22MCA23</b>	CIE Marks	50
L:T:P	4:0:0	SEE Marks	50
Total Hours of Pedagogy	50 hours	Total Marks	100
Credits	04	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- To understand and implement fundamental data structures.
- To develop efficient algorithms for solving problems.
- To analyze the time and space complexity of algorithms.
- To gain practical experience in applying data structures and algorithms to real-world problems.
- To prepare students for industry roles requiring strong foundations in data structures and algorithmic thinking.

### **UNIT-I**

#### **Introduction to Data Structures and Algorithms**

**10 Hours**

Basic Concepts: Definition and importance of data structures, Abstract Data Types (ADTs), Algorithm analysis: Time and space complexity, Big O notation. Arrays: Definition and operations: Insertion, deletion, traversal, Multidimensional arrays, Applications of arrays. Linked Lists: Singly linked list: Creation, insertion, deletion, traversal, Doubly linked list and circular linked list, Applications of linked lists.

### **UNIT-II**

#### **Stacks, Queues, and Recursion**

**10 Hours**

Stacks: Definition and operations: Push, pop, peek, Applications: Expression evaluation, backtracking, function calls. Queues: Definition and operations: Enqueue, dequeue, front, rear, Types: Circular queue, priority queue, double-ended queue (deque), Applications of queues. Recursion: Definition and principles of recursion, Recursive algorithms: Factorial, Fibonacci series, Tower of Hanoi, Analysis of recursive algorithms.

### **UNIT-III**

#### **Trees and Graphs**

**10 Hours**

Trees: Definition and terminology: Root, leaf, internal node, height, depth, Binary trees: Traversal (preorder, inorder, postorder), creation, insertion, deletion, Binary search trees (BST), AVL trees, B-trees. Graphs: Definition and terminology: Vertices, edges, adjacency list, adjacency matrix, Graph traversal algorithms: Depth-first search (DFS), breadth-first search (BFS), Shortest path algorithms; Dijkstra's algorithm, Floyd-Warshall algorithm.

### **UNIT-IV**

#### **Sorting and Searching Algorithms**

**10 Hours**

Sorting Algorithms: Basic concepts and classification, Comparison-based sorting: Bubble sort, selection sort, insertion sort, quicksort, mergesort, heapsort, non-comparison-based sorting: Radix sort, counting sort. Searching Algorithms: Linear search and binary search, Search in linked lists, trees, and graphs, Hashing: Hash functions, collision resolution techniques (chaining, open addressing).

### **UNIT-V**

#### **Advanced Data Structures and Applications**

**10 Hours**

Advanced Data Structures: Heaps: Definition, operations, heap sort, applications, Tree: Definition, operations, applications in dictionary and spell-checking, Segment trees and Fenwick trees: Definition, operations, range queries. Algorithm Design Techniques: Divide and conquer, Greedy algorithms, Dynamic programming. Industry Applications: Real world applications of data structures and algorithms, Best practices in data structure and algorithm implementation, Case studies of complex problem-solving using advanced data structures.

## Text Books

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
3. Anany Levitin: Introduction to the Design and Analysis of Algorithms, 2<sup>nd</sup> edition, Pearson Education, 2003.

## Reference Books

1. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Ed, Cengage Learning, 2014.
2. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2<sup>nd</sup> Ed, McGraw Hill, 2013
4. A M Tenenbaum, Data Structures using C, PHI, 1989
5. Robert Kruse, Data Structures and Program Design in C, 2nd Ed, PHI, 1996.
6. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009, Pearson.
7. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press.
8. Algorithms, Kenneth A Berman and Jerome L Paul, Cengage Learning India Pvt Ltd, 2002 Edition

## Web links

- [https://www.youtube.com/watch?v=BBpAmxU\\_NQo](https://www.youtube.com/watch?v=BBpAmxU_NQo)
- <https://www.youtube.com/watch?v=8hly31xKli0>
- <https://archive.nptel.ac.in/courses/106/106/106106127/>

## Course Outcomes

**On completion of this course, the students should be able to:**

- CO1: Demonstrate** an understanding of fundamental data structures and algorithms. (L2)  
**CO2: Implement** and manipulate data structures such as arrays, linked lists, stacks, queues, trees, and graphs. (L3)  
**CO3: Develop** algorithms for searching, sorting, and optimization problems. (L3)  
**CO4: Analyze** the efficiency and correctness of algorithms. (L4)  
**CO5: Apply** data structures and algorithms to solve complex problems in various domains. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-
CO4	3	2	2	2	-	-	-	-
CO5	2	2	2	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Software Engineering</b>			
Course Code	<b>P24MCA24</b>	CIE Marks	50
L:T:P	3:1:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- Understand the importance of various Software Engineering Lifecycle Models.
- Document the Software Requirements Specification (SRS) for the identified system.
- Gain knowledge of the System Analysis and Design concepts using UML.

### **UNIT-I**

#### **Software Process And Agile Development**

**10 Hours**

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models  
Introduction to Agility-Agile process-Extreme programming-XP Process-Case Study.

### **UNIT-II**

#### **Requirements Analysis And Specification**

**10 Hours**

Requirement analysis and specification, Requirements gathering and analysis, Software Requirement Specification Formal, system specification, Finite State Machines, Object modelling using UML, Use case Model, Class diagrams, Interaction diagrams, Activity diagrams, State chart diagrams, Functional modelling Data Flow Diagram- CASE TOOLS.

### **UNIT-III**

#### **Software Design**

**10 Hours**

Software design Design process Design concepts Coupling Cohesion Functional Independence Design patterns Model-view-controller Publish-subscribe Adapter Command Strategy Observer Proxy Facade Architectural styles Layered - Client Server - Tiered - Pipe and filter- User interface

### **UNIT-IV**

#### **Testing And Maintenance**

**10 Hours**

Testing Unit testing Black box testing White box testing Integration and System testing Regression testing Debugging - Program analysis Symbolic execution Model Checking Case Study.

### **UNIT-V**

#### **Project Management**

**10 Hours**

Software Project Management- Software Configuration Management - Project Scheduling- DevOps: Motivation-Cloud as a platform-Operations- Deployment Pipeline: Overall Architecture Building and Testing-Deployment- Tools- Case Study.

### **Text Books**

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009
2. David C Kung, "Object-Oriented Software Engineering: An Agile Unified Methodology", First Edition, Mc Graw-Hill International Edition, 2014.
3. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect's Perspective", Pearson Education, 2016.

4. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009
5. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.

### Reference Books

1. Pankaj Jalote, Software Engineering Wiley India Pvt. Ltd. (2010)
2. Roger S Pressman: Software Engineering-A Practitioners approach, 6th edition, McGraw-Hill, 2010.
3. Hans Van Vliet: Software Engineering Principles and Practices, 3rd Edition, Wiley-India, 2010

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Discuss** the fundamental software process models and the principles of requirement analysis (L6)

**CO2: Analyze** Software Requirement Specification and different system models (L4)

**CO3: Implement** design patterns and architectural styles to construct software systems (L3)

**CO4: Utilize** the software testing methodologies to ensure the quality and reliability of software (L3)

**CO5: Analyze** the integration of software project management practices with DevOps principles to improve software delivery and operational efficiency (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	1	-	-	-	-	-	-
CO2	2	3	1	1	-	-	-	-
CO3	3	2	1	2	-	-	-	-
CO4	2	3	1	2	-	-	-	2
CO5	2	2	1	-	1	1	-	2
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Web Application Development</b>			
Course Code	<b>P24MCA25</b>	CIE Marks	50
L:T:P	3:1:0	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	04	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- To understand the fundamental concepts and technologies of web application development.
- To gain proficiency in front-end and back-end web development.
- To learn and apply modern web frameworks and libraries.
- To develop skills in creating responsive and dynamic web applications.
- To Implement front-end and back-end technologies to expertise in web development.

### **UNIT-I**

#### **Introduction to Web Development and HTML5**

**10 Hours**

Web Development Basics: Introduction to web technologies and protocols, Client-server architecture, Overview of front-end and back-end development

HTML5 Fundamentals: HTML5 elements and attributes, Semantic HTML5 tags, Forms and input types, Multimedia elements (audio, video)

Advanced HTML5: Canvas and SVG for graphics, HTML5 APIs (Geolocation, Web Storage, Web Workers), Offline web applications using AppCache.

### **UNIT-II**

#### **CSS3 and Responsive Web Design**

**10 Hours**

CSS3 Basics: Introduction to CSS3, Selectors, properties, and values, Box model, layout, and positioning, Flexbox and Grid layouts.

Responsive Web Design: Media queries, Responsive design principles, Fluid grids and flexible images, Mobile-first design approach.

CSS Frameworks: Introduction to Bootstrap, Bootstrap components and utilities, Customizing Bootstrap with Sass.

### **UNIT-III**

#### **JavaScript and DOM Manipulation**

**10 Hours**

JavaScript Basics: Introduction to JavaScript, Variables, data types, and operators, Control structures (if-else, loops), Functions and scope

Document Object Model (DOM): DOM structure and manipulation, Event handling and event listeners, Creating and modifying DOM elements, Form validation using JavaScript

Advanced JavaScript: Asynchronous JavaScript (callbacks, promises, async/await), AJAX and Fetch API, Introduction to JavaScript libraries (e.g., jQuery).

### **UNIT-IV**

#### **Front-End Frameworks and AngularJS**

**10 Hours**

Introduction to Front-End Frameworks: Importance of front-end frameworks, Overview of popular frameworks (React, Angular, Vue)

Advanced AngularJS: Services and dependency injection, Routing and single-page applications (SPAs), Data binding and form handling, Custom directives and components

## UNIT-V

### Back-End Integration and Deployment

10 Hours

Back-End Development: Introduction to server-side programming, Overview of server-side languages (Node.js, PHP, Python), RESTful web services and APIs, Database integration (SQL, NoSQL)

Full-Stack Development: Integrating front-end and back-end technologies, Developing fullstack web applications, Case studies on full-stack applications

Deployment and Security: Web application deployment (cloud platforms, hosting services), Security best practices for web applications, Authentication and authorization, Performance optimization.

#### Text Books:

1. Web Programming By Chris Bates , Wiley Publications
2. Robert W. Sebesta: Programming the World Wide Web, 8th Edition, Pearson education, 2015.
2. HTML5 Black Book by Dreamtech
3. Angular JS By Krishna Rungta
4. Bootstrap essentials by Snig by Packt-open source .

#### Reference Book:

1. Deitel, P.J. Deitel, A. B. Goldberg: Internet & World Wide Web How to program, 3<sup>rd</sup>Edition, Pearson Education / PHI, 2004.

#### Reference links:

- <https://www.tutorialspoint.com/angularjs>
- [https://www.tutorialspoint.com/angularjs/angularjs\\_tutorial.pdf](https://www.tutorialspoint.com/angularjs/angularjs_tutorial.pdf)

#### Course outcomes

On completion of this course, the students should be able to:

**CO1: Outline** the understanding of web technologies and protocols. (L2)

**CO2: Develop** web applications using HTML, CSS, JavaScript, and modern frameworks. (L3)

**CO3: Apply** responsive design principles using frameworks like Bootstrap.(L3)

**CO4: Construct** dynamic web applications using AngularJS. (L3)

**CO5: Develop** front-end and back-end technologies to create full stack web applications. (L3)

#### Mapping with Program Outcomes:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-
CO4	3	1	2	2	-	-	-	-
CO5	2	2	2	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

Object Oriented Programming using JAVA Laboratory			
Course Code	P24MCAL26	CIE Marks	50
L:T:P	0:0:1	SEE Marks	50
Total Hours of Pedagogy	10 Hours	Total Marks	100
Credits	01	Exam Hours	03

### Course Learning Objectives (CLOs)

- Using java programming to develop programs for solving real-world problems.
- Reinforce the understanding of basic object-oriented programming concepts.

### Experiments

1. Write a Java program to print the following triangle of numbers

```

1 2
1 2 3
1 2 3 4
1 2 3 4 5

```

- Write a Java program to list the factorial of the numbers 1 to 10. To calculate the factorial value, use while loop. (Hint Fact of 4 = 4\*3\*2\*1)
- Write a Java program
  - To find the area and circumference of the circle by accepting the radius from the user.
  - To accept a number and find whether the number is Prime or not
- Write a Java program to demonstrate a division by zero exception
- Write a Java program to implement Inner class and demonstrate its Access protection.
- Write a Java program to demonstrate Constructor Overloading and Method Overloading.
- Write a JAVA program to demonstrate Inheritance. Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.
- Write a Java applet program, which handles keyboard event.
- Write a Java Program to create a window when we press
  - ✓ M or m the window displays Good Morning
  - ✓ A or a the window displays Good After Noon
  - ✓ E or e the window displays Good Evening
  - ✓ N or n the window displays Good Night
- Write a Java program to implement a Queue using user defined Exception Handling (also make use of throw, throws). a. Complete the following: b. Create a package named shape. c. Create some classes in the package representing some common shapes like Square, Triangle, and Circle. d. Import and compile these classes in other program.

**Course Outcomes:**

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the fundamental data types and constructs of Java Programming by writing Executable/interpretable programs. (L2)

**CO2: Illustrate** the object-oriented principles with the help of java programs. (L2)

**CO3: Develop** reusable and efficient applications using inheritance concepts of java. (L3)

**CO4: Understand** the object-oriented concepts and its implementation in Java. (L2)

**Mapping with Program Outcomes:**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	1	3	-	-	-	-	-
CO2	-		-	-	-	-	-	3
CO3	-	2	-	3	-	-	-	-
CO4	-	-	3	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Data Structures with Algorithms Laboratory</b>			
Course Code	<b>P24MCAL27</b>	CIE Marks	50
L:T:P	0:0:1	SEE Marks	50
Total Hours of Pedagogy	10 Hours	Total Marks	100
Credits	01	Exam Hours	03

### **Course Learning Objectives (CLOs)**

- Evaluate the Expressions like postfix, prefix conversions.
- Implementing various data structures like Stacks, Queues, Linked Lists, Trees and Graphs.

### **LAB EXPERIMENTS**

- 1 Implement a Program in C for converting an Infix Expression to Postfix Expression.
- 2 Design, develop, and execute a program in C to evaluate a valid postfix expression using stack. Assume that the postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are + (add), - (subtract), \* (multiply) and / (divide)
- 3 Design, develop, and execute a program in C to simulate the working of a queue of integers using an array. Provide the following operations: a. Insert b. Delete c. Display
- 4 Write a C program to simulate the working of a singly linked list providing the following operations: a. Display& Insert b. Delete from the beginning/end c. Delete a given element
- 5 Write a C program to Implement the following searching techniques a. Linear Search b. Binary Search.
- 6 Write a C program to implement the following sorting algorithms using user defined functions: a. Bubble sort (Ascending order) b. Selection sort (Descending order).
- 7 Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm ( C programming)
- 8 From a given vertex in a weighted connected graph, find shortest paths to other vertices Using Dijkstra's algorithm (C programming)
- 9 Using circular representation for a polynomial, design, develop, and execute a program in C to accept two polynomials, add them, and then print the resulting polynomial.
- 10 Check whether a given graph is connected or not using DFS method.

**Course Outcomes:****On completion of this course, the students should be able to:****CO1: Implement** the techniques for evaluating the given expression.(L3)**CO2: Design** sorting / searching techniques and validate input/output for the given problem. (L3)**CO3: Apply** data structures (namely Stacks, Queues, Circular Queues, Linked Lists, and Trees), its operations and algorithms. (L3)**CO4: Apply** data structures(namely Linked Lists, and Trees),its operations and algorithms. (L3)**CO5: Implement** the algorithm to find whether the given graphics connected or not and conclude on the performance of the technique implemented. (L3)**Mapping with Program Outcomes:**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	2	-	-	-	-	-
CO2	2	3	2	-	-	-	-	-
CO3	2	2	2	-	-	-	-	-
CO4	3	1	2	2	-	-	-	-
CO5	2	2	2	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Employability Enhancement Skills-2 (EES-2)</b>			
Course Code	<b>P24MHU28</b>	CIE Marks	50
L:T:P	-	SEE Marks	-
Total Hours of Pedagogy	32 Hours	Total Marks	100
Credits	PP	Exam Hours	03

### Course Learning Objectives (CLOs)

- Strengthen foundational knowledge in Data Structures and Algorithms (DSA) using C.
- Enhance problem-solving skills through Python and Object-Oriented Programming (OOPs).
- Develop core skills in Database Management Systems (DBMS) with a focus on SQL and NoSQL concepts.
- Integrate programming knowledge to build and manage practical applications.

### UNIT-I

**07 Hours**

**Introduction to Data Structures and Algorithms (DSA): Basic Concepts:** Definition, importance, and real-world applications of data structures. **Data Structures Overview:** Arrays: Basics and operations (insertion, deletion), Introduction to pointers in C.

**Hands-On Practice:** Implementing basic array operations in Introduction to git repository and online coding platforms (LeetCode, HackerRank).

#### Expected Outcomes:

- Clear understanding of basic data structures.
- Ability to implement array operations and manage version control.

### UNIT-II

**07 Hours**

#### Intermediate Data Structures and Problem-Solving

**Linked Lists:** Singly linked lists: Creation, traversal, and deletion, Comparison with arrays.

**Stacks:** Basic operations (push, pop) and applications, **Problem-Solving Activities:** Coding exercises on linked list traversal and stack operations.

#### Expected Outcomes:

- Proficiency in working with linked lists.
- Understanding of stack operations and their practical applications.

### UNIT-III

#### Object-Oriented Programming (OOPs) Using Python

**06 Hours**

**Python Overview:** Syntax, data types, and control structures, **OOPs Principles:** Classes, objects, encapsulation, and inheritance.

**Hands-On Practice:** Creating classes and implementing inheritance, Developing modular and reusable code structures.

#### Expected Outcomes:

- In-depth understanding of OOPs principles and Python programming.

## UNIT-IV

6 Hours

**Database Management Systems (DBMS) : Core Concepts:** Overview of data models and relational databases, Basics of SQL: DML, DQL, DLL.

### Expected Outcomes:

- Fundamental knowledge of relational and unstructured databases.
- Ability to write SQL queries for data management.

## UNIT-V

6 Hours

**CRUD operations:** Core operations for interacting with databases—Create, Read, Update, and Delete.

**Unstructured Databases:** Introduction to NoSQL databases, Schema-less design for flexibility, Horizontal scalability to handle large data volumes.

Optimized for high-velocity data processing

**Capstone Project:** Developing a CRUD-based application using Python and SQL.

Exploring structured and unstructured data integration, **Assessment and Evaluation:** Written test and program coverage report.

### Expected Outcomes:

- Hands-on experience in integrating programming and database skills.
- Improved logical thinking and practical application development.

### Reference Books:

1. “Word Power Made Easy New Revised and Expanded Edition”, First Edition, Norman Lewis, Goyal Publisher.
2. “Essential English Grammar” by Raymond Murphy, published by Cambridge University Press.

### Course outcomes

**On completion of this course, the students should be able to:**

**CO1: Implement** array operations and utilize version control systems effectively to manage code (L3)

**CO2: Demonstrate** proficiency in implementing and manipulating linked lists to solve Computational problems. (L2)

**CO3: Analyze** and apply Object-Oriented Programming (OOP) principles in Python to design and develop efficient software solutions (L4)

**CO4: Design** and execute SQL queries for effective data management and retrieval. (L6)

**CO5: Demonstrate** improved logical thinking to develop and implement practical applications Effectively. (L2)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	-	-	-	1
CO2	3	3	3	3	-	-	2	1
CO3	2	3	3	3	-	-	2	1
CO4	3	3	3	3	3	2	2	2
CO5	3	3	3	3	3	2	2	2
<b>3-Strong; 2-Medium; 1-Low</b>								

Ability Enhancement Courses with Seminar-I			
Course Code	<b>P24MCA29</b>	CIE Marks	-
L:T:P	-	SEE Marks	-
Total Hours of Pedagogy	-	Total Marks	-
Credits	PP	Exam Hours	-

### Guidelines

- A team of TWO students must develop the project.
- The team may implement a project of their choice based on emerging trends.
- The team must present their work in front of the Internal panel members and also submit a Brief Report (25 to 30 Pages) that must include the following:
  - Introduction
  - Requirements
  - Software Development Process Model Adopted
  - Analysis and Design Models
  - Implementation
  - Testing
  - References

### Course outcomes

**On completion of this course, the students should be able to:**

**CO1: Identify**, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach (L3).

**CO2: Analyse** and design the project (L4).

**CO3: Apply** acquired knowledge for project development using modern tools and technology (L3).

**CO4: Apply** debugging tools for testing the project(L3).

**CO5: Demonstrate** the project (L2)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
<b>CO1</b>	3	2	-	2	3	-	2	-
<b>CO2</b>	3	2	3	2	-	-	-	-
<b>CO3</b>	3	3	3	3	-	-	-	-
<b>CO4</b>	3	1	3	2	3	-	-	3
<b>CO5</b>	-	-	-	2	3	-	-	2
<b>3-Strong; 2-Medium; 1-Low</b>								

## SEMESTER-III

<b>Data Mining and Visualization</b>			
Course Code	<b>P24MCAA311A</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- **Understand foundational concepts of** data mining, preprocessing techniques and KDD process using Python.
- **Apply data mining algorithms** to extract useful patterns, trends, and insights from large datasets.
- **Explain** outlier detection methods and research trends in data mining applications.
- **Develop** static visualization using Matplotlib and create dashboards using Jupyter notebooks
- **Simplify** visualization with Seaborn and develop interactive dashboards using Bokeh.

### UNIT -I

**Foundations of Data Mining and Data Preprocessing** **8 Hours**

#### Introduction to Data Mining & Preprocessing Techniques

**Introduction to data mining:** Motivation: Why data mining, KDD process. Types of data: Structured, semi-structured, unstructured.

**Data preprocessing:** Cleaning, Integration, Reduction and Transformation.

**Implementation using Python:** Pandas, NumPy for basic preprocessing.

### UNIT -II

**Data Mining Techniques and Algorithms** **08 Hours**

#### Mining Techniques: Association ,Classification &Clustering

**Association:** Basic Concepts, Frequent Item set Mining methods, Pattern Evaluation method .

**Classification:** Basic Concepts, Decision Tree Induction, Bayes classification methods .

**Clustering:** Cluster Analysis, Partitioning methods , Hierarchical methods.

### UNIT -III

**Advanced Data Mining Applications and Trends** **08 Hours**

**Outliers Detection :** Outliers analysis , detection methods, Statistical Approaches, Proximity-based approaches.

**Trends and Research:** Mining complex data types, Methodologies of data mining, Data mining applications .

### UNIT -IV

**Data Visualization Techniques** **08 Hours**

**A Deep Dive into Matplotlib:** Overview, Pyplot Basics, Basic Text and Legend Functions, Basic Plots, Layouts, Images .

Dashboard creation using Jupyter notebooks and interactive widgets, Case studies and real - world examples using multi-dimensional data.

### UNIT -V

**Interactive and Advanced Data Visualization Using Seaborn and Bokeh** **08 Hours**

**Simplifying Visualization using Seaborn:** Color Palettes, Plots and Multi-plots in Seaborn , Regression Plots , Squarify .

**Making things interactive with Bokeh:** Concepts of Bokeh, Interfaces in Bokeh, Bokeh Server, Presentation, Integrating , Adding Widgets.

## Text Books

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Morgan Kaufmann.
2. Tim Grobmann, Mario Dobler, Data Visualization with Python, O'Reilly Media.

## Web links and Video Lectures (e-Resources):

- NPTEL –Data Mining by IIT Kharagpur (Prof. Pabitra Mitra)  
<https://nptel.ac.in/courses/106105174>
- Data Mining Full Course by Great Learning (YouTube)  
[https://www.youtube.com/watch?v=RID5q\\_pIWkM](https://www.youtube.com/watch?v=RID5q_pIWkM)
- Data Visualization using Python (Edureka)  
<https://www.youtube.com/watch?v=UB3DE5Bgfx4>
- Harvard Data Science: Visualization (edX)  
<https://cs50.harvard.edu/>
- Tableau for Data Visualization (Simplilearn)  
<https://www.youtube.com/watch?v=IFM03Nis2dg>

## Skill Development Activities Suggested

- Hands-on Data Mining Projects
- Work on real-world datasets (e.g., Kaggle, UCI ML Repository).
- Implement data preprocessing, cleaning, and feature engineering.
- Apply classification, clustering, and association rule mining techniques.
- Learning and Using Data Visualization Tools
- Get hands-on with Tableau, Power BI, and Matplotlib/Seaborn in Python.
- Use SQL for data extraction and processing.

## Course outcomes

On completion of this course, the students should be able to:

**CO1: Understand** foundational concepts of data mining and apply preprocessing techniques using Python. (L2)

**CO2: Build** key data mining techniques such as classification, clustering, and association rule mining. (L3)

**CO3: Analyse** advanced data mining applications including sentiment analysis, time. (L4)

**CO4: Design and develop** effective static and interactive data visualizations using Python libraries. (L3, L6)

**CO5: Simplify** visualization with Seaborn and **Develop** interactive dashboards using Bokeh (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-
CO3	2	2	3	2	1	-	-	-
CO4	2	3	3	3	2	-	1	-
CO5	3	2	3	3	2	1	-	1
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Big Data Analytics</b>			
Course Code	<b>P24MCAA311B</b>	CIE Marks	50
L:T:P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives:

- **Understand Big Data Concepts** – Gain a comprehensive understanding of Big Data, its characteristics, and its significance in modern computing.
- **Explore Big Data Technologies** – Learn about various Big Data tools and frameworks such as Hadoop, Spark, and NoSQL databases.
- **Perform Data Processing & Analysis** – Develop skills in processing, storing, and analysing large-scale data using distributed computing techniques.

### UNIT -I

#### **Big Data Fundamentals and Ecosystem Overview** **8 Hours**

**Introduction to Big Data: Concepts and Ecosystem:** Definition and Evolution of Big Data. Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value). Traditional vs Big Data Systems,

Introduction to Hadoop Ecosystem: HDFS, YARN, MapReduce. Architecture and components of Hadoop. Limitations of Hadoop and the shift to Spark

### UNIT -II

#### **Hadoop Architecture and MapReduce Programming** **8 Hours**

**Distributed Data Processing using Hadoop:** Hadoop Distributed File System (HDFS): Design and operations. Hadoop MapReduce: Programming model, job execution flow. Writing MapReduce programs (Word Count, Sorting, Joins). Advanced Hadoop: Combiners, Partitioners, Counters. Hadoop Streaming and

### UNIT -III

#### **Apache Spark for Big Data Analytics** **8 Hours**

**In-Memory Big Data Processing with Spark:** Spark architecture and components: RDDs, DAG, Executors. Transformations and Actions on RDDs. Introduction to Data Frames and Spark SQL.

Introduction to Spark MLlib for machine learning. PySpark: Setting up and running Spark jobs using Python.

### UNIT -IV

#### **NoSQL and Big Data Storage Systems** **8 Hours**

**Scalable Data Storage with NoSQL Databases:** Need for NoSQL: Limitations of RDBMS in Big Data. Types of NoSQL Databases: Key-Value, Document, Column, Graph. Introduction to HBase: Architecture and CRUD operations. Working with Cassandra and MongoDB. Data modelling for scalability and performance.

### UNIT -V

#### **Big Data Tools and Industry Applications** **8 Hours**

**Real-World Big Data Applications and Tools :** Overview of Big Data Tools: Hive, Pig, Sqoop, Flume, Oozie. Data ingestion with Flume and Sqoop. Use cases in healthcare, finance, e-commerce, IoT, social media. Real-time analytics introduction using Kafka and Spark Streaming. Ethics and challenges in Big Data (privacy, bias, governance).

### Text Books:

1. Tom White – Hadoop: The Definitive Guide, O'Reilly Media.
2. Vignesh Prajapati – Big Data Analytics with R and Hadoop, Packt Publishing.
3. Jure Leskovec, Anand Rajaraman, Jeff Ullman – Mining of Massive Datasets, Cambridge University Press.
4. Venkat Ankam – Big Data Analytics with Spark, Packt Publishing

### Web links and Video Lectures (e-Resources):

- NPTEL Big Data Analytics Course – <https://nptel.ac.in/courses/106/104/106104189/>
- Simplilearn Big Data Tutorial (YouTube)–<https://www.youtube.com/watch?v=-FrXAKGthF8>
- Detailed explanation of Big Data concepts and tools.
- Big Data Analytics using Python (YouTube – Great Learning) - <https://www.youtube.com/watch?v=ZkZclIFmgVY>

### Skill Development Activities Suggested

- **Hands-on with Hadoop and Spark** – Work on real-time data processing using Hadoop (HDFS, MapReduce) and Apache Spark. Set up a small Hadoop cluster and practice writing Spark applications.
- **Data Processing and SQL** – Master SQL-based tools like Hive, Impala, and Presto. Work with large datasets to optimize queries and improve performance.
- **Machine Learning with Big Data** – Implement machine learning algorithms using libraries like MLlib

### Course outcomes

On completion of this course, the students should be able to:

- CO1: Understand** the fundamental concepts, evolution, and architecture of Big Data, including the Hadoop ecosystem. (L1)
- CO2: Develop** and execute distributed data processing tasks using HDFS and MapReduce techniques. (L2)
- CO3: Analyze** and implement in-memory data processing using Apache Spark and perform machine learning tasks with Spark MLlib. (L3)
- CO4: Compare** and evaluate NoSQL data models (Key-Value, Document, Column, Graph) and perform operations on HBase, MongoDB, and Cassandra. (L4)
- CO5: Apply** big data tools (Hive, Pig, Sqoop, Flume, Kafka) in real-world domains and understand ethical issues related to Big Data analytics. (L5)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	-	-	-	-	-	-
CO2	1	2	3	-	-	-	-	-
CO3	-	2	3	-	3	-	-	3
CO4	-	2	-	-	-	-	-	3
CO5	-	2	3	3	-	-	3	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Business Data Analytics</b>			
Course Code	<b>P24MCAA311C</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- **Understand the Fundamentals of Business Analytics** – Learn the core concepts, tools, and techniques used in data-driven decision-making for businesses.
- **Data Collection and Processing** – Gain knowledge of data acquisition, cleaning, transformation, and management techniques for business applications.
- **Exploratory Data Analysis & Visualization** – Develop skills to analyze and visualize business data using statistical and graphical methods.
- **Predictive Analytics & Machine Learning** – Apply statistical models and machine learning techniques to predict business trends and customer behavior.

### UNIT –I

#### Foundations of Business Data Analytics

**8 Hours**

**Introduction to Business Analytics and Data-Driven Decision Making:** Introduction to Business Analytics: Scope, Types (Descriptive, Predictive, Prescriptive). Data in Business: Structured vs Unstructured, Sources of Data. Business Intelligence vs Business Analytics.

Analytics Life Cycle: CRISP-DM methodology. Role of Business Analyst: Tools, Skills, and Case Examples

### UNIT –II

#### Data Preprocessing and Exploratory Analysis

**8 Hours**

#### Data Wrangling, Cleaning, and Exploration for Business Insights:

Data Preparation: Cleaning, Integration, Transformation. Handling Missing Data, Outliers, and Noise. Descriptive Statistics: Mean, Median, Mode, Variance, Skewness. Correlation and Covariance.

Visualization for Exploration: Histograms, Boxplots, Heatmaps. Business Case: Customer Segmentation and Sales Data Analysis.

### UNIT –III

#### Predictive Analytics in Business Forecasting and Predictive Modelling for Business Decision Making:

**8 Hours**

Introduction to Regression: Simple & Multiple Linear Regression. Logistic Regression: Applications in classification. Time Series Analysis and Forecasting Techniques. Model Evaluation: RMSE, MAE, Accuracy, Precision, Recall. Business Applications: Sales Forecasting, Customer Churn Prediction.

### UNIT –IV

#### Prescriptive Analytics and Optimization

**8 Hours**

#### Optimization and Decision-Making Techniques:

Introduction to Prescriptive Analytics. Linear Programming and Solver in Excel. Optimization Models: Objective functions, Constraints. Sensitivity and Scenario Analysis. Decision Trees and Business Rules. Case Study: Resource Allocation, Pricing Models, Supply Chain Optimization.

## UNIT –V

### Data Visualization and Business Intelligence Tools

8 Hours

#### Storytelling and Visualization for Business Insights

Principles of Data Visualization and Dashboards. BI Tools: Introduction to Power BI, Tableau. Designing Interactive Dashboards. KPI Definition and Visualization. Business Reporting and Data-Driven Story telling.

Final Capstone: Complete Business Analytics Solution

#### Text Books

1. Abdulhamit Subasi, Practical Machine Learning for Data Analysis Using Python, Academic Press.
2. U. Dinesh Kumar, Business Analytics: The Science of Data-Driven Decision Making, Wiley.
3. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython , O'Reilly.
4. Wayne Winston , Microsoft Excel Data Analysis and Business Modeling, Microsoft Press.

#### Web links and Video Lectures (e-Resources)

- Introduction to Business Analytics – NPTEL Course
- Harvard Data Science and Business Analytics Lectures – [YouTube Playlist](#)
- Coursera: Business Analytics by Wharton – [Coursera](#)

#### Skill Development Activities Suggested

- Hands-on Experience with Data Tools
- Practice using Excel, Power BI, and Tableau for data visualization.
- Work with SQL and NoSQL databases (MySQL, MongoDB).
- Learn Python and R for data analysis.
- Real-world Data Projects
- Analyse publicly available datasets (Kaggle, UCI Machine Learning Repository).
- Work on case studies in business analytics (sales forecasting, customer segmentation).
- Implement predictive analytics models using machine learning.

#### Course outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the foundational concepts of business analytics, types of analytics, and the data analytics lifecycle. (L1)

**CO2: Apply** data preprocessing techniques and perform exploratory data analysis to extract meaningful business insights. (L2)

**CO3: Develop** and evaluate predictive models using regression and time series forecasting for business decision making. (L3)

**CO4: Implement** prescriptive analytics using optimization techniques to support data - driven decisions in a business context. (L4)

**CO5: Design** interactive dashboards using BI tools and present data-driven stories for effective communication of business insights. (L5)

#### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2						
CO2		2		2	2			
CO3		2	3					3
CO4			3	3				3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Enterprise Resource Planning</b>			
Course Code	<b>P24MCAA311D</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- **Understand ERP Concepts** – Explain the fundamentals of ERP, its evolution, and its significance in modern businesses.
- **Analyze ERP Modules** – Explore core ERP modules like Finance, HR, Supply Chain, and Customer Relationship Management (CRM).
- **ERP Implementation Strategies** – Understand the phases of ERP implementation, challenges, and best practices.
- **ERP Technologies & Trends** – Examine emerging trends in ERP, such as cloud-based solutions, AI integration, and analytics.
- **Real-world Applications** – Analyse case studies of ERP implementations in various industries to understand its impact on business efficiency.

### UNIT -1

**8 Hours**

#### ERP Systems and Business Process Integration

**Fundamentals of ERP and Business Process Mapping** Evolution of ERP – MRP, MRP II to ERP. Business Functions and Business Processes. Need for Integration and ERP as an Integrator, Benefits, Risks, and Misconceptions of ERP.

Overview of Functional Modules: Finance, HR, Production, Sales. Case Example: Business Process before and after ERP

### UNIT -2

**8 Hours**

#### ERP Architecture and Technologies

**ERP System Architecture and Technological Infrastructure** Client/Server Architecture, Service-Oriented Architecture (SOA), Cloud-based ERP vs On-Premise ERP, ERP Platforms and Databases, ERP and Web Integration, Security, Customization, and Interoperability in ERP Systems.

Overview of leading ERP systems: SAP, Oracle, Microsoft Dynamics, Odoo

### UNIT -3

**8 Hours**

#### ERP Modules and Functional Features

**Core ERP Modules and Organizational Applications** Finance and Accounting Module, Manufacturing and Production Planning, Sales and Distribution, Human Resource Management (HRM) .

Supply Chain Management (SCM), CRM and Business Intelligence Features, Industry Examples: ERP use in Retail, Healthcare, Logistics.

### UNIT -4

**8 Hours**

#### ERP Implementation and Project Management

**ERP Life Cycle and Implementation Strategies** Phases of ERP Implementation Life Cycle, Business Process Reengineering (BPR) and Change Management, Implementation Methodologies (ASAP, AIM), ERP Project Planning, Testing, Training, Go-Live & Support, Cost-Benefit Analysis, Vendor Selection, Risk Management, Failure Cases and Lessons Learned.

## UNIT -5

8 Hours

### Emerging Trends in ERP and Industry Practices

**Future Directions and ERP in the Digital Era** ERP with AI, ML, IoT, and Blockchain, ERP and Digital Transformation , Mobile ERP and UX Design, ERP in SMEs and Cloud ERPs.

ERP Data Analytics and Reporting, Future Trends: Low-Code ERP, Industry 4.0 Integration, Capstone: Evaluation of ERP for a case enterprise.

### Text Books

1. Alexis Leon, Enterprise Resource Planning, McGraw Hill Education.
2. Mary Sumner, Enterprise Resource Planning, Pearson Education.
3. Mahadeo Jaiswal & Ganesh Vanapalli, Enterprise Resource Planning, Macmillan India.
4. Ellen Monk, Bret Wagner, Concepts in Enterprise Resource Planning, Cengage Learning.

### Web links and Video Lectures (e-Resources)

- [https://www.youtube.com/watch?v=qgHIU\\_1l6mk](https://www.youtube.com/watch?v=qgHIU_1l6mk)
- [https://www.youtube.com/watch?v=pSttK5Op1rI&utm\\_source=chatgpt.com](https://www.youtube.com/watch?v=pSttK5Op1rI&utm_source=chatgpt.com)
- [https://www.youtube.com/watch?v=JnSrp4k1gJw&utm\\_source=chatgpt.com](https://www.youtube.com/watch?v=JnSrp4k1gJw&utm_source=chatgpt.com)
- [https://www.youtube.com/watch?v=ppfBvofxCM0&utm\\_source=chatgpt.com](https://www.youtube.com/watch?v=ppfBvofxCM0&utm_source=chatgpt.com)
- [https://www.youtube.com/watch?v=cblNqNEThcE&utm\\_source=chatgpt.com](https://www.youtube.com/watch?v=cblNqNEThcE&utm_source=chatgpt.com)

### Skill Development Activities Suggested

- Map business processes of a small business (e.g., order-to-cash or procure-to-pay) using a flowchart or BPMN tool (e.g., Draw.io or Lucidchart).
- Group discussion/debate on ERP benefits vs. risks in real-world businesses.
- Create a basic ERP system architecture diagram using PowerPoint or any diagramming tool.
- Create a module-wise feature matrix comparing SAP, Oracle, and Odoo ERP.

### Course outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the fundamentals of ERP systems, their evolution, business processes, and the need for integration. (L2)

**CO2: Outline** ERP architectures, technologies, and distinguish between various deployment models and ERP solutions.(L2)

**CO3: Examine** ERP functional modules and their applications across different business domains.( L4)

**CO4: Apply** ERP implementation strategies, project management techniques, and evaluate risk and success factors. (L3)

**CO5: Analyse** emerging trends in ERP such as AI, IoT, Blockchain. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	-	-	-	-	-	-
CO2	2	2	-	-	3	-	-	-
CO3	-	2	3	-	3	-	-	-
CO4	-	-	3	-	-	3	-	-
CO5	-	-	-	-	3	-	3	3

**3-Strong; 2-Medium; 1-Low**

<b>Exploratory Data Analysis</b>			
Course Code	<b>P24MCAA311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To introduce the fundamental concepts and principles of exploratory data analysis.
- To equip students with skills to summarize and visualize both univariate and multivariate data effectively.
- To develop the ability to clean, pre-process, and transform raw data for analysis.
- To expose learners to current trends and tools used in the field of EDA.

### UNIT -1

**8 Hours**

**Introduction to Exploratory Data Analysis:** Historical background and role of EDA in data science, Philosophy and goals of EDA, Comparison with classical statistical methods, Types of data and scales of measurement, Importance of visual summaries before formal modelling.

### UNIT -2

**8 Hours**

**Univariate Data Exploration: Distribution shape:** symmetry, skewness, kurtosis Summary statistics: mean, median, mode, variance, standard deviation, range, IQR  
Graphical techniques: histograms, dot plots, stem-and-leaf plots, boxplots, Identifying outliers and anomalies

### UNIT -3

**8 Hours**

**Bivariate and Multivariate Data Exploration:** Scatter plots, trend analysis, Correlation vs. causation, Crosstabs and pivot tables, Pair plots and heatmaps, Data smoothing (moving averages, LOESS).

### UNIT -4

**8 Hours**

**Data Transformation and Cleaning:** Motivation for data transformation (e.g., to achieve normality or reduce skew) Log, square root, and other transformations, Handling missing values and duplicates, Introduction to resistant statistics (median, trimmed mean).

### UNIT -5

**8 Hours**

**Emerging Trends and case studies:** EDA as a storytelling tool, AI-powered visualizations, integration with big data platforms. Case studies: EDA on real-world datasets (Titanic, Iris, planet), pitfalls in EDA.

## Text Books

1. Exploratory Data Analysis by John W. Tukey.
2. An Introduction to Statistical Learning by Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani
3. Think Stats: Exploratory Data Analysis in Python by Allen B. Downey

## Reference Books

1. Practical Statistics for Data Scientists by Peter Bruce, Andrew Bruce, and Peter Gedeck

## Web links and Video Lectures (e-Resources)

- <https://youtu.be/fHFOANOHwh8?si=MFGfiOEvpQSF-g2H>
- <https://youtu.be/w2QVZHcJapU?si=xfacUu80VK8J4fzc>
- [https://youtu.be/clblk\\_NwEU8?si=e4O8qLB6TnuaejdQ](https://youtu.be/clblk_NwEU8?si=e4O8qLB6TnuaejdQ)

## Skill Development Activities Suggested

- Hands-on labs using Python for real-world datasets (Titanic, Iris, Sales, etc.)
- Participation in Kaggle or similar online EDA competitions
- Group project: Collaborative analysis and presentation of EDA findings

## Course Outcomes

**On completion of this course, the students should be able to:**

- CO1: Understand** the role and importance of Exploratory Data Analysis in the data science pipeline. (L2)
- CO2: Analyse** univariate and bivariate datasets using appropriate summary statistics and visualization Techniques. (L4)
- CO3: Apply** data analysis techniques to explore relationships between multiple variables and derive insights using Python. (L3)
- CO4: Apply** data transformation and cleaning methods to prepare raw data for further analysis. (L3)
- CO5: Interpret** insights from real-world datasets and communicate findings through visual storytelling and reporting. (L2)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-
CO3	1	2	-	-	3	-	-	-
CO4	1	-	-	3	-	-	-	3
CO5	1	2	-	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Social Media Analytics</b>			
Course Code	<b>P24MCAA311F</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the fundamentals and evolution of social media platforms.
- Explore key concepts and techniques in social media data collection and analysis.
- Apply analytics tools to extract insights from social media data.
- Develop skills in sentiment analysis, trend prediction, and influence measurement.
- Design data-driven strategies for business and marketing using social media insights.

### UNIT -1

#### Introduction to Social Media Analytics

**8 Hours**

**Foundations of Social Media Data Analysis** Introduction to Social Media Analytics: Definition, Applications, and Importance, Overview of Popular Social Media Platforms: Facebook, Twitter, Instagram, LinkedIn, YouTube

Social Media Data Types: Structured vs. Unstructured Data, Social Media Metrics and KPIs: Engagement, Reach, Impressions, Sentiment Score, Data Collection Techniques: Web Scraping, APIs (Twitter, Facebook, YouTube), Streaming Data

### UNIT -2

#### Sentiment Analysis and Text Mining

**8 Hours**

**Natural Language Processing for Social Media Data** Fundamentals of Sentiment Analysis: Positive, Negative, Neutral Sentiments, Text Preprocessing: Tokenization, Stopword Removal, Stemming, Lemmatization.

Machine Learning Approaches for Sentiment Classification: Naïve Bayes, SVM, LSTM, Word Embeddings

### UNIT -3

#### Social Network Analysis and Trend Detection

**8 Hours**

**Graph-based Social Media Analytics** Basics of Social Network Analysis (SNA) Key Metrics: Centrality, Clustering Coefficients, Community Detection, Influencer Identification and User Engagement Analytic

Hashtag Analysis and Topic Modelling using LDA, Trend Detection on Social Media: Time Series Analysis, Virality Prediction.

### UNIT -4

#### Visualizing and Interpreting Social Media Insights

**8 Hours**

**Data Visualization and Interpretation for Social Media Analytics** Importance of Data Visualization in Social Media Analytic.

Visualization Techniques: Word Clouds, Heatmaps, Network Graphs Sentiment Heatmaps and Hashtag Trends Visualization, Dashboard Creation using Tableau and Power BI.

## UNIT -5

### Applications of Social Media Analytics in Business and Research Business and Industry

#### Applications of Social Media Analytics

8 Hours

Social Media Analytics in Digital Marketing: Ad Performance and Customer Engagement, Social Media in Business Intelligence: Brand Monitoring and Crisis Management, Ethical Considerations in Social Media Analytics: Privacy, Bias, and Data Protection.

Future Trends in Social Media Analytics: AI-Driven Social Insights, Capstone Project: Analyzing Real-World Social Media Data for Business Insights.

#### Text Books

1. Matthew A. Russell, Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Instagram, GitHub, and More, O'Reilly Media.
2. Wasim Ahmed, Social Media Analytics: Techniques and Insights for Extracting Business Value Out of Social Media, Wiley
3. Reza Zafarani, Mohammad Ali Abbasi, Huan Liu, Social Media Mining: An Introduction, Cambridge University Press.
4. Piyushimita Thakuria, Nebiyu Tilahun, Moira Zellner, Seeing Cities Through Big Data: Research, Methods and Applications in Urban Informatics, Springer.

#### Web links and Video Lectures (e-Resources)

- NPTEL Course on Social Media Analytics – [nptel.ac.in](https://nptel.ac.in)
- IBM Social Media Analytics Tutorials – [ibm.com](https://ibm.com)
- YouTube Channel: Analytics Vidhya – [youtube.com/analyticsvidhya](https://youtube.com/analyticsvidhya)

#### Skill Development Activities Suggested

- Hands-on training with social media analytics tools (e.g., Hootsuite, Google Analytics).
- Data collection from various social media platforms.
- Analyzing engagement metrics and sentiment.
- Creating visual dashboards and reports.
- Case studies on brand performance and campaign impact

#### Course Outcomes

On completion of this course, the students should be able to:

- CO1: Understand** the fundamentals of social media analytics, data types, key metrics, and data collection techniques. (L2)
- CO2: Apply** sentiment analysis and text mining techniques to analyze social media data using NLP and ML models. (L2)
- CO3: Analyze** social network structures and trends using graph-based analytics, hashtag modeling, and virality detection. (L3)
- CO4: Visualize** and interpret social media insights using tools like Tableau and Power BI to support decision-making. (L4)
- CO5: Evaluate** real-world applications of social media analytics in business, digital marketing brand monitoring, and ethical considerations. (L5)

#### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	-	-	-	-	-	-
CO2	-	2	2	-	3	-	-	-
CO3	-	2	-	3	3	-	-	-
CO4	-	-	2	-	3	-	-	3
CO5	-	-	-	-	3	3	-	-

3-Strong; 2-Medium; 1-Low

Web Development using Full Stack Open			
Course Code	P24MCAB311A	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the structure and styling of web pages.
- Develop interactive web applications using React.
- Integrate databases for dynamic content.
- Integrate front-end and back-end components.
- Deploy full-stack applications on cloud services.

### UNIT – I

**8 Hours**

**Basics of Web Technologies:** Overview of HTML: structure, elements, and semantics, CSS basics: styling, layouts, and responsiveness, JavaScript fundamentals: variables, functions, and DOM manipulation, Integrating HTML, CSS, and JavaScript for a basic web page.

### UNIT – II

**8 Hours**

**Front-End Development with React:** Introduction to React: Why use React?, JSX and how it differs from HTML, Components: functional vs. class components, Creating dynamic user interfaces with conditional rendering, Handling user events and form submission, React Hooks: useState, useEffect, useContext, and custom hooks, Introduction to Redux: Setting up a Redux store, actions, reducers.

### UNIT – III

**8 Hours**

**Back-End Development with Node.js:** Introduction to Node.js: Features and Architecture, Working with npm and package management, Building a basic server using Express, Middleware functions: Logging, authentication, and error handling, Introduction to MongoDB: NoSQL database concepts, CRUD Operations: Creating, reading, updating, and deleting data, Querying and filtering data using Mongoose, Handling database errors.

### UNIT – IV

**8 Hours**

**Full-Stack Integration:** concept of full-stack applications, RESTful APIs: Principles and best practices, Data exchange using JSON: Serialization and parsing, Connecting React front-end to Node.js back-end, Introduction to authentication and authorization concepts, Implementing user authentication using JWT (JSON Web Token), Managing user sessions and tokens.

### UNIT – V

**8 Hours**

**Deployment and Maintenance:** Setting up Continuous Integration and Continuous Deployment(CI/CD) pipelines, Automating tests and builds using Jenkins, GitHub Actions, or similar tools, Deploying back-end services using AWS EC2, Heroku, and Docker, Deploying back-end services.

## Text Books

1. Full Stack Open 2023 by University of Helsinki (Online Course Material)
2. Learning React by Alex Banks and Eve Porcello
3. MongoDB: The Definitive Guide by Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow
4. Node.js Design Patterns by Mario Casciaro and Luciano Mammino

## Web links and Video Lectures (e-Resources)

- <https://youtu.be/Vi9bxu-M-ag?si=OK1-w5YqIKJ5oYh7>
- [https://youtu.be/nu\\_pCVPKzTk?si=DOAiec3IorQtKmjA](https://youtu.be/nu_pCVPKzTk?si=DOAiec3IorQtKmjA)
- <https://youtu.be/4EjKroJCpFA?si=gR3jzPn3rgvYwHsl>

## Course outcome

At the end of the course the student will be able to:

**CO1: Understand** the fundamentals of web development using modern technologies. (L1)

**CO2: Develop** full-stack web applications using JavaScript. (L2)

**CO3: Develop** full-stack web applications using React, Node.js. (L3)

**CO4: Develop** full-stack web applications using and MongoDB. (L3)

**CO5: Analyze** and solve real-world problems by building scalable web applications. (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-
CO5	3	3	-	3	2	2	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Rich Internet Application Development</b>			
Course Code	<b>P24MCAB311B</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To provide knowledge of rich internet technologies using modern frameworks.
- To understand and apply client-side scripting, AJAX, and advanced UI/UX.
- To develop responsive, dynamic, and interactive web applications using frameworks like Angular or React.
- To learn how to integrate backend services with frontend interfaces.
- To enable deployment and testing of web applications in real-world environments.

### UNIT – I

**8 Hours**

**Introduction to Rich Internet Applications (RIA) and JavaScript Enhancements:** Definition, Evolution, Architecture, RIA vs Traditional Web Applications. **Modern JavaScript (ES6+):** Let/Const, Arrow functions, Classes, Modules, Promises

### UNIT – II

**8 Hours**

**Client-Side Frameworks and Single Page Applications (SPA):** Introduction to SPA –Concepts, Routing, Lifecycle. **React.js Basics** – Components, Props, State, JSX, Event Handling.

### UNIT – III

**8 Hours**

**AJAX, REST APIs and Asynchronous Communication:** AJAX & Fetch API –XML Http Request, Fetch, Axios, Error Handling. **Interfacing with REST APIs** – JSON,HTTP methods, Postman Testing.

### UNIT – IV

**8 Hours**

**Advanced UI Development & State Management:** React Advanced – Hooks (useState, useEffect), Context API. **UI/UX Libraries** – Material UI/ Bootstrap, Responsive Design Techniques.

### UNIT – V

**8 Hours**

**Deployment, Security and Testing of Web Applications:** Deployment – **Hosting** on Firebase/Vercel, Build & Environment Configuration. Web Application Security & Testing – XSS, CSRF, Linting, Unit Testing with Jest.

## Text Books

1. Learning React: Modern Patterns for Developing React Apps, Authors: Alex Banks & Eve Porcello  
Publisher: O'Reilly Media Edition: 2nd Edition, 2020
2. Rich Internet Applications with Ajax Author: Harwani, B.M. Publisher: Dreamtech Press
3. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker Author:  
Frank Zammetti Publisher: Apress

## Web links and Video Lectures (e-Resources)

- <https://youtu.be/BrjWObZ13AU?si=CUIH3FUfU2F2ujbt>
- <https://youtu.be/-ZO3QVgs-sk?si=wpOnaHacgL1SxOtF>

## Course Outcomes

On completion of this course, the students should be able to:

- CO1: Understand** the architecture and role Rich Internet Applications in modern web systems. (L2)  
**CO2: Develop** single-page applications using frameworks like React. (L3)  
**CO3: Implement** AJAX and RESTful services for interactive client-service communication. (L3)  
**CO4: Design** responsive, user-friendly interactive with advanced UI/UX techniques. (L3,L4)  
**CO5: Secure**, test and deploy scalable rich internet applications on modern platforms. (L4, L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	2	-	3	-	-	-	-	-
CO3	-	-	3	2	3	-	-	-
CO4	1	2	3	-	3	-	-	-
CO5	2	2	2	2	3	2	-	1
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Web Development Using PHP and MySQL</b>			
Course Code	<b>P24MCAB311C</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the fundamentals of web technologies .
- Develop dynamic web pages using HTML, CSS, JavaScript.
- Work with MySQL for database-driven applications
- Apply security and validation in web forms.
- Deploy basic web applications.

### UNIT – I

**8 Hours**

**Introduction to Web Technologies:** Internet and WWW, Basics of JavaScript and client-side scripting, HTTP, Web Servers, Client-Server Architecture,HTML5 and CSS3 – Forms, Tables, Layout, and Responsive Design.

### UNIT – II

**8 Hours**

**PHP Basics:** PHP syntax and variables, Control structures, Functions and Arrays, File Handling, Sessions, and Cookies, Error handling, Introduction to OOP in PHP, Working with Forms.

### UNIT – III

**8 Hours**

**JavaScript for Web Interactivity:** JavaScript Basics – Variables, Operators, Functions, DOM, Events, Form Validation, and Integration with HTML/CSS.

### UNIT – IV

**8 Hours**

**MySQL and PHP Integration:** Introduction to MySQL, Database Concepts, SQL Queries (CRUD), Table Design, Connecting PHP to MySQL, Prepared statements and data handling.

### UNIT – V

**8 Hours**

**Web Application Features:** Form validation (Client-side and Server-side), User authentication and session management, File uploads and downloads, Security practices (SQL Injection, XSS, CSRF), Hosting and deployment basics.

### Text Books

1. Luke Welling and Laura Thomson, PHP and MySQL Web Development, 5th Edition, Addison- Wesley, 2016.
2. "PHP & MySQL: Novice to Ninja" (6th Edition) Author: Tom Butler and Kevin Yank Publisher: SitePoint, 2022
3. "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5" (5th Edition) Author: Robin Nixon Publisher: O'Reilly Media, 2018

### Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/live/s-iza7kAXME?si=cIV2baX4EjkzBGel>
- <https://youtu.be/btoVIlr7rAQ?si=PYiphzXfd0pij0op>
- <https://youtu.be/cGwSm8xDSwI?si=-ZTkFmBTVIUB0eOL>

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Describe** the structure and components of web technologies. (L1)

**CO2: Develop** web pages using HTML, CSS, and JavaScript. (L2)

**CO3: Design** and interact with MySQL databases from PHP. (L3)

**CO4: Implement** form validation and apply security measures in web apps. (L3,L4)

**CO5: Deploy** a basic PHP-MySQL-based web application. (L4,L5)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-
CO3	3	3	2	2	-	-	-	-
CO4	3	3	3	2	2	-	-	-
CO5	3	3	3	3	3	2	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Enterprise Application Programming</b>			
Course Code	<b>P24MCAB311D</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the architecture of enterprise applications.
- Develop server-side applications using Java EE/Spring.
- Work with databases and persistence layers using ORM tools.
- Design and implement secure, scalable, and distributed applications.
- Explore deployment strategies and enterprise application testing.

#### UNIT – 1

**8 Hours**

**Introduction to Enterprise Applications:** Defination, Characteristics, types (ERP, CRM, SCM, etc.), and challenges, Enterprise application architecture and layers, Overview of Java EE, Spring Boot introduction ,Comparison of monolithic vs micro services architecture.

#### UNIT – 2

**8 Hours**

**Web Development with Spring:** Spring MVC and Controller, Dispatcher Servlet, Handler Mapping, Controller classes, Request Mapping, View Resolvers, Model And View, RESTful Web Services, REST API design, JSON processing, Creating REST controllers with Spring Boot.

#### UNIT – 3

**8 Hours**

**Business Logic and Dependency Injection:** Spring Core & Bean Life cycle, Inversion of Control(IoC), Bean scopes, Configuration (XML/Java-based), Application Context, Service Layer and Transactions, Creating service classes, transaction management, AOP for business concerns (logging, security).

#### UNIT – 4

**8 Hours**

**Database Access and Persistence:** JDBC and Spring JDBC Template, Data Source, connection pooling, querying with templates, Exception handling in JDBC,JPA and Hibernate with Spring, Entity classes, annotations, persistence context, Repositories and query methods.

#### UNIT – 5

**8 Hours**

**Security, Testing, and Deployment:** Spring Security Fundamentals, Authentication, authorization, custom login forms, Securing REST APIs, Testing and Deployment: Unit testing (JUnit, Mockito), integration testing, WAR/JAR packaging, deploying on Tomcat, Docker basics.

## Text Books

1. Spring in Action Author: Craig Walls Edition: 6th Edition (or latest available)  
Publisher: Manning Publications
2. Enterprise Java Microservices: Building Scalable and Resilient Distributed Systems Author: Ken Finnigan Publisher: O'Reilly Media

## Web links and Video Lectures (e-Resources)

- [https://youtu.be/If1Lw4pLLEo?si=B3F-MHZ8q4N9vh\\_b](https://youtu.be/If1Lw4pLLEo?si=B3F-MHZ8q4N9vh_b)
- [https://youtu.be/UgX5lgv4uVM?si=GJLcXH9jior1\\_4pp](https://youtu.be/UgX5lgv4uVM?si=GJLcXH9jior1_4pp)

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** architecture and layers of enterprise applications. (L1)

**CO2: Build** web applications using Spring MVC and REST. (L2)

**CO3: Implement** service layers and apply dependency injection. (L3)

**CO4: Integrate** database operations using JDBC, JPA, and Hibernate. (L3,L4)

**CO5: Secure,** test, and deploy enterprise applications efficiently. (L4,L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-
CO5	2	2	-	1	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Advances in Web Technologies</b>			
Course Code	<b>P24MCAB311E</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the syntax and usage of PHP for server-side scripting and develop basic web applications.
- Develop web applications using Ruby and Ruby on Rails with database integration.
- Design rich internet applications using AJAX and asynchronous communication principles.
- Implement AJAX patterns and manage complex XML Http Request scenarios.
- Apply responsive design principles using Bootstrap to create modern web interfaces.

### UNIT – I

**8 Hours**

**Introduction to PHP:** Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching. Building Web applications with PHP: Form handling, Files, Tracking users, cookies, sessions, Using databases, Handling XML.

### UNIT – II

**8 Hours**

**Introduction to Ruby and Introduction to Rails:** Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterates, Pattern matching. Overview of Rails, Document requests, Processing forms, Layouts. Rails applications with Databases.

### UNIT – III

**8 Hours**

**Rich Internet Applications With Ajax:** Limitations of Classic Web application model, AJAX principles, Technologies behind AJAX, Examples of usage of AJAX; Asynchronous communication and AJAX application model. Ajax with XML HTTP object: Part 1 Creating Ajax Applications: An example, Analysis of example ajax.html, Creating the JavaScript, Creating and opening the XML Http Request object, Data download, Displaying the fetched data, Connecting to the server, Adding Server-side programming, Sending data to the server using GET and POST.

### UNIT – IV

**8 Hours**

**Ajax with XMLHTTP object:** Part 2 Handling multiple XML Http Request objects in the same page, Using two XML Http Request objects, Using an array of XML Http Request objects, AJAX Patterns – Predictive Fetch, Multi-stage download, Periodic Refresh and Fall-back patterns, Submission throttling.

### UNIT – V

**8 Hours**

**Introduction to Bootstrap:** What Is Bootstrap? Bootstrap File Structure, Basic HTML Template, Global Styles, Default Grid System, Basic Grid HTML, Offsetting Columns, Nesting Columns, Fluid Grid System, Container Layouts, Responsive Design. Typography, Emphasis Classes, Lists, Code, Tables, Optional Table Classes, Table Row Classes, Forms, Buttons, Images, Icons.

## Text Books

1. Robert W. Sebesta: Programming the Worldwide Web, 4th Edn, Pearson, 2012
2. Professional AJAX – Nicholas C Zakas et al, Wrox publications, 2008.
3. Steven Holzner: Ajax: A Beginner's Guide, Tata McGraw Hill, 2014.
4. Jake Spurlock: "Bootstrap: Responsive Web Development", O'Reilly Media, 2014.
5. Thomas A. Powell: Ajax The Complete reference, McGraw Hill, 2008.
6. Aravind Shenoy, Ulrich Sossou: Learning Bootstrap, Packt, Dec 2014.
7. Dana Moore, Raymond Budd, Edward Benson: Professional Rich Internet Applications: AJAX and Beyond, Wiley 2012.

## Web links and Video Lectures (e-Resources)

- <https://www.php.net/manual/en/>
- <https://www.ruby-lang.org/en/documentation/>
- <https://guides.rubyonrails.org/>
- <https://developer.mozilla.org/en-US/docs/Web/Guide/AJAX>
- <https://getbootstrap.com/docs/5.3/getting-started/introduction/>

## Skill Development Activities Suggested

- Build a blog application with database interaction.
- Build a TODO web app using Ruby on Rails. Create a basic blog with CRUD operations using Rails and Active Record. Handle form inputs and layouts dynamically in Rails.
- Develop a live search feature using AJAX. Create a weather info retriever using XML Http Request and an API.
- Build a multi-tabbed interface with AJAX loading each tab's content. Use AJAX to periodically update a dashboard.
- Design a responsive portfolio website. Convert a static HTML form into a responsive Bootstrap - styled form. Style tables and buttons dynamically with Bootstrap classes.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Explain** and use PHP for server-side scripting and web application development. (L1, L2)

**CO2: Develop** and deploy web applications using Ruby and Rails with database support. (L3)

**CO3: Explain** AJAX technology and build AJAX-enabled web applications. (L3)

**CO4: Implement** advanced AJAX functionalities using multiple XML Http Request objects and AJAX Patterns. (L3, L4)

**CO5: Design** responsive and styled web interfaces using Bootstrap framework. (L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	-	2	-	3	-	-	-
CO3	1	-	-	2	-	-	-	-
CO4	-	2	-	-	-	-	3	-
CO5	-	-	-	-	3	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Web Programming using Java</b>			
Course Code	<b>P24MCAB311F</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To understand web technologies and develop dynamic, interactive web applications using Java.
- To build client-server-based applications using Java Servlets and JSP.
- To integrate backend databases with web front-ends.
- To explore the MVC architecture in web development using Java frameworks.

### UNIT – I

**8 Hours**

**Introduction to Web Development and Java Web Technologies:** Basics of Web Programming -HTTP, HTML, CSS, JavaScript overview. Introduction to Java EE, Architecture of Java Web Applications.

### UNIT – II

**8 Hours**

**Java Servlets:** Servlet Lifecycle, Writing a basic Servlet, Deployment using web.xml, Servlet Config and Servlet Context, Request and Response Handling, Session Management, Cookies, and URL Rewriting, Redirecting requests (send Redirect vs forward), Status codes and response headers.

### UNIT – III

**8 Hours**

**Java Server Pages (JSP):** Introduction to JSP and its advantages over Servlets, JSP Architecture, Implicit Objects, Scripting Elements, JSP Directives, Error Handling, JSTL (JSP Standard Tag Library), Advanced JSP Features.

### UNIT – IV

**8 Hours**

**JDBC and Database Connectivity:** Introduction to JDBC and its architecture, JDBC Drivers, Connection, Statement, ResultSet. Integrating JDBC with JSP and Servlets.

### UNIT – V

**8 Hours**

**MVC Architecture and Java Frame works:** MVC Architecture Pattern in Web Applications, Introduction to Spring MVC Framework -Controllers, Views, Models.

### Text Books

1. Web Programming using Java Author: Uttam K. Roy Publisher: Oxford University Press  
Edition: Latest.
2. Java Web Programming and Web Services Author: David E. Flanagan Publisher: O'Reilly Media  
Edition: 2nd Edition
3. Head First Servlets and JSP Authors: Bryan Basham, Kathy Sierra, Bert Bates Publisher: O'Reilly Media  
Edition: 2nd Edition.

### Web links and Video Lectures (e-Resources)

- [https://youtu.be/BGTx91t8q50?si=PT8zIooy3p2J\\_awp](https://youtu.be/BGTx91t8q50?si=PT8zIooy3p2J_awp)
- <https://youtu.be/Js4FIB0zTbg?si=XJNOQYzdpcTCLSdT>
- [https://youtu.be/r4EqfjMsP48?si=p9PbgqbqebXYsqV\\_u](https://youtu.be/r4EqfjMsP48?si=p9PbgqbqebXYsqV_u)

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the fundamentals of web development and Java web technologies. (L1)

**CO2: Develop** Java Servlet-based web applications. (L2)

**CO3: Create** dynamic websites using Java Server Pages (JSP). (L3)

**CO4: Integrate** databases with Java web applications using JDBC. (L3)

**CO5: Apply** MVC architecture for scalable Java web applications using frameworks. (L2)

### Mapping with Program Outcomes:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	-	-	-	-	2	2	-	-
CO4	2	2	2	-	-	-	-	-
CO5	2	-	-	-	-	-	-	2
<b>3-Strong; 2-Medium; 1-Low</b>								

Computer Networks			
Course Code	P24MCAC311A	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

At the end of the course, the student will be able to

- Familiarize the basic terminologies used for computer networking.
- Implement the computer networks concepts like TCP/IP, IPC and Congestion avoidance techniques
- Simulate the working of wired networks and analyze its performance

### UNIT - I

**8 Hours**

**Introduction:** Data Communications, Networks, The Internet, Broadcast and Point-To Point Networks; Connectionless and Connection-Oriented Services; Network Devices; Network Topologies; Types of Network: LAN, MAN, WAN,PAN; Server Based LANs and Peer-to-Peer LANs; Transmission Types; Modes of Communication;

### UNIT - II

**8 Hours**

**Network Models:** Design Issues of the Layer, Protocol Hierarchy, ISO-OSI Reference Model: Functions of each Layer; Various Terminology used in Computer Network; Connection-Oriented and Connectionless Services, Internet (TCP/IP) Reference Model, Comparison of ISO OSI and TCP/IP Model.

### UNIT – III

**8 Hours**

**Transmission Media: Transmission** Medium, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable; Unguided Media: Radio Waves, Infrared, Micro-wave, Satellite communication, Laser. Switching Techniques.

### UNIT – IV

**8 Hours**

**Data Link layer:** Data link layer design issues, Error Detection and Correction Codes, Data Link Protocols (Simplex Stop-and-wait protocol for Error free and noisy channel) and Sliding window protocols.

**Network Layer:** Network Layer Design issues, Routing algorithms, Congestion Control Algorithms, Quality of Service, Internetworking and The Network Layer in the Internet.

### UNIT – V

**8 Hours**

**The Transport Layer:** The Transport Service, Elements of Transport Protocols, Congestion Control, The Internet Transport Protocol: UDP, The Internet Transport Protocols – TCP.

**The application Layer:** DNS: Domain Name Space, Domain Resource Records, Domain Name Servers. Electronic mail: SMTP, The World Wide Web: Static and dynamic web pages, web applications, HTTP, mobile web. Streaming audio and Video: Digital audio and video, streaming stored and live media, Content delivery: Content and internet traffic, content delivery networks, peer-to-peer networks.

## Text Books

1. Behrouz A. Forouzan,: Data Communication and Networking, 4 th Edition Tata McGraw-Hill, 2006.
2. Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004.
3. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
4. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
5. Nader F. Mir: Computer and Communication Networks, Pearson Education, 2007.

## Web links and Video Lectures (e-Resources)

- <https://www.binghamton.edu/watson/continuing-education/data-science/intro-to-computer-networks.html>
- <https://elearn.daffodilvarsity.edu.bd/course/view.php?id=5457>
- [https://onlinecourses.nptel.ac.in/noc21\\_cs18/preview](https://onlinecourses.nptel.ac.in/noc21_cs18/preview)

## Skill Development Activities Suggested

The students with the help of the course teacher can take up technical –activities which will enhance their skill or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Apply** the basic concepts of networks like protocol, internet and OSI layers. (L3)

**CO2: Analyze** the working of Physical Layer. (L3)

**CO3: Demonstrate** the various Switching networks. (L3)

## Mapping with Program Outcomes:

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	1	-
CO3	-	2	3	-	-	-	-	-

**3-Strong; 2-Medium; 1-Low**

<b>Network and Linux Administration</b>			
Course Code	<b>P24MCAC311B</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Set up and manage network interfaces, IP addresses, and network services.
- Configuration of firewalls using ip tables, NAT, and secure Linux networks.
- To Manage Network Services – Work with DNS, DHCP, remote login, and web server configurations.
- To Diagnose network issues and optimize performance using Linux tools.

### UNIT – I

**8 Hours**

**Introduction to Networking** :History and evolution of computer networking Basic network components and models **TCP/IP Networks** :Layers of the TCP/IP model Understanding IP addresses, subnetting, and classes The Internet Control Message Protocol (ICMP) **Linux Networking Basics** :Maintaining your Linux system for networking networking interfaces and configuration in Linux Overview of the /proc file system.

### UNIT – II

**8 Hours**

**Configuring Serial Hardware** :Communications software for modem links Accessing and managing serial devices Configuration utilities for serial communication **TCP/IP Configuration** : Understanding /proc for network-related data Configuring Linux-based TCP/IP networking **Name Services and DNS** :Resolver library overview How DNS works and alternatives to BIND.

### UNIT – III

**8 Hours**

**Point-to-Point Protocol in Linux** Running pppd and using options files, Automating dialing with chat ,IP configuration and link control options Security considerations and authentication in PPP **Advanced PPP Configurations** : Debugging PPP setups, PPPoE options in Linux, **Networking Security & Firewalls** : Understanding network security threats, Firewall concepts and IP filtering basics.

### UNIT – IV

**8 Hours**

**TCP/IP Firewalls** :Methods of attack and security considerations, Netfilter and iptables basics, Setting up and managing Linux firewalls, **IP Masquerade & Network Address Translation**: Configuring the kernel for IP Masquerade, Handling NAT and DNS lookups **IP Accounting & Network Monitoring** : Configuring IP accounting Collecting and analyzing network data.

### UNIT – V

**8 Hours**

**Network Services and Remote Access** : Understanding inetd, tcpd, and xinetd, Remote Procedure Call (RPC) configuration, Remote login and execution services **IPv6 & Web Server Configuration** :IPv4 limitations and introduction to IPv6, Configuring IPv6 networks in Linux, Apache Web Server setup and configuration. **Wireless Networking**: History and standards of wireless networking, Security concerns in 802.11b networks.

## Text Book

1. "Linux Network Administrator's Guide" – Tony Bautts, Terry Dawson, Gregor N. Purdy 3<sup>rd</sup> edition.

## Reference Books

1. "Computer Networking: A Top-Down Approach" – James F. Kurose & Keith W. Ross A great introduction to networking concepts, covering application-layer protocols, TCP/IP, and security.
2. "Linux Firewalls: Enhancing Security with nftables and Beyond" – Steve Suehring A comprehensive guide on firewall security, iptables, and nftables in Linux.
3. "Mastering Linux Network Administration" – Jay LaCroix Covers advanced Linux networking topics, including system administration and server configuration.

## Web links and Video Lectures (e-Resources)

1. **Computer Networking Full Course** (Beginner-Friendly)
  - o <https://www.youtube.com/watch?v=qiQR5rTSshw> (NetworkChuck – Cisco Basics & TCP/IP)
2. **Linux Networking & Firewall Setup**
  - o <https://www.youtube.com/watch?v=zA42YPS52Xo> (TechWorld with Nana – Linux Networking Guide)
3. [https://youtu.be/\\_eY4IfpbRDs?si=vHeCLsgFewCGJw3t](https://youtu.be/_eY4IfpbRDs?si=vHeCLsgFewCGJw3t)

## Skill Development Activities Suggested

### Server Setup and Administration

- Install and configure Apache Web Server, DNS, and DHCP in Linux.
- Set up remote login (SSH) and secure authentication mechanisms.
- Set up and configure static & dynamic IP addressing using Linux commands.
- Use the ping, trace route, and net stat tools to diagnose network issues.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Learn** about network setup, IP addresses and how computers communicate. (L1)

**CO2: Configure** internet connections, share files and manage network settings. (L2)

**CO3: Protect** a system from hackers by setting up firewall rules and security measures. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-
CO3	1	2	-	-	3	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>TCP/IP</b>			
Course Code	<b>P24MCAC311C</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- This course provides a solid foundation for understanding the communication process of the Internet.
- The student will understand the fundamental concepts of computer networking in the context of the TCP/IP model and protocols.
- To study classful and classless addressing, IPV4, IPv6, UDP, TCP, congestion control and flow control.

### **UNIT – I**

**8 Hours**

TCP/IP Protocol Suite - Protocol Layers, The TCP/IP Protocol suite and Addressing. IPV4 Addresses- Introduction, Classful and Classless Addressing, Internet Protocol Version4 (IPv4) – Datagram's, Fragmentation, Options, Checksum, Security, IP Package.

### **UNIT – II**

**8 Hours**

Introduction to the Transport Layer: Transport Layer Services and Protocols. User Datagram Protocol (UDP) :Introduction, User Datagram, UDP Services and Applications, UDP Package.

### **UNIT – III**

**8 Hours**

Transmission Control Protocol – I: TCP Services: Process-to-Process Communication, Full-Duplex Communication, Multiplexing and De-multiplexing, Reliable Service, Connection-Oriented Service Features, Segment, TCP Connection, Windows in TCP.

### **UNIT – IV**

**8 Hours**

Transmission Control Protocol – II: Flow Control, Error Control, Congestion Control, TCP Timers, Options and TCP Package.

### **UNIT – IV**

**8 Hours**

IPv6 Addressing – Introduction, Address Space Allocation, Global Unicast Addresses, Auto configuration and Renumbering. IPv6 Protocol - Introduction, Packet Format, Transition from IPv4 to IPv6. ICMPv6 - Introduction, Error Messages, Informational Messages, Neighbor- Discovery Messages, Group Membership Messages.

### **Text Books**

1. TCP/IP Protocol Suite, Behrouz A. Forouzan, 4th Edition, Tata McGraw-Hill Edition.
2. Data communication and Networking with TCP/IP Protocol Suite, Behrouz A. Forouzan, 6th Edition, Tata McGraw-Hill Edition.
3. The TCP/IP Tutorial and Technical Overview Adolfo Rodriguez, John Gattrell, John Karas, Roland Peschke

### Web links and Video Lectures (e-Resources)

- [https://www.youtube.com/watch?v=TBHHCd\\_9tz8](https://www.youtube.com/watch?v=TBHHCd_9tz8)
- <https://www.youtube.com/watch?v=7GnSWC7CINs>

### Skill Development Activities Suggested

- **Activity:** Study TCP/IP Model Layers: Learn about the four layers (Transport, and Transmission I and II) and how they compare to the OSI model.
- **Skills Developed:** Get the idea of the depth of Computer Networks.
- **Activity:** Protocol Deep Dive Explore protocols like TCP, IP, UDP etc.
- **Skills Developed:** Understanding the about the protocols and its use

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understanding** of TCP/IP Architecture. (L2)

**CO2: Identify** and assign IPv4 & IPv6 address effectively. (L3)

**CO3: Evaluate** TCP & UDP Transmission Mechanisms. (L5)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	2	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-
CO3	1	-	3	-	-	3	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Unix Shell Programming</b>			
Course Code	<b>P24MCAC311D</b>	CIE Marks	50
L: T :P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- This course will enable students to
- To help the students to understand effective use of Unix concepts, commands and terminology. Identify, access, and evaluate UNIX file system
- Explain the fundamental design of the Unix operating system
- Familiarize with the systems calls provided in the Unix environment
- Design and build an application/service over the Unix operating system

### **UNIT – I**

**8 Hours**

Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.

### **UNIT – II**

**8 Hours**

File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions. The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Shell programming: Ordinary and environment variables. The .profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters.

### **UNIT – III**

**8 Hours**

Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. File I/O: Introduction, File Description, open, create, read, write, close, fcntl functions. Files and Dictionaries: mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions.

## UNIT – IV

8 Hours

Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1.

## UNIT – IV

8 Hours

Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock\_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model.

### Text Books

1. Sumitabha Das., Unix Concepts and Applications., 4thEdition., Tata McGraw Hill
2. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005

### Reference Books

1. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.
2. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
3. Richard Blum, Christine Brenham: Linux Command Line and Shell Scripting Bible, 2ndEdition, Wiley, 2014.

### Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/watch?v=ffYUfAqEamY>
- <https://www.youtube.com/watch?v=Q05NZiYFcD0>
- <https://www.youtube.com/watch?v=8GdT53KDIyY>
- <https://www.youtube.com/watch?app=desktop&v=3Pga3y7rCgo>

### Skill Development Activities Suggested

- **Demonstrate** the basics of Unix concepts and commands.
- **Demonstrate** the UNIX file system.
- **Apply** comands to reflect changes in file system.
- **Demonstrate** IPC and process management
- **Develop** an application/service over a Unix system.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** UNIX basics, navigate files and directories and use command –line interfaces. (L1)

**CO2: Manage** user accounts, permissions, and system resources, create and edit files. (L2)

**CO3: Apply** advanced UNIX concepts, including shell scripting, troubleshooting, and networking/ security features. (L2, L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	2	-	-	-	-
CO2	-	2	-	-	3	-	-	-
CO3	1	-	3	-	-	-	3	-

**3-Strong; 2-Medium; 1-Low**

<b>Cloud Essentials</b>			
Course Code	<b>P24MCAC311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Explain the fundamentals of cloud
- Analyse Business Benefits and Risks of Cloud Computing.
- Evaluate Emerging Trends in Cloud Computing

### **UNIT – I**

**8 Hours**

Introduction to Cloud: Defining a cloud, Characteristics of Cloud Computing, Cloud computing reference model, Architectures for parallel and distributed computing, Elements of parallel computing and Elements of distributed computing.

Cloud Service Models: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Function as a Service (FaaS), Blockchain-as-a-Service (BaaS) and use cases, Cloud Deployment Models: Public Cloud, Private Cloud, Hybrid and Multi-Cloud, Community Cloud.

### **UNIT – II**

**8 Hours**

Core Components of Cloud Architecture: Compute Services, Storage Services, Networking Services, Virtualization, Types of Virtualization, Containers vs. Virtual Machines (VMs), Load Balancing in Cloud, Auto-Scaling & Fault Tolerance, Content Delivery Networks(CDN), Bare Metal Cloud, Cloud Orchestration and Automation.

### **UNIT – III**

**8 Hours**

Cloud Automation, DevOps, and Future Innovations: Cloud Automation and Infrastructure as Code(IaC), Dev Ops and Continuous Integration/Continuous Deployment (CI/ CD), Multi-Cloud and Hybrid Cloud Strategies, Sustainability and Green Cloud Computing, Cloud Innovations- AI-powered cloud automation-5G and its impact on cloud computing.

### **UNIT – IV**

**8 Hours**

Cloud Security & Risk Management: Cloud Adoption, Advantages and Challenges of Cloud Adoption, Security Risks in Cloud- Data Breaches, Identity Theft, Network Security in Cloud. Security Solutions in Cloud: Identity and Access Management (IAM), Data Encryption Techniques, Firewalls & Intrusion Detection Systems: Compliance & Regulatory Frameworks, Disaster Recovery and Business Continuity Planning in Cloud.

### **UNIT – IV**

**8 Hours**

Emerging Trends and case study: AI, Edge Computing, Quantum Cloud, Event-driven architecture in cloud, Cloud-based AI services -AWS SageMaker, Google Vertex AI, Azure ML.

Case Study: Netflix's Cloud Migration, Zoom's Cloud Scalability .

## Text Books

1. Rajkumar Buyya, Christian Vecchiola, and Thamrai Selvi Mastering Cloud Computing McGraw Hill Education.
2. CompTIA Cloud Essentials+ Study Guide: Exam CLO-002 [2 ed.] .
3. Handbook of Cloud Computing, Borko Furht- Armando Escalante.
4. Cloud Essentials: CompTIA Authorized Courseware for Exam CLO-001.
5. RjkumarBuyya, Christian Vecchio la, and ThamaraiSelci, Mastering Cloud Computing, Tata Mc Graw Hill, New Delhi, India, 2013.

## Reference Books

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)
2. Toby Velte, Anthony Velte, Cloud Computing: A Practical Approach, McGraw -Hill Osborne Media

## Web links and Video Lectures (e-Resources)

- <https://youtu.be/dUpwh5XgxsA?si=pF4mgT2n5W7nyQFc>
- <https://www.youtube.com/watch?v=1N3oqYhzHv4>
- <https://www.youtube.com/watch?v=RWgW-CgdIk0>

## Skill Development Activities Suggested

- **Activity:** Develop a small web application using **PaaS** platforms like **Google App Engine** or **Heroku**  
**Skills Developed:** Hands-on experience with Platform-as-a-Service, web application hosting.
- **Activity:** Create and manage a free-tier account on **AWS, Azure, or Google Cloud Platform (GCP)**  
**Skills Developed:** Basic cloud navigation, account setup, and cloud resource management  
The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the Fundamental concepts of cloud computing. (L2)

**CO2: Understand** cloud Security Challenges. (L2)

**CO3: Understand and Explain** Cloud Compute Service and Analyze Cloud Networking Services. (L2)

**CO4: Compare** different deployment and services models of cloud to develop different variety of Application with securities. (L2)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	2	2	-	-	2	-	-	-
CO3	2	2	-	-	3	-	-	-
CO4	2	3	-	3	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Introduction to ERP and SAP Basis Administration</b>			
Course Code	<b>P24MCAC311F</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Explain the objectives, importance, and decision phases of supply chain management.
- Evaluate ERP Implementation Processes
- Analyze the ERP Market and Leading Vendors
- Explain SAP system architecture, installation, and administration processes.

### **UNIT – I**

**8 Hours**

#### **Introduction to Supply Chain Management**

Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing.

### **UNIT – II**

**8 Hours**

#### **ERP Implementation**

Implementation of Life Cycle, Implementation Methodology, Hidden Costs, Organizing Implementation, Vendors, Consultants and Users, Contracts, Project Management and Monitoring

### **UNIT – III**

**8 Hours**

#### **ERP Market**

ERP Market Place, SAP AG, People Soft, Baan Company, JD Edwards World Solutions Company, Oracle Corporation, QAD, System Software Associates.

### **UNIT – IV**

**8 Hours**

**Introduction to SAP Basis:** System architecture, Installation/administration. User and role management, Transport Management System (TMS), Job/spool management, and database administration. System monitoring, troubleshooting, performance optimization, focusing on work processes, buffer tuning and memory management.

### **UNIT – V**

**8 Hours**

**Advanced SAP Basis & HANA:** SAP patch management, system upgrades, security, audit logs, user access monitoring, backup and disaster recovery strategies. A brief introduction to SAP HANA: architecture, basic administration and case studies.

## Text Books

1. "Supply Chain Management: Strategy, Planning, and Operation" – Sunil Chopra, Peter Meindl
2. "Enterprise Resource Planning: Fundamentals of Design and Implementation" – K. Ganesh, Sanjay Mohapatra
3. "SAP Basis Administration Handbook, NetWeaver Edition" – Ranjit Mereddy
4. "SAP HANA Administration" – Richard Bremer, Lars Breddemann

## Web links and Video Lectures (e-Resources)

- <https://training.sap.com/content/sap-logistic-supply-chain>
- <https://www.sap.com/products/erp/what-is-erp.html>.
- <https://youtu.be/uuF746PiZ9k>

## Skill Development Activities Suggested

- **Hands-on ERP System Exploration** – Use an open-source ERP system like **Odoo** or **ERPNext** to understand real-world implementation, role management, and basic configurations.
- **Supply Chain Case Study Analysis** – Analyze a company's supply chain (e.g., Amazon, Toyota) to identify key drivers, challenges, and strategic decisions, then present findings in a report or presentation.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1:** Analyse the essentials of supply chain management in ERP. (L2)

**CO2:** Analyse the implementation of ERP in the context of business of the different organization. (L3)

**CO3:** Analyse the given case study of ERP marketing. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	1	2	-	-	-	-	-
CO2	-	2	1	3	-	-	-	-
CO3	-	-	2	-	3	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Management Information Systems</b>			
Course Code	<b>P24MCAD311A</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand the role and impact of information systems in global business environments.
- Analyse how organizations leverage information systems for strategic advantage.
- Evaluate the components and infrastructure of information systems, including databases and networking.
- Assess the applications of enterprise systems, e-commerce, and knowledge management in business processes.
- Apply principles of system development and project management to real-world scenarios.

### **UNIT – I**

**8 Hours**

**Foundations of Management Information Systems:** Role of Information Systems in Business Today Global E-Business and Collaboration Information Systems, Organizations, and Strategy Ethical and Social Issues in Information Systems

### **UNIT – II**

**8 Hours**

**Information Technology Infrastructure:** IT Infrastructure and Emerging Technologies Foundations of Business Intelligence: Databases and Information Management Telecommunications, the Internet, and Wireless Technology Securing Information Systems

### **UNIT – III**

**8 Hours**

**Enterprise Applications and E-Commerce:** Achieving Operational Excellence and Customer Intimacy: Enterprise Applications E-commerce: Digital Markets, Digital Goods Managing Knowledge and Artificial Intelligence

### **UNIT – IV**

**8 Hours**

**Decision Making and System Development:** Enhancing Decision Making Building Systems Managing Projects

### **UNIT – V**

**8 Hours**

**Managing Global Systems:** The Growth of Global Business and Information Systems, Challenges of Global Information Systems, Organizing Global Business and Systems, Managing Global Systems Development, Strategies for Implementing Global Systems, Case Studies and Real-World Examples

## Text Books

1. Pearson - Management Information Systems: Managing the Digital Firm
2. "Management Information Systems" by Raymond McLeod & George Schell
3. "Information Systems for Managers" by Gabriele Piccoli & Federico Pigni
4. "Essentials of Management Information Systems" by Kenneth C. Laudon & Jane P. Laudon

## Web links and Video Lectures (e-Resources)

1. <https://youtu.be/QrLZfvGJ5pw>
2. <https://youtu.be/dZP2J2tzSwc>
3. <https://www.youtube.com/watch?v=QrLZfvGJ5pw&list=PLim9gWjsjN-MpFDCjM5n2HfI9NFrsoDe6>

## Skill Development Activities Suggested

1. Conduct a business simulation where students run a virtual company.
2. Students act as CIOs, System Analysts, or Database Managers and solve a business problem collaboratively.
3. Students prepare posters, presentations, or videos promoting information security best practices.
4. Analyze real-world business cases involving successful or failed MIS implementations

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the fundamental concepts and types of Management Information Systems. (L1)

**CO2: Analyze** how MIS supports decision-making and strategic business goals. (L2)

**CO3: Examine** the components of IT infrastructure including databases, networks, and cloud. (L3)

**CO4: Evaluate** enterprise systems, e-commerce and knowledge-based systems in practice. (L3, L4)

**CO5: Design** and manage system development processes and global information systems. (L4, L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	-
CO2	3	3	2	2	-	-	-	-
CO3	2	3	3	2	3	-	-	-
CO4	2	3	2	3	-	2	-	3
CO5	2	2	3	3	-	3	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Database Design &amp; Applications</b>			
Course Code	<b>P24MCAD311B</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand database system concepts and data models.
- Design effective databases using ER models and normalization techniques.
- Write SQL queries for data manipulation and retrieval.
- Implement databases using popular RDBMS tools.
- Apply PL/SQL constructs to develop application-level logic

### UNIT – I

**8 Hours**

**Introduction to Databases :** File systems vs Database systems, Characteristics of database systems, DBMS architecture & data independence, Data models: Hierarchical, Network, Relational, Object-oriented, Database users & DBA roles.

### UNIT – II

**8 Hours**

**ER Modeling and Relational Model:** Entity-Relationship model: Entities, attributes, relationships, ER diagrams, cardinality, participation, Mapping ER to relational schema, Relational algebra basics, Integrity constraints: Key, domain, referential integrity.

### UNIT – III

**8 Hours**

**SQL and Advanced SQL:** Basics of SQL: DDL, DML, DCL, SQL queries: Selection, projection, joins, grouping, Sub-queries, nested queries, Views, indexes, sequences, Triggers and stored procedures

### UNIT – IV

**8 Hours**

**Normalization and Database Design :** Functional dependencies, 1NF, 2NF, 3NF, BCNF, Multivalued dependencies, 4NF, 5NF, Decomposition and lossless joins, Case study: Designing a university database.

### UNIT – V

**8 Hours**

**PL/SQL and Applications :** Introduction to PL/SQL, Cursors, loops, exception handling, Procedures and functions, Packages and triggers, Database connectivity using programming language (e.g., Python or Java)

### Text Books

1. "Database System Concepts" by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGraw Hill Education
2. "Fundamentals of Database Systems" by Ramez Elmasri and Shamkant B. Navathe, Pearson Education
3. "SQL, PL/SQL: The Programming Language of Oracle" by Ivan Bayross
4. "Modern Database Management" by Jeffrey A. Hoffer, V. Ramesh, Heikki Topi
5. "Learning SQL" by Alan Beaulieu, O'Reilly

### Web links and Video Lectures (e-Resources)

- <https://sqlzoo.net/>
- <https://mode.com/sql-tutorial/>
- <https://oracle-base.com/>

### Skill Development Activities Suggested

- **Mini Project:** Design and develop a database-backed web/mobile application (e.g., Library, Hostel, Inventory Management).
- **Hands-on Lab:** Write complex SQL queries including joins, nested queries, and views.
- **ER Design Challenge:** Analyze a real-world system and model it using ER diagrams.
- **Normalization Lab:** Decompose messy schemas into normalized forms.
- **PL/SQL Hackathon:** Implement procedures, triggers, and error handling for a chosen application.

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Explain** database concepts and architectures. ( L1, L2)

**CO2: Design** ER models and convert them into relational schemas. ( L3)

**CO3: Write** SQL queries to retrieve and manipulate data. ( L3)

**CO4: Apply** normalization techniques for effective schema design. ( L4)

**CO5: Develop** PL/SQL programs and integrate with front-end applications. (L5, L6)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	1	-	-	-	-	-	-
CO2	-	-	1	2	-	-	-	3
CO3	-	-	-	-	2	3	-	-
CO4	-	-	1	2	-	-	-	3
CO5	-	-	2	2	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Software Architectures</b>			
Course Code	<b>P24MCAD311C</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Describe the foundational concepts, components, and the significance of software architecture in the software lifecycle.
- Identify and apply appropriate architectural styles and patterns to different software system requirements.
- Analyze software architectures based on quality attributes such as performance, modifiability, and scalability.
- Use UML and architecture description languages (ADLs) to model and document software architectures.
- Critically evaluate real-world software architectures and understand their evolution and trade-offs through case studies.

### **UNIT – I**

**8 Hours**

**Introduction to Software Architecture** Definition and significance, Architectural structures and views, Role of software architect, Architecture vs Design

### **UNIT – II**

**8 Hours**

**Architectural Styles and Patterns** :Layered, Client-Server, Pipe-and-Filter, Event-driven, Microservices, Common architectural patterns: MVC, Broker, Blackboard, Service-Oriented, Design patterns review relevant to architecture

### **UNIT – III**

**8 Hours**

**Quality Attributes and Architecture Evaluation** : Quality attributes: Performance, Security, Availability, Modifiability, Attribute-Driven Design (ADD),Architecture Tradeoff Analysis Method (ATAM),Tactics to achieve quality attributes

### **UNIT – IV**

**8 Hours**

**Architecture Design and Documentation** :Architecture modeling with UML, Views: Logical, Development, Process, Physical (4+1 view model),Documenting architecture (ADL, SAD),Case study - driven design

### **UNIT – V**

**8 Hours**

**Architecture in Practice** :Architecture recovery and reengineering, Architecture and Agile development, Cloud-native and Micro services architectures ,Case studies of large-scale systems

## Text Books

1. Len Bass, Paul Clements, Rick Kazman, "Software Architecture in Practice," 4th Edition, Addison - Wesley, 2021
2. Documenting Software Architectures: Views and Beyond – Paul Clements, Felix Bachmann, Len Bass, David Garlan, James Ivers
3. Software Architecture: Foundations, Theory, and Practice – Richard N. Taylor, Nenad Medvidovic, and Eric M. Dashofy

## Web links and Video Lectures (e-Resources)

- <https://resources.sei.cmu.edu/library/subject-areas/software-architecture/>
- [https://www.tutorialspoint.com/software\\_architecture\\_design/index.htm](https://www.tutorialspoint.com/software_architecture_design/index.htm)
- <https://learn.microsoft.com/en-us/azure/architecture/>
- <https://www.visual-paradigm.com/guide/uml-unified-modeling-language/>

## Skill Development Activities Suggested

1. Analyze architecture documentation of open-source projects (e.g., Apache Kafka, Spring Framework) to understand architecture decisions.
2. Implement mini-projects using common architectural styles such as MVC, Microservices, Layered Architecture, and Client-Server.
3. Use UML tools (like StarUML, Lucidchart) to model system architecture including component, deployment, and sequence diagrams.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Define** and explain key software architecture concepts and their importance in the software development process. (L1)

**CO2: Identify** and analyze various architectural styles and patterns and their applicability to different software applications. (L2)

**CO3: Evaluate** software architectures based on quality attributes such as performance, security and modifiability and make informed decisions. (L3)

**CO4: Model,** design, and document software architectures using appropriate tools, including UML and other architectural description languages (ADLs). (L3, L4)

**CO5: Apply** software architecture principles through practical case studies, demonstrating the ability. (L4, L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	2	-	-	-	-	-	-
CO2	1	2	3	2	-	-	3	-
CO3	-	2	3	-	3	-	-	3
CO4	-	2	3	-	3	-	-	-
CO5	-	2	-	-	3	2	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Computer Organization and Software Systems</b>			
Course Code	<b>P24MCAD311D</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Acquire fundamental knowledge of computer architecture.
- Gain practical skills in assembly language programming.
- Analyze the interplay between hardware and software components.
- Develop and optimize software with an understanding of system constraints.

### UNIT -I

**8 Hours**

**Introduction to Computer Architecture:** Overview of computer organization and architecture, Evolution of architectures (CISC, RISC, MIPS), Performance measures: CPI, MIPS, MFLOPS, Instruction sets and types, Structure of the CPU: ALU, CU, registers, Memory hierarchy: cache, main memory, virtual memory, Instruction pipelining and hazards, Memory addressing modes.

### UNIT -II

**8 Hours**

**Basics of Assembly Language:** Assembly language structure and syntax, Data representation: binary, hexadecimal, Instruction formats and encoding, Arithmetic and logical operations, Data transfer instructions: MOV, LOAD, STORE, Stack operations: PUSH, POP, CALL, RET.

### UNIT -III

**8 Hours**

**Operating System Fundamentals:** OS structure and functions, Process management and scheduling, Memory management techniques: paging and segmentation, Linkers and loaders: role and functionality, Device driver basics: kernel mode, user mode, Interaction between drivers and hardware.

### UNIT -IV

**8 Hours**

**Storage Devices and Interfaces:** Overview of primary and secondary storage, HDD, SSD, RAID configurations, Interfaces: SATA, SCSI, NVMe, Virtual memory concepts: paging and page replacement.

### UNIT -V

**8 Hours**

**Hardware-Software Co-Design and case study:** Hardware-software partitioning, Performance optimization in co-design, Characteristics of embedded systems, Real-time operating system (RTOS) basics, Case study: Embedded systems development

### Text Books

1. Title: Computer Organization and Design: The Hardware/Software Interface Authors: David A. Patterson, John L. Hennessy Edition: 6th Edition Publisher: Morgan Kaufmann
2. Computer Organization and Architecture: Designing for Performance Author: William Stallings Edition: 11th Edition Publisher: Pearson.

### Web links and Video Lectures (e-Resources)

- <https://youtu.be/j8NnE1YeSN0?si=eP7qF3bv-92ps0tG>
- [https://youtu.be/-qyM8XJVnxg?si=Rks1jpJEcd0F\\_c\\_y](https://youtu.be/-qyM8XJVnxg?si=Rks1jpJEcd0F_c_y)

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the basic concepts of computer organization and architecture. (L1)

**CO2: Analyze** the functioning of software systems and their interaction with hardware. (L2)

**CO3: Develop** problem-solving skills using assembly language and low-level programming. (L2)

**CO4: Integrate** concepts from computer architecture to design efficient software systems. (L3)

**CO5: Demonstrate** the ability to apply software concepts in real-world scenarios. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	-	-	3	-	-	-	-	3
CO4	3	2	3	-	2	-	-	3
CO5	2	2	3	-	-	2	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Software Design and Patterns</b>			
Course Code	<b>P24MCAD311E</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand the importance and role of design patterns in software development.
- Learn how to implement various creational, structural, and behavioral design patterns.
- Analyze software design problems and apply appropriate design patterns to solve them.
- Develop reusable and maintainable object-oriented software.

### **UNIT -I**

**8 Hours**

**Fundamentals and Design Principles:** Introduction to Design Patterns, Definition, purpose, and history, Benefits and limitations of design patterns, Classification: Creational, Structural, Behavioral. Principles of Object-Oriented Design, SOLID principles, Coupling and Cohesion, UML for patterns.

### **UNIT -II**

**8 Hours**

**Creational Design Patterns:** Singleton and Factory Method, Singleton: ensuring a single instance, Factory Method: object creation interface, Abstract Factory: related object families, Builder: step-by- step complex object creation.

### **UNIT -III**

**8 Hours**

**Structural Design Patterns:** Adapter and Decorator, Adapter: interface compatibility, Decorator: dynamic behavior extension, Composite and Proxy, Composite: tree-like structure, Proxy: controlling object access.

### **UNIT -IV**

**8 Hours**

**Behavioral Design Patterns:** Observer and Strategy, Observer: publish-subscribe systems, Strategy: interchangeable algorithms, Command and Template Method, Command: encapsulate requests, Template Method: algorithm skeleton

### **UNIT -V**

**8 Hours**

**Case Studies and Pattern Integration:** State and Chain of Responsibility, State: dynamic behavior changes. Chain of Responsibility: passing request chains, Pattern combination in real systems, Anti-patterns and refactoring using patterns.

### **Text Books**

1. Title: Design Patterns: Elements of Reusable Object-Oriented Software Authors: Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides Publisher: Addison-Wesley Professional
2. Design Patterns: Elements of Reusable Object-Oriented Software  
Authors: Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides (Gang of Four – GoF)

### **Reference book**

1. Head First Design Patterns Authors: Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra  
Publisher: O'Reilly Media, 2004 / 2020 (2nd Ed. covers modern Java and updated patterns)

**Web links and Video Lectures (e-Resources)**

- <https://youtu.be/4Dtv16aaNLQ?si=aaDLJtJHEX7xdGEy>
- <https://youtu.be/T9zbvi8eUW0?si=qCucZA4uFYsd-6Q8>

**Course Outcomes**

**On completion of this course, the students should be able to:**

**CO1: Understand** fundamental concepts and classifications of design patterns. (L1)

**CO2: Apply** creational patterns to construct flexible and reusable objects. (L2)

**CO3: Demonstrate** the use of structural patterns for building scalable architectures. (L3)

**CO4: Implement** behavioral patterns for effective communication among objects. (L3)

**CO5: Integrate** multiple design patterns into a real-world software solution. (L3)

**Mapping with Program Outcomes**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	-	-	-	-	-	-
CO2	3	-	2	-	-	-	-	-
CO3	-	-	2	2	-	-	-	3
CO4	3	3	3	-	3	-	-	-
CO5	3	2	3	-	3	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Object Oriented Analysis &amp; Design</b>			
Course Code	<b>P24MCAD311F</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the fundamental concepts of object-oriented software development.
- Apply object-oriented principles such as abstraction, encapsulation, inheritance, and polymorphism in designing software systems.
- Analyze and model real-world problems using object-oriented analysis techniques.
- Develop design solutions applying object-oriented design patterns and principles.
- Evaluate and refine object-oriented design to meet quality attributes and software architecture standards.

### UNIT – I

**8 Hours**

**Introduction to OOAD :** Evolution of software development methodologies, Introduction to Object-Oriented Software Development, Benefits and limitations of OOAD Comparison with Structured Analysis and Design, Key Concepts: Objects, Classes, Attributes, Methods, Messages, State, and Behaviour.

### UNIT – II

**8 Hours**

**Object-Oriented Principles:** Abstraction and Encapsulation, Inheritance and Generalization, Polymorphism and Dynamic Binding, Object Reuse and Reusability, Aggregation and Composition, Coupling and Cohesion in OO Design.

### UNIT – III

**8 Hours**

**Object-Oriented Analysis:** Gathering Requirements from the perspective of OO, Identifying Classes and Objects from problem statements, Responsibility Assignment, Identifying Relationships and Interactions, Class Responsibility Collaborator (CRC) Cards, Domain Modelling and Object Discovery.

### UNIT – IV

**Object-Oriented Design:** Principles of good OO Design (GRASP), Design for Change and Reuse, Applying Object Design Patterns (Factory, Singleton, Adapter, Strategy, Observer – Basic Understanding), Layered Architecture and Design Components, Design Metrics and Evaluation.

### UNIT – V

**8 Hours**

**Implementation and Case Studies:** Translating Design to Code – Best Practices, Testing in OO Systems: Unit Testing, Integration Testing, Common Pitfalls in OOAD, Case Study: University Course Management & Evaluation System, Healthcare Appointment & Prescription System

## Text Books

1. Grady Booch – Object Oriented Analysis and Design with Applications, Pearson Education.
2. Craig Larman – Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, Pearson.
3. .Ali Bahrami – Object Oriented Systems Development, Mc Graw Hill.
4. .James Rumbaugh, Michael Blaha – Object-Oriented Modeling and Design with UML, Pearson Education.
5. Grady Booch “Object-Oriented Analysis and Design with Applications”
6. Erich Gamma et al. – Design Patterns: Elements of Reusable Object-Oriented Software, Addison Wesley.

## Web links and Video Lectures (e-Resources)

- <https://refactoring.guru> – Design Patterns explained with examples
- [https://sourcemaking.com/design\\_patterns](https://sourcemaking.com/design_patterns) – Comprehensive guide to patterns
- <https://martinfowler.com> – Software design and architecture blogs
- <https://www.geeksforgeeks.org> – Object-oriented programming and design tutorials
- <https://www.tutorialspoint.com> – OOAD topics simplified

## Skill Development Activities Suggested

1. Mini project: Design an object-oriented system (e.g., Library Management, E-commerce).
2. Identify classes, responsibilities, and relationships in real-life applications.
3. Case study analysis of existing OO-based software.
4. Peer review of object-oriented design diagrams.
5. Write class diagrams and responsibility charts for a given use case

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Describe** fundamental concepts and principles of object-oriented software development. (L1)

**CO2: Identify** objects and classes from real-world problems and model them using OOA concepts. (L2)

**CO3: Apply** object-oriented principles in the design of software systems. (L3)

**CO4: Use** appropriate design patterns for building flexible and reusable systems. (L3, L4)

**CO5: Analyze** object-oriented solutions and apply best practices in coding and testing. (L4, L5)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	1	-	-	-	-	-
CO2	-	3	2	1	-	-	-	-
CO3	-	-	3	2	1	-	3	-
CO4	3	3	3	2	2	-	-	3
CO5	3	-	-	-	2	1	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Mobile Computing</b>			
Course Code	<b>P24MCAE311A</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Define concepts of wireless communication.
- Compare and contrast propagation methods, Channel models, capacity calculations multiple antennas and multiple user techniques used in mobile communication.
- Explain CDMA, GSM, Mobile IP, WiMAX and Different Mobile OS
- Illustrate various Markup Languages CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, and security concerns

### UNIT-I

**8 Hours**

**Mobile Computing Architecture:** Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing. Emerging Technologies: Wireless broadband (WiMAX), Mobile IP: Introduction, discovery, Registration, Tunneling, Cellular IP, Mobile IP with IPv6. Wireless Networks : Global Systems for Mobile Communication (GSM): GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, GSM Frequency allocation. Short Service Messages (SMS): Introduction to SMS, SMS Architecture, SMMT, SMMO, SMS as Information bearer, applications

### UNIT-II

**8 Hours**

**GPRS and Packet Data Network:** GPRS Network Architecture, GPRS Network Operations, Data Services in GPRS, Applications for GPRS, Billing and Charging in GPRS. Spread Spectrum technology, IS-95, CDMA versus GSM, Wireless Data, Third Generation Networks, Applications on 3G, Mobile Client: Moving beyond desktop, Mobile handset overview, Mobile phones and their features, PDA, Design Constraints in applications for handheld devices.

### UNIT-III

**8 Hours**

**Mobile OS and Computing Environment:** Smart Client Architecture, The Client: User Interface, Data Storage, Performance, Data Synchronization, Messaging. The Server: Data Synchronization, Enterprise Data Source, Messaging. Mobile Operating Systems: WinCE, Palm OS, Symbian OS, Linux, Proprietary OS Client Development: The development process, Need analysis phase, Design phase, Implementation and Testing phase, Deployment phase, Development Tools, Device Emulators

### UNIT-IV

**8 Hours**

**Building Wireless Internet Applications :** Thin client overview: Architecture, the client, Middleware, messaging Servers, Processing a Wireless request, Wireless Applications Protocol (WAP) Overview, Wireless Languages: Markup Languages, HDML, WML, 10 Hours HTML, cHTML, XHTML, VoiceXML.

## UNIT-V

8 Hours

**J2ME:** Introduction, CDC, CLDC, MIDP; Programming for CLDC, MIDlet model, Provisioning, MIDlet life- cycle, Creating new application, MIDlet event handling, GUI in MIDP, Low level GUI Components, Multimedia APIs; Communication in MIDP, Security Considerations in MIDP.

### Text Books

1. Ashok Talukder, Roopa Yavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. Martyn Mallik: Mobile and Wireless Design Essentials, Wiley India, 2003

### Reference Books

1. Raj kamal: Mobile Computing, Oxford University Press, 2007.
2. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

### Web links and Video Lectures (e-Resources)

- <https://youtu.be/GT-tYP8RGI?si=8fs7TgNVN8-ej-TU>
- <https://youtu.be/OxdUs9E8Aps?si=93ur91NnDVmtY5zS>
- [https://youtu.be/QWwLtCE\\_8cY?si=NIbSTijMEkcq7IgC](https://youtu.be/QWwLtCE_8cY?si=NIbSTijMEkcq7IgC)

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Explain** state of art techniques in wireless communication. (L1)

**CO2: Discover** CDMA, GSM. Mobile IP, Wimax. (L2)

**CO3: Demonstrate** program for CLDC, MIDP let model and security concerns. (L3)

**CO4: Building** Wireless Internet Applications. (L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	2	-
CO3	-	-	2	-	-	-	-	-
CO4	3	2	3	-	3	-	-	2
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Data Storage Technologies and Networks</b>			
Course Code	<b>P24MCAE311B</b>	CIE Marks	50
L: P: T	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Learn to apply storage resource management tools for efficient system monitoring and resource allocation.
- Learn performance optimization techniques to enhance storage system efficiency and reliability.
- Explore data encryption methods and access control strategies to secure sensitive information and ensure compliance.
- Explore emerging trends in storage, including software-defined storage, NVMe technology, and the CompTIA Storage+ certification.

### **UNIT – I**

#### **Fundamentals of Data Storage**

**8 Hours**

Direct Attached Storage (DAS), Network Attached Storage (NAS), Storage Area Networks (SAN), storage devices such as HDDs, SSDs, and tape drives, and RAID principles and configurations including various levels for data protection.

### **UNIT – II**

#### **Storage Area Networks (SAN)**

**8 Hours**

SAN architecture, Fibre Channel SAN, iSCSI SAN, SAN topologies, zoning, Host Bus Adapters (HBAs), switches, cabling, performance tuning, and troubleshooting strategies for SAN environments.

### **UNIT – III**

#### **Networked and Cloud Storage**

**8 Hours**

File- level storage systems with protocols such as NFS and SMB, object-based storage like S3, unified storage systems, cloud storage models including public, private, hybrid, and the integration of storage in virtualized environments.

### **UNIT – IV**

#### **Data Services and Optimization**

**8 Hours**

Data replication methods (local and remote), snapshot technologies, storage virtualization, deduplication, compression techniques, backup and recovery strategies, business continuity, and disaster recovery planning.

### **UNIT – V**

#### **Storage Management and Security**

**8 Hours**

Storage resource management tools, monitoring, performance tuning, data encryption, access control mechanisms, audit trails, emerging trends such as software-defined storage, NVMe, and CompTIA Storage.

## Text Books

1. "Introduction to Storage Area Networks" by Jon Tate
2. Cloud Computing Concepts, Technology & Architecture Thomas Erl, Zaigham Mahmood, and Ricardo Puttini

## Web links and Video Lectures (e-Resources)

- <https://www.geeksforgeeks.org/storage-area-networks/>
- [https://www.youtube.com/watch?v=HP3Z48VnZjk&pp=ygUzZGF0YSBzdG9yYWdlIHRIY2hub2xvZ2llcyBhbmQgbmV0d2\\_9ya3MgZnVsbCBjb3Vyc2Ug](https://www.youtube.com/watch?v=HP3Z48VnZjk&pp=ygUzZGF0YSBzdG9yYWdlIHRIY2hub2xvZ2llcyBhbmQgbmV0d2_9ya3MgZnVsbCBjb3Vyc2Ug)
- <https://youtu.be/4FJJGNnHOfc>

## Skill Development Activities Suggested

1. Hands-on Workshop: Setting Up a NAS (Network Attached Storage) System
2. Practical Task: Exploring Cloud Storage Services
3. Mini Project: RAID Configuration and Benchmarking
4. Case Study + Presentation: Modern Storage Technologies in Enterprise Networks

## Course Outcomes

On completion of this course, the students should be able to:

- CO1: Develop** the ability to explain the fundamentals of data storage technologies including DAS, NAS, SAN, HDDs, SSDs, tape drives, and RAID configurations. (L2)
- CO2: Demonstrate** the configuration and performance tuning of SAN components like Fibre Channel, iSCSI, zoning, HBAs, and switches. (L3)
- CO3: Demonstrate** the working of file-based and object-based storage (NFS, SMB, S3) and analyze their use in virtualized and cloud environments. (L3, L4)
- CO4: Design** data replication, backup, and disaster recovery strategies using snapshots, deduplication, and storage virtualization techniques. (L5)
- CO5: Demonstrate** the ability to apply encryption, access control, and monitoring tools while exploring emerging trends in storage technologies. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	-	-	3	-	-	-	-	-
CO3	3	-	3	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-
CO5	2	3	-	2	3	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Design and Operation of Data Centres</b>			
Course Code	<b>P24MCAE311C</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand the fundamental concepts of data centres, their types, and their roles in modern IT infrastructure.
- Learn the key components of a data centre, including servers, storage systems, networking, and power/cooling systems.
- Explain the importance of scalability, availability, and reliability in data centre design.
- Identify the industry standards and best practices for data centre design, including Uptime Institute classifications.
- Discuss the process of site selection, facility planning, and space optimization for efficient data centre operations.

### **UNIT – I**

**8 Hours**

**Overview of Data Centres: Architecture and Evolution:** Introduction to Data Centres, Evolution of Data Centres, Data Centre Architecture, Data Centre Design and Implementation, Types of Data Centres **On-Premises, Cloud, and Hybrid On-Premises Data Centres** : Cloud Data Centres, Benefits of Cloud Data Centres, Challenges and Risks, Comparing Data Centre Types

### **UNIT – II**

**8 Hours**

**Data Centre Network Architecture:** Introduction to Network Architecture in Data Centres, Data Centre Network Topologies, Network Virtualization in Data Centres, Redundancy and Fault Tolerance, Security in Data Centre Networks, Introduction to Power Systems in Data Centres, Disaster Recovery and Business Continuity

### **UNIT – III**

**8 Hours**

**Space Management and Physical Security:** Space Management in Data Centres, Physical Security in Data Centres, Security and Compliance Standards, Redundancy in Data Centres, Redundant Cooling Systems, Scalability in Data Centres, Fault Tolerance in Data Centres, High Availability Models.

### **UNIT – IV**

**8 Hours**

**Data Centre Operations and Management:** Introduction to Data Centre Monitoring, Types of Monitoring Systems, Management Protocols and Tools, Incident Management and Troubleshooting, Data Centre Energy Management, Introduction to Automation in Data Centres, Automation Tools and Platforms, Virtualization Technologies in Data Centres, Virtualization Management and Monitoring.

### **UNIT – V**

**8 Hours**

**Security Management in Data Centres:** Physical Security in Data Centres, Cybersecurity in Data Centres, Security Monitoring and Incident Response, Disaster Recovery Planning (DRP), Backup and Data Replication Strategies, Testing and Updating Disaster Recovery Plans.

## Text book

1. "Data Center Handbook" by **Hwaiyu Geng** (McGraw-Hill Professional, 2015)
2. Cloud Data Centers and Cost Modeling: A Complete Guide to Planning, Designing, and Building a Cloud Data Center" by Hwaiyu Geng

## Web links and Video Lectures (e-Resources):

- [https://youtu.be/wZzQBI628Hs?si=k3HAFHnalvDWF\\_Y4](https://youtu.be/wZzQBI628Hs?si=k3HAFHnalvDWF_Y4)
- <https://youtu.be/saQGWdOHfzM?si=1FRJoAbaclOdHooT>

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the fundamentals of data centre design, architecture and operations. (L1)

**CO2: Analyze** the various components involved in the infrastructure and environment of data centres. (L2)

**CO3: Explore** best practices and technologies for maintaining data centre operations, security and sustainability. (L3)

**CO4: Evaluate** network architecture, power and cooling mechanisms in data centres. (L3)

**CO5: Security Management in Data Centres.** (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-
CO3	-	-	3	-	2	2	-	-
CO4	3	3	3	-	-	-	-	-
CO5	-	-	-	-	3	-	2	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Wireless and Mobile Communication</b>			
Course Code	<b>P24MCAE311D</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- **Explain** the fundamentals of wireless communication systems, propagation models, and the evolution from 1G to 5G technologies.
- **Analyze** wireless channel characteristics and apply appropriate modulation techniques for efficient data transmission.
- **Evaluate** the design principles of cellular systems, including frequency reuse, handoff, and interference management.
- **Compare** the architecture and protocols of major mobile communication systems like GSM, CDMA, LTE, and 5G.
- **Design** wireless networks considering MAC protocols, mobility management, and routing mechanisms in dynamic environments.

### UNIT-I

**8 Hours**

**Introduction to Wireless Communication Systems:** Evolution of wireless communication: From 1G to 5G, characteristics of wireless communication vs. wired communication, Cellular networks (GSM, CDMA, LTE, 5G), Wireless LANs and PANs (Wi-Fi, Bluetooth, Zigbee), Satellite, Paging, and RFID systems, Basics of electromagnetic wave propagation, Propagation mechanisms, Types of propagation models, Empirical path loss models.

### UNIT -II

**8 Hours**

**Wireless Channel and Modulation:** Fading, Types of Fading, Multipath Effects, Statistical Channel Models, **Channel Impulse Response (CIR)**, Time and Frequency Selectivity, Overview of Modulation Schemes, Digital Modulation Techniques-BPSK,QPSK, Spread Spectrum Techniques- Frequency Hopping Spread Spectrum (FHSS), Direct Sequence Spread Spectrum (DSSS), Concept and relevance in LTE and 5G.

### UNIT -III

**8 Hours**

**Cellular System Design Fundamentals:** Introduction to cells, cell clustering, and hexagonal cell structure, Reuse of frequencies and frequency planning, Cell Splitting and Sectoring, Handoff Techniques, Hard handoff vs. soft handoff, Handoff in GSM and CDMA systems, Interference in Cellular Systems and its types.

### UNIT -IV

**8 Hours**

**GSM and CDMA Systems:** GSM System Architecture, Mobile Station, Base Station Subsystem, Network and Switching Subsystem, Base Transceiver Station (BTS), Mobile Switching Center (MSC), GSM Services- Bearer services, teleservices, and supplementary services, Basic Concepts of CDMA- Spread spectrum and orthogonality, Use of pseudo-random codes, CDMA System Architecture, Channel Structure in CDMA.

## UNIT -V

8 Hours

**Wireless Networks and Mobility Management:** WLAN, WLAN Architecture, MAC Layer Functionality, WLAN Frame Format and Types, Security in WLAN.PAN, Bluetooth protocol stack (L2CAP, RFCOMM), Piconets and Scatternets, Zigbee and Infrared, Mobility Management- Types of Mobility, Mobility Management Techniques, Challenges in Mobility Management, Routing in Mobile Networks, Mobile IP.

### Text Books

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education, 2023 (latest reprint).
2. "Wireless Communications" by Andrea Goldsmith, Publisher: Cambridge University Press

### Web links and Video Lectures (e-Resources):

- <https://youtu.be/8T7orRAQgic?si=ke1agkiLMSyPczLC>
- <https://youtu.be/PifOY5z3HI4?si=QE37fJygRAUHCDrb>

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** wireless communication systems and propagation models. (L1)

**CO2: Analyze** wireless channel characteristics and modulation techniques. (L2)

**CO3: Evaluate** cellular system design and interference management techniques. (L3)

**CO4: Compare** mobile communication systems (GSM, CDMA, LTE, 5G) and their features. (L3)

**CO5: Design** and analyze wireless networks and mobility management techniques. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	3	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	2	-	-
CO5	2	3	3	2	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Software Defined Networks</b>			
Course Code	<b>P24MCAE311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Apply the fundamentals of Software Defined Networks for the given problem
- Illustrate the basics of Software Defined Networks Operations and Data flow
- Apply different Software Defined Network Operations and Data Flow
- Analyse alternative definitions of Software Defined Networks
- Apply different Software Defined Network Operations in real world problem

### **UNIT-I**

**8 Hours**

**Introduction to SDN** :Understanding the SDN, Understanding the SDN technology, Control Plane, Data Plane, Moving information between planes, separation of the control and data planes, Distributed control planes, Load Balancing, Creating the MPLS Overlay, Centralized control planes.

### **UNIT -II**

**8 Hours**

**Working of SDN**: Evaluation of Switches and Control planes, SDN Implications, Data centre Needs, Forerunner of SDN, Software Defines Networks is Born, Sustain SDN interoperability, Open source contribution, Fundamental Characteristics of SDN, SDN Operations, SDN Devices, SDN Controllers, SDN Applications, Alternate SDN methods.

### **UNIT -III**

**8 Hours**

**The Open Flow Specifications**:Open Flow Overview, Open Flow Basics, Open Flow 1.0 additions, Open Flow 1.1 additions, Open Flow 1.2 additions, Open Flow 1.3 additions, Open Flow limitations.

### **UNIT -IV**

**8 Hours**

SDN via APIS, SDN via Hypervisor-Based Overlays, SDN via Opening up the device, Network function virtualization, Alternative Overlap and Ranking.

### **UNIT -V**

**8 Hours**

**Data centres**: definition, Data centres demand, tunnelling technologies for Data centres Path technologies in data centres, Ethernet fabrics in Data centres, SDN use case in Data centres.

### **Text Books**

1. Software Defined Networking by Thomas D Nadeau and Ken Gray.
2. Software Define Networks, A Comprehensive Approach, Paul Goransson, Chuck Black. MK Publications.

## Reference Book

1. Software Defined Networking for Dummies brought you by cisco, Brian Underdahl and Gary Kinghorn.

## Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/watch?v=nUN40N91fJ4&list=PLJ6vZHpRUoJNn-3F918wKpAtr6gGUOixc>
- <https://youtu.be/WdTHHXOI8kg?si=3TjSR6p954i3Fm98>
- [https://youtu.be/\\_961s5WGkok?si=Zj6ejHH5SEQVk3TN](https://youtu.be/_961s5WGkok?si=Zj6ejHH5SEQVk3TN)

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Apply** the fundamentals of Software Defined Networks for the given problem.(L1)

**CO2: Illustrate** the basics of Software Defined Networks Operations and Data flow. (L2)

**CO3: Apply** different Software Defined Network Operations and Data Flow. (L3)

**CO4: Analyse** alternative definitions of Software Defined Networks. (L3)

**CO5: Apply** different Software Defined Network Operations in real world problem. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-
CO3	-	-	3	-	3	-	3	-
CO4	3	2	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

Cloud Computing			
Course Code	<b>P24MCAE311F</b>	CIE Marks	50
L: T: P	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Explain the fundamentals of cloud computing
- Illustrate the cloud application programming and aneka platform
- Contrast different cloud platforms used in industry

### UNIT-I

**8 Hours**

**Introduction to Cloud Computing:** Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing.

### UNIT -II

**8 Hours**

**Architectures for parallel and distributed computing:** Parallel Vs Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed

### UNIT -III

**8 Hours**

**Virtualization:** Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Tec hnology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.

### UNIT -IV

**8 Hours**

**Cloud computing architecture:** Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.

### UNIT -V

**8 Hours**

**Cloud Platforms in Industry :** Amazon web services; Google AppEngine; Microsoft Azure; Cloud Applications. Scientific applications: Healthcare; Biology; Geo-Science, Business and Consumer applications: ARM & ERP; Productivity; Social networking.

### Text Books

1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013

## Reference Books

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M. Kanfman, F.Halper (Wiley India Edition)
2. Cloud Computing: A Practical Approach by J.Vette, Toby J. Vette, Robert Elsenpeter (Tata McGraw Hill).

## Web links and Video Lectures (e-Resources)

- <https://youtu.be/dmGybCohHsw?si=9idoJWu5C8GI2Lr6>
- <https://youtu.be/2LaAJq11B1Q?si=Hi4UWAJOw1fML0YV>
- <https://youtu.be/RmuVkB3siYY?si=MT6IqmW8p3PytQGF>

## Skill Development Activities Suggested

Skill Development Activity the students with the help of the course teacher can take up relevant technical – activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the fundamental and core concepts of cloud computing. (L1)

**CO2: Compare** between parallel and distributed computing. (L2)

**CO3: Investigate** the system virtualization and outline its role in enabling the cloud computing system model. (L3)

**CO4: Compare** different deployment and service models of cloud to develop different variety of Applications. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	2	-	-	2	-	-	2	-
CO3	-	-	-	-	3	-	-	-
CO4	2	3	3	-	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Introduction to Generative AI</b>			
Course Code	<b>P24MCAF311A</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives:**

- Understand the Fundamentals of Generative AI
- Master in Core Generative AI Models: GANs, VAEs, and Diffusion Models
- Develop Practical Skills in Generative AI Using Popular Frameworks
- Explore the Ethical Implications and Social Impact of Generative AI
- Apply Generative AI to Real-World Applications

### **UNIT-I**

**8 Hours**

Introduction to AI and Machine Learning-Types of Generative Models (e.g., LLM, SLM, GANs, VAEs, Autoregressive Models)- Neural Networks: Basic Architecture, Back propagation, Activation Functions-Deep Learning Basics and its Applications-Unsupervised vs. Supervised Learning

### **UNIT-II**

**8 Hours**

Introduction to Generative Adversarial Networks (GANs) and Variational Autoencoders (VAEs)- Understanding the Generator-Discriminator Architecture in GANs-Latent Space Representation and Loss Functions-Training Strategies, Optimization, and Hyperparameter Tuning- Applications and Case Studies in Image, Video, and Text Generation-Diffusion Models and their Use in Modern AI Art Generation

### **UNIT-III**

**8 Hours**

Introduction to TensorFlow and PyTorch for Generative AI Building GANs and VAEs from Scratch Hands-on Projects: Generating Images, Music, and Text - Model Evaluation Techniques (FID Score, Inception Score, BLEU Score) - Fine-tuning Pretrained Models for Specialized Applications

### **UNIT-IV**

**8 Hours**

Ethical Challenges in AI: Bias, Fairness, and Accountability- Deepfakes and Synthetic Media: Risks and Regulations - AI in Content Creation: Copyright, Ownership, and Creativity - Data Privacy in Generative AI Systems - Bias and Fairness in Training Data: Identifying and Mitigating

### **UNIT-V**

**8 Hours**

AI in Digital Art and Content Creation - Music Generation Using Neural Networks - Healthcare Applications: Drug Discovery and Medical Imaging - Natural Language Generation (NLG) and Chatbots - Case Studies: Generative AI in Gaming, Fashion, and Virtual Reality

## Text Books

1. Gohil P. (2019). Machine learning with Tensor Flow. BPB Publications.
2. Akerkar R. (2020). Deep learning: A practitioner's approach. Springer.
3. Arora R. (2021). Artificial intelligence: A guide for thinking humans. Wiley India Pvt. Ltd.
4. Schwab K. (2017). The fourth industrial revolution (Indian edition). Penguin Random House India.

## Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/watch?v=rwF-X5STYks>
- <https://www.youtube.com/watch?v=6aZiboOfYRA>
- <https://www.youtube.com/shorts/W5nwke7iw8c>
- <https://www.youtube.com/watch?v=t64TZ5S-IeY>
- <https://www.youtube.com/watch?v=Hv4oyBthags>

## Skill Development Activities Suggested

### AI-Generated Art and Creativity

- **Objective:** Encourage creativity using generative models.
- **Task:** Have students use AI models like StyleGAN or DeepDream to generate unique pieces of art. Encourage them to experiment with the style transfer and image manipulation capabilities of these models.
- **Outcome:** Students will explore the intersection of AI and creativity, understanding how generative AI can be used in the arts.

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the Fundamentals concepts of Generative AI. (L2)

**CO2: Identify** the performance of generative models using metrics.(L2)

**CO3: Analyze** the ethical implications of generative AI. (L4)

**CO4: Apply** algorithms to build and train generative models using frameworks. (L3)

**CO5: Compare** the performance of various generative AI architectures. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	-	-	-
CO2	3	-	-	3	3	-	-	-
CO3	-	2	-	3	-	-	3	3
CO4	3	-	3	-	2	-	-	3
CO5	-	-	-	-	2	1	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Artificial Neural Networks</b>			
Course Code	<b>P24MCAF311B</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand the Fundamentals of Artificial Neural Networks
- Learn the Training Process of Neural Networks
- Explore Different Neural Network Architectures
- Implement Neural Networks Using Frameworks
- Understand Practical Applications and Limitations of Neural Networks

#### **UNIT-I**

**8 Hours**

Overview of Artificial Intelligence and Machine Learning - What are Neural Networks? Introduction to Neurons and Perceptrons - Structure of an ANN: Layers (Input, Hidden, Output) - Activation Functions: Sigmoid, ReLU, Tanh - Introduction to Feedforward Networks

#### **UNIT-II**

**8 Hours**

Forward Propagation and Loss Functions - Introduction to Gradient Descent and Backpropagation Learning Rate and Optimization Algorithms (e.g., Stochastic Gradient Descent, Adam) - Overfitting and Regularization Techniques (e.g., Dropout, L2 regularization) - Introduction to Epochs and Batch Processing

#### **UNIT-III**

**8 Hours**

Single-Layer vs. Multi-Layer Perceptrons (MLPs) - Convolutional Neural Networks (CNNs) for image processing - Recurrent Neural Networks (RNNs) for sequence data - Autoencoders and their applications - Introduction to Transfer Learning

#### **UNIT-IV**

**8 Hours**

Introduction to TensorFlow and PyTorch- Implementing a Simple Neural Network with PyTorch/TensorFlow - Data Preprocessing and Loading Datasets - Training, Testing, and Evaluating Models - Hyperparameter Tuning and Model Optimization

#### **UNIT-V**

**8 Hours**

Applications of Neural Networks in Image Recognition, Natural Language Processing, and Time Series Prediction-Neural Networks for Classification vs. Regression-Common Pitfalls in Neural Network Training-Ethical Considerations and Model Interpretability-Future Trends in Neural Networks and Deep Learning

## Text Books

1. Deepa, S. N. (2020). Artificial Neural Networks: A Practical Approach. Wiley India Pvt. Ltd.
2. Patel, M., & Patel, A. (2019). Artificial Neural Networks: Applications and Implementations. BPB Publications
3. Gupta, S. K. (2017). Introduction to Neural Networks using MATLAB 6.0. Tata McGraw-Hill Education

## Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/watch?v=jmmW0F0biz0>
- <https://www.youtube.com/watch?v=mlk0rddP3L4>
- <https://www.youtube.com/watch?v=oJNHXP0XDk>
- [https://www.youtube.com/watch?v=Wo5dMEP\\_BbI&list=PLQVvva0QuDcjD5BAw2DxE6OF2tius3V3](https://www.youtube.com/watch?v=Wo5dMEP_BbI&list=PLQVvva0QuDcjD5BAw2DxE6OF2tius3V3)
- <https://www.youtube.com/watch?v=rEDzUT3ymw4>

## Skill Development Activities Suggested

- The students will implement a simple Feedforward Neural Network (FNN) to classify the MNIST dataset (handwritten digits) using TensorFlow or PyTorch.
- The task will involve loading the dataset, pre-processing the data, defining the neural network architecture, training the model, and evaluating its performance.

## Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the principles of Neural Networks. (L2)

**CO2: Analyze** the feed-forward neural networks. (L4)

**CO3: Identify** different types of models of neural networks. (L3)

**CO4: Implement** ANN using frameworks. (L4)

**CO5: Compare** different applications of artificial neural networks. (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-
CO3	-	3	-	-	-	-	-	3
CO4	-	2	-	3	-	-	-	-
CO5	-	2	-	-	-	3	2	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Natural Language Processing</b>			
Course Code	<b>P24MCAF311C</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

### Course Learning objectives

- Understand the Fundamentals of Natural Language Processing
- Learn Text Pre-processing Techniques
- Implement Basic NLP Models
- Explore Word Embeddings and Advanced NLP Models
- Understand NLP Applications and Real-World Use Cases

#### UNIT-I

**8 Hours**

Introduction to NLP: Definition and scope - Basic Linguistic Concepts: Syntax, Semantics, and Pragmatics - Language Models: Unigram, Bigram, and N-grams - Overview of NLP Tasks: Text classification, Named Entity Recognition (NER), Sentiment Analysis, etc. - Key Applications of NLP: Machine Translation, Speech Recognition, Chatbots

#### UNIT-II

**8 Hours**

Text Cleaning: Removing special characters, punctuation, stop words, and irrelevant data - Tokenization: Word- level and sentence- level tokenization - Stemming and Lemmatization: Understanding and applying common text normalization techniques - Text Vectorization: Bag-of- Words (BoW), TF-IDF, Word Embeddings (Word2Vec, GloVe) - Part-of-Speech (POS) Tagging: Introduction to syntactic categories

#### UNIT-III

**8 Hours**

Introduction to Machine Learning for NLP: Supervised vs. Unsupervised Learning - Building a Text Classification Model: Naive Bayes, Logistic Regression, and SVM for text classification - Sentiment Analysis: Using basic machine learning models for sentiment classification - Introduction to Deep Learning for NLP: Feedforward Neural Networks for text - Evaluating NLP Models: Accuracy, Precision, Recall, and F1-score

#### UNIT-IV

**8 Hours**

Word Embeddings: Introduction to Word2Vec and GloVe - Semantic Analysis: Understanding word similarity, cosine similarity, and vector-based word representations - Neural Networks for NLP: Simple architectures like RNNs and LSTMs -Introduction to Transformer Models: Basic understanding of BERT and GPT - Language Representation Models and Fine-tuning

#### UNIT-V

**8 Hours**

Named Entity Recognition (NER): Techniques for identifying entities in text-Text Summarization: Extractive vs. Abstractive Summarization-Machine Translation: Introduction to rule-based, statistical, and neural machine translation systems-Chatbots and Conversational AI: Building simple conversational agents using NLP-Ethical Considerations: Bias in NLP models and ethical implications of NLP applications.

## Text Books

1. Kumar, V., & Dey, L. (2019). Introduction to Natural Language Processing. Wiley India Pvt. Ltd..
2. Sahani, M., & Dey, L. (2021). Natural Language Processing: Techniques and Applications. McGraw-Hill Education.
3. Rai, M. (2019). Foundations of Natural Language Processing. Oxford University Press.
4. Prasad, R., & Rani, N. (2020). Natural Language Processing with Python: A Practical Guide. BPB Publications

## Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/watch?v=aeOLjFe256E&list=PLD392E2ACAEF0C689>
- <https://www.youtube.com/watch?v=zG8AJhVy5NY&list=PLD392E2ACAEF0C689&index=2>
- <https://www.youtube.com/watch?v=dBEpW4h2Gig&list=PLD392E2ACAEF0C689&index=6>
- <https://www.youtube.com/watch?v=kfssS6bD5FQ&list=PLD392E2ACAEF0C689&index=7>
- <https://www.youtube.com/watch?v=iWbkjwe-xag&list=PLD392E2ACAEF0C689&index=12>

## Skill Development Activities Suggested

Students will use Python and scikit-learn (or another machine learning library) to implement a text classification model. The task involves preprocessing text data, feature extraction using TF-IDF, training a machine learning model, and evaluating its performance.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the basic concepts of Natural Language Processing. (L2)

**CO2: Apply** text pre-processing techniques. (L3)

**CO3: Apply** Machine Learning Algorithms to NLP Tasks. (L3)

**CO4: Implement** and train word embedding models (Word2Vec, GloVe) on text corpora. (L4)

**CO5: Analyze** the ethical considerations in NLP applications. (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-
CO3	2	-	-	3	2	-	-	-
CO4	2	-	-	3	3	-	-	-
CO5	1	1	-	-	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Deep Learning Fundamentals</b>			
Course Code	<b>P24MCAF311D</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the fundamentals of deep learning
- Understanding the working of Convolutional Neural Networks and RNN in decision making.
- Illustrate the strength and weaknesses of many popular deep learning approaches.
- Introduce major deep learning algorithms, the problem settings, and their applications to solve real world problems

### UNIT-I

**8 Hours**

**Introduction:** What is a Neural Network? The Human Brain, Models of a Neuron, Neural Networks Viewed As Directed Graphs, Feedback, Network Architectures

**Rosenblatt's Perceptron:** Introduction, Perceptron, The Perceptron Convergence Theorem, Relation Between the Perceptron and Bayes Classifier for a Gaussian Environment.

**Textbook 1: Introduction: (1- 6), Ch 1: (1.1 - 1.4)**

### UNIT-II

**8 Hours**

**Multilayer Perceptrons:** Introduction, Some Preliminaries, Batch Learning and On-Line Learning, The Back- Propagation Algorithm, XOR Problem, Heuristics for Making the Back- Propagation Algorithm Perform Better, Computer Experiment: Pattern Classification, Back Propagation and Differentiation.

**Textbook 1: Ch 4: (4.1- 4.8)**

### UNIT-III

**8 Hours**

**Regularization for Deep Learning:** Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under Constrained Problem, Dataset Augmentation, Semi-Supervised Learning.

**Optimization for Training Deep Models:** How Learning Differs from pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rate.

**Textbook 2: Ch 7: (7.1 – 7.6), Ch 8: (8.1 – 8.5)**

### UNIT-IV

**8 Hours**

**Convolution Networks:** The Convolution Operation, Motivation, Pooling, Convolution and Pooling as an Infinitely Strong Prior, Variants of the Basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, The Neuroscientific Basic for Convolutional Network, Convolutional Networks and the History of Deep Learning .

**Textbook 2: Ch 9: (9.1 – 9.11)**

## UNIT-V

8 Hours

**Sequence Modeling: Recurrent and Recursive Nets:** Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, The Long Short-Term Memory and Other Gated RNNs.

**Textbook 2: Ch 10: (10.1-10.6, 10.10)**

### Text books

1. Simon Haykin, Neural networks and Learning Machines, Third Edition, Pearson, 2016
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

### Reference books

1. Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning, 2009
2. N.D. Lewis, "Deep Learning Made Easy with R: A Gentle Introduction for Data Science", January 2016
3. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly publications

### Web links and Video Lectures (e-Resources)

- [https://www.deeplearningbook.org/lecture\\_slides.html](https://www.deeplearningbook.org/lecture_slides.html)
- <https://www.youtube.com/watch?v=VyWAvY2CF9c>
- <https://www.youtube.com/watch?v=7sB052Pz0sQ>
- [https://www.youtube.com/watch?v=Mubj\\_fqiAv8](https://www.youtube.com/watch?v=Mubj_fqiAv8)
- <https://www.coursera.org/learn/neural-networks-deep-learning>
- [https://onlinecourses.nptel.ac.in/noc20\\_cs62/preview](https://onlinecourses.nptel.ac.in/noc20_cs62/preview)

### Skill Development Activities Suggested

- Mini projects (2 to 4 students) using Deep Learning concepts

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the basic concepts of neural networks and deep learning. (L2)

**CO2: Apply** multilayer perceptrons and backpropagation algorithms to solve classification problems. (L3)

**CO3: Analyze** optimization methods and regularization techniques used in training deep models. (L4)

**CO4: Design** and Evaluate convolutional neural networks for image and pattern recognition tasks. (L5, L6)

**CO5: Implement** recurrent models such as RNNs and LSTMs for sequential data tasks. (L6)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2						2
CO2	3	3	2	2				
CO3	3	3	3	2				
CO4	2	3	3	3	3	1	1	3
CO5	2	3	3	3	2	1	1	2
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Introduction to Machine Learning</b>			
Course Code	<b>P24MCAF311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To understand the basic theory underlying machine learning, types, and the process.
- To become familiar with data and visualize univariate, bivariate, and multivariate data using statistical techniques and dimensionality reduction.
- To understand various machine learning algorithms such as similarity -based learning, regression, decision trees.
- To familiarize with learning theories, probability-based models, and reinforcement learning, developing the skills required for decision-making in dynamic environments.

### UNIT – I

**8 Hours**

**Introduction to Machine Learning:** Need for Machine Learning, Machine Learning Explained, Machine Learning in Relation to Other Fields, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Machine Learning Application.

**Understanding Data:** Introduction, Big Data Analytics and Types of Analytics, Big Data Analysis Framework, Descriptive Statistics, Univariate Data Analysis and Visualization, Bivariate Data and Multivariate Data.

**Textbook 1:** Ch 1, 1.1-1.7, Ch 2, 2.1 -2.6

### UNIT – II

**8 Hours**

**Understanding Data:** Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques.

**Basics of Learning Theory:** Introduction to Learning and its Types, Introduction to Computation Learning Theory, Design of a Learning System, Introduction to Concept Learning, Induction Biases, Modelling in Machine Learning.

**Textbook 1:** Ch 2, 2.7-2.10, Ch 3 3.1 – 3.6

### UNIT – III

**8 Hours**

**Similarity-based Learning:** Introduction to Similarity or Instance-based Learning, Nearest-Neighbor Learning, Weighted K-Nearest-Neighbor Algorithm, Nearest Centroid Classifier, Locally Weighted Regression (LWR).

**Regression Analysis:** Introduction to Regression, Introduction to Linearity, Correlation, and Causation, Introduction to Linear Regression, Validation of Regression Methods, Multiple Linear Regression, Polynomial Regression, Logistic Regression.

**Textbook 1:** Ch 4, 4.1 – 4.5, Ch 5, 5.1 – 5.7

## UNIT – IV

8 Hours

**Decision Trees Learning:** Introduction to Decision Tree Learning model, Decision Tree Induction Algorithms, Validating and Pruning of Decision Trees.

**Bayesian Learning:** Introduction to Probability-based Learning, Fundamentals of Bayes Theorem, Classification Using Bayes Model.

**Textbook 1:** Ch 6, 6.1 – 6.3, Ch 8, 8.1 – 8.3

## UNIT – V

8 Hours

**Artificial Neural Networks:** Introduction, Biological Neurons, Artificial Neurons, Perceptron and Learning Theory, Types of Artificial Neural Network.

**Reinforcement Learning:** Overview and Scope of Reinforcement Learning, Components of Reinforcement Learning, Q-Learning.

**Textbook 1:** Ch 10, 10.1-10.5, Ch 14, (14.1, 14.2, 14.4, 14.9)

### Text Books

1. S Sridhar and M Vijayalakshmi, “Machine Learning”, Oxford University Press, 2021.
2. M N Murty and Ananthanarayana V S, “Machine Learning: Theory and Practice”, Universities Press (India) Pvt. Limited, 2024

### Reference Books

1. Tom M. Mitchell, “Machine Learning,” McGraw-Hill Education, 2013.
2. Miroslav Kubat, “An Introduction to Machine Learning,” Springer, 2017.

### Web links and Video Lectures (e-Resources):

- <https://www.universitiespress.com/resources?id=9789393330697>
- [https://onlinecourses.nptel.ac.in/noc23\\_cs18/preview](https://onlinecourses.nptel.ac.in/noc23_cs18/preview)
- <https://www.geeksforgeeks.org/machine-learning/>
- [https://www.w3schools.com/python/python\\_ml\\_getting\\_started.asp](https://www.w3schools.com/python/python_ml_getting_started.asp)
- [https://www.tutorialspoint.com/machine\\_learning/index.html](https://www.tutorialspoint.com/machine_learning/index.html)

### Skill Development Activities Suggested

- Course project by taking suitable machine learning-based real-world application problem

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** ML Fundamentals. (L2)

**CO2: Applying** ML Algorithms. (L3)

**CO3: Models** Evaluation and Optimization. (L3)

**CO4: Practical** Implementation and Problem – Solving. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	2
CO3	-	-	-	-	-	-	-	3
CO4	-	-	2	-	-	-	-	2
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Computer Vision</b>			
Course Code	<b>P24MCAF311F</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand the Fundamentals of Computer Vision
- Implement Feature Extraction and Object Recognition
- Analyze Motion and Video Processing Techniques and Apply Deep Learning in Computer Vision

### UNIT –I

**8 Hours**

**Introduction to Computer Vision and Image Representation:** Basics of Computer Vision and its applications, Digital images: Pixels, resolution, and color models, Image formation and perception Visualizing pixel intensity distributions, Working with pixel-based operations, Introduction to video processing

### UNIT –II

**8 Hours**

**Feature Detection and Image Processing Techniques:** Edge detection techniques (Sobel, Canny) Line and corner detection, Gaussian kernels and filters, Delaunay mesh segmentation,

### UNIT –III

**8 Hours**

**Shape and Object Recognition:** Contour detection and shape analysis, Feature extraction Methods Maximal nucleus clusters and Lower key points, Image segmentation techniques, Introduction to object tracking in videos

### UNIT –IV

**8 Hours**

**Computational Geometry and Machine Vision:** Concepts of computational topology in Vision Linear filtering and transformations, Spatial relationships and image transformations, Use of graphs and meshes in object representation, Real-time and offline video analysis

### UNIT –V

**8 Hours**

**Advanced Topics and Applications:** Deep learning for computer vision (basics) ,Convolutional Neural Networks (CNNs) overview, Applications in biometrics, medical imaging, and robotics . Future trends in computer vision , Case studies and project discussions

### Text Books

1. Peters, J. F. (2017). Foundations of computer vision: Computational geometry, visual image structures, and object shape detection. Springer International Publishing
2. Szeliski, R. (2022). Computer vision: Algorithms and applications (2nd ed.). Springer.
3. Forsyth, D. A., & Ponce, J. (2011). Computer vision: A modern approach (2nd ed.). Pearson.

### Web links and Video Lectures (e-Resources)

- <https://www.youtube.com/channel/UCf0WB91t8Ky6AuYcQV0CcLw>
- <https://www.youtube.com/watch?v=2w8XIskzdFw>
- <https://16385.courses.cs.cmu.edu/spring2021/lectures>

### Skill Development Activities Suggested

- Implementing Basic Image Processing Techniques: Activity: Perform image transformations like grayscale conversion, blurring, edge detection (Sobel, Canny), and thresholding using OpenCV.
- Feature Detection and Key point Matching: Activity: Implement SIFT, SURF, and ORB algorithms to detect features in images and match them between two scenes.

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understanding** Image Processing Fundamentals. (L2)

**CO2: Apply** Feature Extraction and Object Recognition techniques. (L3)

**CO3: Understand** Motion Analysis and Video Processing methods. (L2)

**CO4: Implement** deep learning models like CNNs for image classification and segmentation. (L3)

**CO5: Evaluate** the performance of different computer vision techniques for practical applications. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	3	-	-	3	3	-	-	-
CO4	3	-	-	3	-	-	-	3
CO5	-	3	-	-	-	-	-	2

**3-Strong; 2-Medium; 1-Low**

<b>Data Management for IOT</b>			
Course Code	<b>P24MCAG311A</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3

### **Course Learning objectives**

- Explain the fundamental concepts, architecture, and communication protocols of IoT, including smart devices, RFID, and wireless sensor networks.
- Analyze IoT network connectivity, data exchange formats, and web integration techniques for efficient IoT communication.
- Apply data acquisition, storage, cloud computing, and analytics techniques to manage IoT data effectively.
- Evaluate IoT security challenges, privacy concerns, and identity management strategies to ensure data protection.
- Develop IoT prototypes, integrate IoT gateways, and analyze business models for real-world applications and Industry 4.0.

### **UNIT-1**

**8 hours**

**Introduction to IoT and System Architecture:** Vision and Definitions of IoT, Smart Hyperconnected Devices and IoT Applications, IoT Conceptual Framework and Architectural Views, IoT Communication Protocols: MQTT, CoAP, XMPP, Sources of IoT Data: RFID, Wireless Sensor Networks, Wearable Technologies, Smart Homes, Smart Cities

### **UNIT-2**

**8 hours**

**IoT Connectivity, Communication, and Web Integration :** IoT Network and Connectivity Principles: IPv4, IPv6, 6LoWPAN, TCP/IP, IP Addressing, MAC Addressing, IETF Six-Layer Design for IoT, Communication Protocols: HTTP, HTTPS, FTP, Telnet, Web Connectivity & Data Exchange: JSON, MIME, TLV Data Formats, REST, SOAP, Web Sockets, MQTT

### **UNIT -3**

**8 hours**

**IoT Data Management and Analytics (8 hours):** Data Acquisition and Storage: Data Validation, Events Assembly, Data Store Processes, SQL vs NoSQL Databases, Spatial & Time-Series Databases, Cloud Data Processing for IoT: SaaS, IaaS, PaaS, DaaS, XaaS Models, Cloud Platforms (AWS IoT, TCS Connected Universe), Cloud-Based Data Storage & Computing, IoT Data Analytics: Descriptive, Real-time, Predictive Analytics, Business Intelligence & Big Data for IoT

### **UNIT -4**

**8 hours**

**IoT Security, Privacy, and Threat Management (8 hours):** IoT Security Challenges: Vulnerabilities & Threat Analysis, Identity Establishment & Access Control, IoT Security Architecture: Layered Attacker Models, IoT Security Tomography, Data Privacy Considerations: Use Cases and Misuse Cases, Blockchain for IoT Security.

### **UNIT -5**

**8 hours**

**IoT Prototyping, Applications, and Business Models (8 hours):** Prototyping IoT Devices and Embedded Systems: Arduino, Intel Galileo, Raspberry Pi, BeagleBone, mBed, IoT Gateway Development & API Integration, IoT in Industrial Applications (Industry 4.0): Connected Vehicles (Tesla Example), Smart Cities, Smart Agriculture, Smart Production, Business Models & IoT Innovation: Value Creation using IoT, IoT-driven Business Strategies

## Text Books

1. "Internet of Things: Principles and Paradigms" – Rajkumar Buyya & Amir Vahid Dastjerdi  
Covers IoT architecture, communication protocols, cloud integration, and security concepts.
2. "Internet of Things: A Hands-on Approach" – Arshdeep Bahga & Vijay Madisetti  
Practical guide with IoT prototyping using Raspberry Pi, Arduino, and cloud platforms
3. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, and Transform Your Industry" – Maciej Kranz
4. "Data Management for the Internet of Things" – C. Müller, S. Karnouskos
5. "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" – David Hanes, Gonzalo Salgueiro, Patrick Grossetete

## Web links and Video Lectures (e-Resources)

IoT Fundamentals & Architecture – Cisco Networking Academy: Introduction to IoT

IoT Communication Protocols – MQTT Essentials by HiveMQ

IoT Security & Privacy – [NIST Guidelines for IoT Security](#)

IoT Data Management & Analytics – Google Cloud IoT Documentation

IoT Business Models & Applications – IBM IoT Solutions

## Skill Development Activities Suggested

- **IoT Architecture & Communication** – Experiment with RFID, wireless sensor networks, and MQTT. Simulate network protocols (IPv4, IPv6, TCP/IP, CoAP) using tools like Cisco Packet Tracer.
- **IoT Data Management & Cloud Integration** – Work with SQL/NoSQL databases (MongoDB, Firebase), use cloud platforms (AWS IoT, Google Cloud IoT) for data storage, and analyze IoT data using Python and visualization tools.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the fundamental concepts, architectures, communication protocols, and data sources of IoT, including smart devices, RFID, and wireless sensor networks. (L2)

**CO2: Analyse** IoT network architectures, communication protocols, data exchange formats, and web integration techniques for seamless IoT connectivity. (L4)

**CO3: Apply** data acquisition, storage, cloud computing, and analytics techniques to process and manage IoT data effectively. (L3)

**CO4: Evaluate** IoT security challenges, privacy concerns, identity management, and emerging security frameworks for safeguarding IoT data. (L5)

**CO5: Develop** IoT prototypes, integrate IoT gateways and APIs, and analyse real-world applications and business models for IoT innovation. (L6)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	2	-	-	-
CO2	3	-	-	-	-	-	-	-
CO3	-	-	3	3	3	-	2	-
CO4	3	3	-	-	-	-	2	3
CO5	-	-	3	-	-	-	3	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Networked Embedded Applications</b>			
Course Code	<b>P24MCAG311B</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- To expose the students to the fundamentals of wired embedded networking techniques.
- To introduce the concepts of embedded ethernet.
- To expose the students to the fundamentals of wireless embedded networking.
- To discuss the fundamental building blocks of digital instrumentation.
- To introduce design of Programmable measurement & control of electrical Device.

### **UNIT-I**

**8 Hours**

#### **Network Embedded Systems: An Introduction**

Networked Embedded Systems: Networking of Embedded Systems- Automotive Networked Embedded Systems Networks-Embedded Systems in Industrial Automation- Wireless Sensor Networks- Networked Embedded Systems in Building Automation – Middleware Design and Implementation for Networked Embedded Systems- Introduction- Middleware Solution Space ORB Middleware for Networked Embedded Systems.

**Textbook 1: Ch. 1,2**

### **UNIT -II**

**8 Hours**

#### **Wireless Sensor Networks**

Introduction To WSNS- Architecture for WSNS- Localization & Synchronization for WSN- Time Sync Issues & Resource Aware Localization.

**Textbook 1: Ch. 3, 4, 5, 6**

### **UNIT -III**

**8 Hours**

#### **Energy-Efficient Mac Protocols For Wsn**

Design Issues for MAC Protocols for WSNs, Overview on Energy-Efficient MAC Protocols for WSNs, Mobility Support in WSNs, Multichannel Protocols for WSNs, Summary and Open Issues.

**Textbook 1: Ch. 8**

### **UNIT -IV**

**8 Hours**

#### **Automotive Networked Embedded Systems**

Trends in Automotive Communication Systems, Time –Triggered Communication, Flex Ray Communications, Lin Standards.

**Textbook 1: Ch. 13, 14, 16, 17**

### **UNIT -V**

**8 Hours**

#### **Industrial Automation**

Introduction To Industrial Automation, Fieldbus Bus – What Is a Fieldbus, Communication Fundamental, The OSI Model Fieldbus Characteristics, Networking Networks, Interconnection in Heterogeneous Environments, Industrial Ethernet, The New Fieldbus, Real-Time Ethernet-Home Automation Home Automation- Introduction-Structure of the IEC Standardization, Real-Time Requirements, Practical Realizations.

**Textbook 1: Ch. 20**

## Text Books

1. R.Zurawski, Network Embedded Systems, Crc Press, 2009.
2. G.Pottie, W.Kaiser, Principles of Embedded Networked System Design
3. Raj Kamal, Embedded Systems, Tata McGraw Hill, New Delhi, 2003
4. Francine Krief,"Communicating Embedded System" Wiley 2010.

## Web links and Video Lectures (e-Resources)

1. <https://youtu.be/aYfBTXXhK70?si=QwkwzAfzGt34ESP2>
2. <https://youtu.be/JO4AEkOVF2M?si=625mOK9NIuaP6Gn->
3. <https://youtu.be/vn7aT9-cYzQ?si=eiEV3iiLAzJIIWYI>
4. <https://youtu.be/runrFcCsC1E?si=FGDXIXMtjNd1Vykp>

## Skill Development Activities Suggested

1. Hands-on Simulation and Implementation.
2. IoT and Embedded Systems Prototyping.
3. Security and Optimization in Embedded Networks.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** the basics of network systems. (L1)

**CO2: Demonstrate** about the sensor network components, architecture and **design** principles of WSN.  
(L2, L3)

**CO3: Illustrate** the need MAC protocols and energy conservation. (L2)

**CO4: Application** of networked automotive system. (L3)

**CO5: Design** and development of home automation. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	
CO2	-	2	-	-	-	-	-	2
CO3	-	-	-	-	-	2	-	-
CO4	-	-	-	3	3	-	-	-
CO5	-	-	1	-	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

Cross Platform Application Development			
Course Code	<b>P24MCAG311C</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Understand Cross-Platform Development Fundamentals
- Install and configure cross-platform development environments.
- Implement responsive UI designs that adapt to different screen sizes and resolutions.
- Write code using languages like Dart (Flutter) and Implement core application functionality using reusable code components.

#### UNIT-1

**8 Hours**

**Introduction to Dart** - Getting started with Dart, The evolution of Dart, How Dart works, Dart VM and JavaScript compilation, Dart development tools, Understanding why Flutter uses Dart, Introducing the structure of the Dart language, Dart operators, Type checking and casting, Dart types and variables, Type inference – bringing dynamism to the show, Control flows and looping, Functions, Data structures, collections, and generics, Introduction to OOP in Dart, Dart OOP features- Objects and classes, Encapsulation, Inheritance and composition, Abstraction, Polymorphism

**Text Book 1 – Chapter 1**

#### UNIT -2

**8 Hours**

**Intermediate Dart Programming-** Dart classes and constructors, Field accessors – getters and setters, Static fields and methods, Class inheritance, Interfaces, abstract classes, and mixins, Callable classes, top-level functions, and variables, Understanding Dart libraries and packages, Creating Dart libraries, Dart packages, Package structures, Stage hand – the Dart Project Generator, The pubspec file, Package dependencies – pub, Introducing async programming with Futures and Isolates, Introducing Unit testing with Dart

**Text Book 1 - Chapter 2**

#### UNIT -3

**8 Hours**

**An Introduction to Flutter** - Comparisons with other mobile app development frameworks, Flutter compilation (Dart), Flutter rendering, Widgets introduction, Hello Flutter -Running the generated project.

**The Flutter User Interface** – Widgets: Building Layouts in Flutter - Stateful versus stateless widgets, Built-in widgets, Understanding built-in layout widgets, Creating a UI with widgets, Creating custom widgets

**Text Book 1 - Chapter 3 and Chapter 4**

#### UNIT -4

**8 Hours**

**Handling User Input and Gestures-** Handling user gestures, Input Widgets, , Validating Inputs (Forms), Custom input and Form Field.

**Theming and Styling** - Theme widgets, Material Design, Using Custom Fonts, Dynamic styling with MediaQuery and LayoutBuilder

**Routing: Navigating between Screens-** Understanding the Navigator widget, Named routes, Screen transitions, Hero animations

**Developing Fully Featured Apps –** Firebase Plug-in - Firebase Overview, Firebase authentication, NoSql Database with Cloud Fire store

**Text Book 1 - Chapter 7 and Chapter 8**

**Text Book:**

- Flutter for Beginners – Alessandro Biessek, Published by Packt Publishing Ltd. ISBN 978-1-78899-608-2

**Web links and Video Lectures (e-Resources)**

- Official Docs: <https://flutter.dev/docs>
- Flutter YouTube Channel: <https://www.youtube.com/c/FlutterDev>
- Dart Programming: <https://dart.dev>

**Skill Development Activities Suggested**

**1. Basic Hands-on Activities**

□ **Setup & Environment Configuration**

- Install and configure cross-platform development tools (Flutter, React Native, Xamarin).
- Set up IDEs like VS Code, Android Studio, and Xcode.

□ **Hello World App**

- Create a simple cross-platform application displaying a text message

**2. Responsive UI Development**

Design and implement adaptive layouts

**Course Outcomes**

**On completion of this course, the students should be able to:**

**CO1: Explain** the fundamental concepts, benefits, and challenges of cross- platform application development. (L2)

**CO2: Compare** different cross-platform frameworks (Flutter, React Native, Xamarin) and select the appropriate one for a given application. (L4)

**CO3: Design** and implement responsive and adaptive user interfaces for cross- platform applications. (L3)

**CO4: Design** and develop basic user interfaces that are responsive across multiple platforms and screen sizes. (L3)

**Mapping with Program Outcomes**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	2	-	-	2	-	-	-
CO2	2	-	2	-	2	-	-	-
CO3	-	-	3	-	3	-	-	3
CO4	-	-	-	-	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>IOT Technology and Applications</b>			
Course Code	<b>P24MCAG311D</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- To understand the concepts of Internet of Things and the application of IoT.
- To Explore IoT Architectures and Technologies.
- Examine IoT Communication and Networking.
- Apply IoT Solutions in Real-World Scenarios.

### **UNIT – 1**

**8 Hours**

What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples- Overview, Smart Metering/Advanced Metering Infrastructure Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.

**Textbook1: Ch1: 1.1 – 1.5, Ch2: 2.1 – 2.3, Ch3: 3.1 – 3.11**

### **UNIT -II**

**8 Hours**

Fundamental IoT Mechanism and Key Technologies-Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards -Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Low power WPAN, Zigbee IP(ZIP), IPSO.

**Textbook1: Ch4: 4.1 – 4.3, Ch5: 5.1 – 5.10**

### **UNIT -III**

**8 Hours**

Layer ½ Connectivity: Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.

**Textbook1: Ch6: 6.1 - 6.2, Ch7: 7.1 - 7.8**

### **UNIT -IV**

**8 Hours**

Case Studies illustrating IoT Design-Introduction, Home Automation, Cities, Environment, Agriculture, Productivity Applications.

**Textbook2: Ch9: 9.1 - 9.6**

## UNIT -V

8 Hours

Data Analytics for IoT: Introduction, Apache Hadoop, Using Hadoop MapReduce for Batch Data Analysis, Apache Oozie, Apache Spark, Apache Storm, Using Apache Storm for Real-time Data Analysis, Structural Health Monitoring Case Study.

**Textbook2: Ch: 10.1 - 10.8**

### Text Books

1. Daniel Minoli: Building the Internet of Things with IPv 6 and MIPv6: The Evolving World of M2M Communications, Wiley, 2013.
2. ArshdeepBahga, Vijay Madiseti: Internet of Things: A Hands-on Approach, Universities Press, 2015.

### Reference Books

1. Michael Miller: The Internet of Things, Pearson, First Edition, 2015.
2. Claire Rowland, Elizabeth Goodman et.al: Designing Connected Products, O'Reilly, First Edition, 2015.

### Web links and Video Lectures (e-Resources):

- <http://download.e-bookshelf.de/download/0000/8067/18/L-G-0000806718-0002366365.pdf>
- <https://jcer.in/jcer-docs/E-Learning/Digital%20Library%20/E-Books/Internet-of-things-a-hands-on-approach-%20Arshdeep.pdf>

### Skill Development Activities Suggested

Students focus on developing IoT-based solutions for smart cities, healthcare, home automation, agriculture, and environmental monitoring. Students will design systems for traffic management, remote health monitoring, smart security, precision farming, and real-time pollution tracking. These hands-on projects will enhance their skills in IoT hardware, cloud integration, AI-driven analytics, and real-time system development for real-world applications.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** the use of Devices, Gateways and Data Management in IoT. (L2)

**CO2: Design** IoT applications in different domain and be able to analyze their performance. (L3)

**CO3: Implement** basic IoT applications on embedded platform. (L3)

**CO4: Implement** basic IoT applications for Data Analytics. (L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	3	-	-	-	2	-	-
CO2	-	-	3	-	-	-	-	-
CO3	-	-	-	3	3	2	-	3
CO4	-	3	-	3	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Communication and Networking Technologies in IOT</b>			
Course Code	<b>P24MCAG311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand fundamentals of IoT architecture outline and standards.
- Understand and analyze different architectural views.
- Understand the importance of IoT Layer Protocols.
- Understand the importance of architecture and Industrial Internet of Things.

### **UNIT-I**

**8 Hours**

Introduction: IoT Technology trends and future opportunities, IoT and Business scope Evolution, Business perspectives, Embedded systems Relationships, Challenges of IoT, Characteristics of IoT, Sensors and Actuators in IoT enabling Industrial Automation, Wireless sensor Networks in IoT, connecting all the things in Internet of things, IoT M2M, Software Define Networking. IoT System Management is Essential.

**Text Book1: Ch1, 1.1 -1.13**

### **UNIT -II**

**8 Hours**

Introduction IOT life cycle, Physical Design, IOT Conceptual architecture, IOT protocols, Levels of IOT, IOT networking Protocols, Networking standards and technologies in IOT.

**Text Book1: Ch 3, 3.1 -3.8**

### **UNIT -III**

**8 Hours**

Introduction of 5G networks in IoT, IoT Networking consideration and Challenges, Business case for the IoT, Network optimization for IoT devices, Transport Layer protocols, Network Layer Protocols, IoT communication Challenges, Application Protocols for IoT.

**Text Book1: Ch 3, 3.9 -3.17.**

### **UNIT -IV**

**8 Hours**

Introduction, Evolution of IIOT, Advantages of IIOT, Drivers, Risk associated with IIOT, Businesses and Industries approach IIOT security, Applications of IIOT, Work flow of IIOT, Security considerations and challenges, IIOT: Use Cases.

**Text Book1: Ch 4, 4.1 -4.11**

### **UNIT -V**

**8 Hours**

Introduction, IIOT layered Architecture, three tier IIOT, Security in IIOT, Service based Frameworks, Solutions against Intrusions in IIOT, Machine learning based solutions, Deep Learning based solutions.

**Text Book1: Ch 5, 5.1 -5.9**

## Text Book

1. Dr. Vijendra Pratap Singh, Mr. Neeraj Kumar., “IoT Communication Protocols”, ISBN: 978-81961690-9-1, Deccan International Academic Publishers,2023.

## Reference Books

1. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e- ISBN 978-3-642-19157-2, Springer, 2016.
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

## Web links and Video Lectures (e-Resources)

- [https://books.google.co.in/books?id=PSe0EAAAQBAJ&printsec=frontcover&source=gbs\\_ge\\_summar\\_y\\_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=PSe0EAAAQBAJ&printsec=frontcover&source=gbs_ge_summar_y_r&cad=0#v=onepage&q&f=false)
- <https://link.springer.com/book/10.1007/978-3-642-19157-2>
- [https://onlinecourses.nptel.ac.in/noc19\\_cs65/preview](https://onlinecourses.nptel.ac.in/noc19_cs65/preview)
- <https://archive.nptel.ac.in/courses/106/105/106105166/>

## Skill Development Activities Suggested

- Demonstration of IoT protocols using any simulation tools.
- The students’ team may of the size of 2 or 4. Students are expected to use any simulation tools to demonstrate some IoT protocols and then they have to prepare a report and then to be submitted to the concerned staff.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Understand** fundamentals of IoT and Architecture. (L2)

**CO2: Illustrate** the different layers of IoT protocols. (L3)

**CO3: Analyse** the importance of Industrial IoT. (L4)

**CO4: Demonstrate** Use cases of IoT applications. (L4)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	-	-	2
CO2	-	-	3	-	-	-	-	-
CO3	-	-	-	3	3	-	-	-
CO4	3	-	2	3	-	-	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Software and Programming in IOT</b>			
Course Code	<b>P24MCAG311F</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand the Fundamentals of IoT Programming with Python
- Develop RESTful API and Web Socket-based IoT Applications
- Implement MQTT-based IoT Communication
- Integrate IoT with Visualization and Automation Platforms
- Explore the Synergies of IoT with Emerging Technologies

#### **UNIT-I**

**8 Hours**

Programming with Python - Setting Up your Development Environment, Understanding your Python installation, Getting Started with Python and IoT, Creating a breadboard prototype circuit, Reading an electronic schematic diagram, Exploring two ways to flash an LED in Python, Exploring two ways to integrate a push button in Python, Creating your first IoT program.

#### **UNIT -II**

**8 Hours**

Networking with RESTful APIs and Web Sockets Using Flask, Introducing the Flask microservices framework, Creating a RESTful API service with Flask-RESTful, Creating a Web Socket service with Flask-SocketIO, Adding a Web Socket client web page, Comparing the RESTful API and Web Socket servers.

#### **UNIT -III**

**8 Hours**

Networking with MQTT, Python, and the Mosquitto MQTT Broker, Installing the Mosquitto MQTT broker, Learning MQTT by example, Introducing the Python Paho-MQTT client library, Controlling an LED with Python and MQTT, Building a web-based MQTT client.

#### **UNIT -IV**

**8 Hours**

IoT Visualization and Automation Platforms-Triggering an IFTTT Applet from your Raspberry Pi, Actioning your Raspberry Pi from an IFTTT Applet, Visualizing data with the ThingSpeak platform, Other IoT and automation platforms for further exploration.

#### **UNIT -V**

**8 Hours**

Exploring Synergies with Emerging Technologies, Benefits of combining IoT and blockchain, Benefits of combining IoT and generative AI, Benefits of combining IoT and LLM, Benefits of combining IoT and AI/ML, Benefits of combining IoT with immersive Technologies, Benefits of combining IoT with 3D and 4D printing, Benefits of combining IoT with 5G and 6G, Benefits of combining IoT and cloud.

### Text Books

1. Practical Python Programming for IoT: Build advanced IoT projects using a Raspberry Pi 4, MQTT, RESTful APIs, WebSockets, and Python 3, Gary Smart, Publisher(s): Packt Publishing.
2. Architectural Patterns and Techniques for Developing IoT Solutions, Jasbir Singh Dhaliwal, Packt Publishing
3. Raspberry Pi Cookbook, Simon Monk, Publisher(s): O'Reilly Media, Inc.

### Reference Books

1. Programming the Internet of Things, by Andy King, Publisher O'Reilly Media, Inc.
2. Internet of Things: Architecture and Design Principles, Raj Kamal, McGraw Hill Education (India) Private Limited

### Web links and Video Lectures (e-Resources)

- Flask Basics – <https://flask.palletsprojects.com/en/latest/>
- Building RESTful APIs with Flask -RESTful – <https://flask-restful.readthedocs.io/en/latest/>
- Flask-SocketIO for Real-time WebSockets – <https://flask-socketio.readthedocs.io/en/latest/>
- Triggering IFTTT with Raspberry Pi – <https://ifttt.com/>
- Learning MQTT Protocol – <https://www.hivemq.com/mqtt-essentials>

### Video Lectures

- [https://youtu.be/E2ZBZb\\_WKMw](https://youtu.be/E2ZBZb_WKMw)
- <https://youtu.be/t7vQF0ynF9g>
- <https://youtu.be/38PkhZBaEE4>
- <https://youtu.be/dPhr1YCQTU4>
- <https://youtu.be/gRRcFdmjOM>
- <https://youtu.be/z3YMz-Gocmw>

### Skill Development Activities Suggested

The students with the help of the course teacher can take up technical activities which will enhance their skill or the students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/testing/projects, and for creative and innovative methods to solve the identified problem. The prepared report shall be evaluated for CIE marks.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** basic IOT programming in Python. (L1, L2)

**CO2: Develop** practical applications with RESTful API, Web Sockets, MQTT, IFTTT etc.(L3, L2)

**CO3: Apply** IoT techniques to solve real world problems. (L3, L5)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	-	-	-	-	-	-	-
CO2	-	-	2	3	-	-	-	3
CO3	-	2	-	-	3	-	-	-

**3-Strong; 2-Medium; 1-Low**

<b>Ethical Hacking</b>			
Course Code	<b>P24MCAH311A</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- To develop a comprehensive understanding of ethical hacking principles, methodologies, and tools, and recognize the significance of ethical and legal considerations in conducting security assessments.
- To acquire hands-on proficiency in executing penetration tests, vulnerability assessments, and Ethical hacking techniques across various system components, networks, and applications.
- To demonstrate the ability to identify, assess, and prioritize vulnerabilities in diverse computing environments using both manual and automated methods, and effectively communicate these findings to stakeholders.
- To develop a strategic mindset towards cyber security by acquiring knowledge of common attack Vectors, learning to simulate real-world attacks, and implementing preventive measures to secure systems, Networks and web applications.

### **UNIT-I**

#### **Introduction to Ethical Hacking**

**8 Hours**

Introduction to ethical hacking and its importance, Legal and ethical considerations in ethical hacking, Differentiating between black hat, white hat, and grey hat hacking, Basic cyber security concepts and terminology, Overview of penetration testing methodologies

**Textbook: 1 Chapter 1**

**Textbook: 2 Chapter 1, 2**

### **UNIT-II**

#### **Foot printing and Information Gathering**

**8 Hours**

Passive and active information gathering techniques, Who is lookup, DNS enumeration, and social engineering, Tools and methodologies for foot printing, Google hacking and OSINT (Open Source Intelligence) techniques

**Textbook: 1 Chapter 3**

### **UNIT -III**

**Scanning and Enumeration:** Port scanning techniques: SYN,TCP,UDP scans; Service enumeration and version detection; NetBIOS, SNMP, and SMTP enumeration; Vulnerability scanning and assessment

**Textbook: 1 Chapter 3, 4, 5**

### **UNIT -IV**

**System Hacking and Exploitation** Password cracking techniques and tools; Privilege escalation and maintaining access; Malware types and counter measures; Exploiting common vulnerabilities (e.g.,bufferoverflow, SQLinjection)

**Textbook: 1 Chapter 7, 9, 10**

### **UNIT -V**

#### **Web Application and Network Security**

**8 Hours**

Common web vulnerabilities: SQL injection, XSS, CSRF; Web application penetration testing methodology; Network sniffing and spoofing; Intrusion Detection Systems (IDS) and Intrusion Prevention Systems (IPS)

**Textbook:1 Chapter 6, 12**

### Text Books

1. Rafay Baloch, Ethical Hacking and Penetration Testing Guide, CRCPress, 2015, ISBN978-1-4822- 3161-8 (Paperback)
2. HarperAllen, GrayHatHacking: The Ethical Hackers H and Book, 3rdEdition, Mc GrawHill, 2011.
3. JayBeale, AndrewR.Baker, JoelEsler, Snort Intrusion Detection and Prevention Toolkit, Syngress Publishing, Inc, 2007, ISBN-13:978-1-59749-099-3

### Reference Books

1. William Stallings, Network Security Essentials: Applications and Standards, Pearson Education Limited 2017, ISBN13:978-1-292-15485-5
2. Patrick Engebretson, The Basics of Hacking and Penetration Testing, Syngress Publishing, 2013, ISBN978-0-12-411644-3

### E- Resources (NPTEL/ SWAYAM. Any Other)-mention links

- Nmap-Official Documentation :<https://nmap.org/book/>
- National Vulnerability Database(NVD):<https://nvd.nist.gov/>

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Understand** the core concepts, principles and legal Considerations of ethical hacking. (L2)

**CO2: Apply** different tools and techniques for information gathering, scanning and enumeration. (L3)

**CO3: Apply** tools and techniques for exploiting vulnerabilities, Network sniffing, web application hacking, system hacking, Escalating privileges, etc. (L3)

**CO4: Analyze** the results of IDS/IPS, ethical hacking and penetration testing tasks. (L4)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	2	-	-
CO2	2	-	-	3	2	3	-	-
CO3	3	-	3	3	3	3	-	3
CO4	3	-	-	-	3	2	3	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Cyber Security</b>			
Course Code	<b>P24MCAH311B</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To learn cybercrime and cyber law.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

### UNIT-1

**8 Hours**

**Introduction:** Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

### UNIT -2

**8 Hours**

**Attacks And Counter Measures Oswap:** Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures.

### UNIT -3

**8 Hours**

**Reconnaissance:** Harvester – Who is – Netcraft – Host – Extracting Information from DNS – Extracting Information from E- mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches.

### UNIT -4

**8 Hours**

**Intrusion Detection:** Host -Based Intrusion Detection – Network -Based Intrusion Detection– Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

### UNIT -5

**8 Hours**

**Intrusion Prevention:** Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations –Intrusion Prevention Systems – Example Unified Threat Management Products.

### Text Books

1. Patrick Engebretson, —The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy, Elsevier, 2011. (Unit-3)
2. William Stallings, Lawrie Brown, —Computer Security Principles and Practicell, Third Edition, Pearson Education, 2015. (Unit-4 & 5)
3. Anand Shinde, —Introduction to Cyber Security Guide to the World of Cyber Security, Notion Press, 2021. (Unit-1 &2)

### Reference Books

1. David Kim, Michael G. Solomon, —Fundamentals of Information Systems Security, Jones & Bartlett Learning Publishers, 2013.
2. Nina Godbole, Sunit Belapure, —Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley Publishers, 2011.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Explain** the basics of cyber security, cybercrime and cyber law (L2)

**CO2: Compare** various types of attacks and learn the tools to launch the attacks (L4)

**CO3: Apply** various tools to perform information gathering (L3)

**CO4: Apply** intrusion techniques to detect intrusion (L3)

**CO5: Apply** intrusion prevention techniques to prevent intrusion (L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	2	-	-	-	-	-	-
CO2	-	2	-	3	-	-	-	-
CO3	2	2	-	-	3	-	-	-
CO4	2	2	-	-	3	3	-	3
CO5	-	1	-	3	-	-	3	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Cryptography and Network Security</b>			
Course Code	<b>P24MCAH311C</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

### UNIT-I

**8 Hours**

**Introduction:** Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. **CLASSICAL ENCRYPTION TECHNIQUES:** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography.

### UNIT-II

**8 Hours**

**Block Ciphers and the Data Encryption Standard:** Block Cipher Principles, The Data Encryption Standard (DES), A DES Example, The Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles. **BLOCK CIPHER OPERATION:** Multiple Encryption and Triple DES, Electronic Codebook Mode, Cipher Block Chaining Mode, Cipher Feedback Mode, Output Feedback Mode, Counter Mode. **STREAM CIPHERS :** Stream ciphers, RC4 Ciphers, RC4.

### UNIT-III

**8 Hours**

**Number Theory-:** Divisibility and the Division Algorithm, The Euclidean Algorithm, Modular Arithmetic, Prime Numbers, Fermat's and Euler's Theorems, Testing for Primality, The Chinese Remainder Theorem, and Discrete Logarithms. **PUBLIC-KEY CRYPTOGRAPHY, RSA AND OTHER PUBLIC-KEY CRYPTOSYSTEMS:** Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie Hellman Key Exchange, ElGamal Cryptosystem.

### UNIT-IV

**8 Hours**

**Cryptographic Hash Functions:** Applications of Cryptographic Hash Function, Two Simple Hash Functions, Requirements and Security, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA). **MESSAGE AUTHENTICATION CODES:** Message Authentication Requirements, Message Authentication Functions, Message Authentication Codes, Security of MACs, MACs Based on Hash Functions (HMAC).

### UNIT-V

**8 Hours**

**Digital Signatures-** Digital Signatures, ElGamal Digital Signature Scheme, Schnorr Digital Signature Scheme, Digital Signature Standard (DSS). **KEY MANAGEMENT AND DISTRIBUTION:** Symmetric Key Distribution Using Symmetric Encryption, Symmetric Key Distribution Using Asymmetric Encryption, Distribution of Public Keys, X.509 Certificates, Public Key Infrastructure.

## Text Book

1. William Stallings: Cryptography and Network Security- Principles And Practice, 5th Edition, Pearson/PHI, 2011.

## Reference books

1. William Stallings, —Network Security Essentials (Applications and Standards)ll, 4th Edition, Pearson Education. , 2012
2. Charlie Kaufman, Radia Perlman and Mike Speciner: — Network Security – Private Communication in a Public Worldll, 2nd Edition, Pearson/PHI, 2002.
3. Eric Maiwald: —Fundamentals of Network Securityll, 1st Edition, Dreamtech Press, 2003.
4. Whitman: —Principles of Information Securityll, 3rd Edition, Thomson, 2009.
5. Robert Bragg, Mark Rhodes: —Network Security: The complete referencell, 1st Edition, TMH, 2004.
6. Buchmann: — Introduction to Cryptographyll, 2nd Ed ition, Springer, 2004.

## Web links and Video Lectures (e-Resources)

- <http://www.nptel.iitm.ac.in/courses/106105031/>.
- [https://www.youtube.com/playlist?list=PLBlnK6fEyqRgJU3EsOYDTW7m6SUmW6kII&utm\\_source=chatgpt.com](https://www.youtube.com/playlist?list=PLBlnK6fEyqRgJU3EsOYDTW7m6SUmW6kII&utm_source=chatgpt.com)
- <https://www.youtube.com/playlist?list=PL71FE85723FD414D7>
- [https://www.youtube.com/playlist?list=PL\\_LGG4Jw4MdfPrMZg-otwrRPPAoXT-vgO](https://www.youtube.com/playlist?list=PL_LGG4Jw4MdfPrMZg-otwrRPPAoXT-vgO)
- [https://onlinecourses.nptel.ac.in/noc20\\_cs21/preview?utm\\_source=chatgpt.com](https://onlinecourses.nptel.ac.in/noc20_cs21/preview?utm_source=chatgpt.com)

## Skill Development Activities Suggested

- Implement Caesar Cipher and Vigenère Cipher using Python.
- Implement DES and Triple DES encryption using a programming language.
- Write code for Euclidean algorithm, Modular inverse, and Chinese Remainder Theorem.
- Case study: Discuss a real-world cyberattack prevented using public-key crypto.
- Build a simple login system with hashed passwords.
- Implement a digital signature using ElGamal or RSA.

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Analyze** and design classical encryption techniques and block ciphers. (L4)

**CO2: Understand** and analyze data encryption standard. (L2)

**CO3: Understand** and analyze public-key cryptography, RSA and other public-key cryptosystems. (L2)

**CO4: Understand** key management and distribution schemes and design User Authentication, such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc. (L2)

**CO5: Apply** intrusion prevention techniques to prevent intrusion. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	1	-	-	3	-	-	-
CO2	2	-	-	3	3	-	-	-
CO3	-	2	-	-	-	3	-	-
CO4	2	-	2	-	-	-	-	-
CO5	-	1	-	2	-	-	-	3

**3-Strong; 2-Medium; 1-Low**

<b>Blockchain Technologies</b>			
Course Code	<b>P24MCAH311D</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### Course Learning objectives

- Demonstrate the basics of Block chain concepts using modern tools/technologies.
- Illustrate the role of block chain applications in different domains including cyber security.
- Evaluate the usage of Block chain implementation/features for the given problem.
- Exemplify the usage of bit coins and its impact on the economy.
- Analyze the application of specific block chain architecture for a given problem

### UNIT-I

**8 Hours**

Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and Private key basics, pros and cons of Blockchain, Myths about Bitcoin.

### UNIT -II

**8 Hours**

Block chain: Architecture, versions, variants, use cases, Life use cases of block chain, Block chain vs shared Database, Introduction to crypto currencies, Types, Applications. Ciphers, RC4.

### UNIT -III

**8 Hours**

Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy ,payment verification, Resolving Conflicts , Creation of Blocks

### UNIT -IV

**8 Hours**

Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet, Converting Bitcoins to Fiat Currency.

### UNIT -V

**8 Hours**

Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.

### Text Books

- Beginning Block chain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep Bikramaditya Signal, Gautam Dhameja (Priyansu Sekhar Panda., A Press.) 2018
- Block chain Applications: A Hands-On Approach by Bahga, Vijay Madiseti ,2017
- Block chain by Melanie Swan, O Reilly 2015
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### Reference Books

- Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princeton
- Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

### Web links and Video Lectures (e-Resources)

- <https://youtu.be/mzPoUjQC4WU>

### Skill Development Activities Suggested

- Create a comparative chart: Blockchain vs Bitcoin vs Traditional Databases.
- Develop a flowchart showing how a cryptocurrency transaction flows through a blockchain.
- Simulate the proof-of-work process using hash functions (SHA256) in Python.
- Create a bitcoin wallet using a mobile app or online simulator (no real money involved).

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Demonstrate** the basics of Block chain concepts using modern tools/technologies. (L2)

**CO2: Analyze** the role of block chain applications in different domains including cyber security. (L3)

**CO3: Evaluate** the usage of Block chain implementation/features for the given problem. (L2)

**CO4: Exemplify** the usage of bitcoins and its impact on the economy. (L2)

**CO5: Analyze** the application of specific block chain architecture for a given problem. (L2)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	-	2	-	-	1	-	-	-
CO2	2	-	3	-	-	-	-	-
CO3	-	3	-	-	-	3	-	-
CO4	-	-	-	3	3	-	-	-
CO5	-	-	3	-	-	3	-	3

**3-Strong; 2-Medium; 1-Low**

<b>Database &amp; Web Application Security</b>			
Course Code	<b>P24MCAH311E</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- To understand the fundamentals of database security concepts, Identify key security threats and vulnerabilities.
- To examine security mechanisms and best practices for database protection Design and implement security solutions.
- To identify and analyze vulnerabilities in web applications and databases.
- To design secure web applications
- To evaluate tools and techniques for detecting and mitigating security breaches

### **UNIT-I**

**8 Hours**

#### **Supporting technologies for database and applications security:**

Data Management Technologies, Information Security, Information Management Technologies.

### **UNIT-II**

**8 Hours**

**Discretionary security for database systems:** Security Policies, Policy Enforcement and Related Issues.

### **UNIT-III**

**8 Hours**

**Mandatory security for database systems:** Historical Developments, Design Principles.

### **UNIT-IV**

**8 Hours**

**Multilevel secure relational database systems:** Multilevel Relational Data Models, Security Impact on Database Functions, Prototypes and Products.

### **UNIT-V**

**8 Hours**

**The inference problem:** A Perspective of the Inference Problem, Security-Constraint Processing for Inference Control, Conceptual Structures for Inference Control

### **Text Book**

1. BhavaniThuraisingham, —Database and Applications Security, Integrating Information Security and Data Management, Auerbach Publications, 2005.

### **Reference Books**

1. Michael Gertz and SushilJajodia, —Handbook of Database Security— Applications andTrends, Springer, 2008.
2. Bryan and Vincent, —Web Application Security, A Beginners Guidel, McGraw-Hill, 2011
3. Alfred Basta, Melissa Zgola, —Database Security, Course Technology, 2012.

## Web links and Video Lectures (e-Resources)

- <https://www.scribd.com/document/450222788/1-2012-Web-Application-Security-a-Beginner-Guide>

## Skill Development Activities Suggested

- Use OWASP Juice Shop or DVWA (Damn Vulnerable Web Application) to identify and exploit vulnerabilities like SQL Injection, XSS, CSRF.
- Students rewrite vulnerable code snippets using secure practices (input validation, sanitization, etc.).

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Demonstrate** core concepts of database and web application security, including data confidentiality, integrity, and access control. (L1)

**CO2: Identify and Demonstrate** common vulnerabilities in web applications and databases. (L2)

**CO3: Apply** appropriate security mechanisms (encryption, authentication, access control) to protect databases and web applications. (L2)

**CO4: Develop** secure web applications using industry best practices and secure coding techniques. (L3)

**CO5: Apply** tools and techniques to analyze, test, and mitigate real-world security threats. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	1	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	3
CO3	-	-	-	3	-	3	-	-
CO4	-	-	3	3	-	-	-	-
CO5	-	-	3	3	-	-	-	3
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Mobile and Wireless Security</b>			
Course Code	<b>P24MCAH311F</b>	CIE Marks	50
L: T: P	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

### **Course Learning objectives**

- Understand mobile and wireless communication fundamentals.
- Identify key security threats and vulnerabilities.
- Analyze security mechanisms in mobile and wireless systems.
- Design and implement security solutions
- Explore emerging trends and research areas

### **UNIT-I**

**8 Hours**

**Security Issues in Mobile Communication:** Mobile Communication History, Security – Wired Vs Wireless, Security Issues in Wireless and Mobile Communications, Security Requirements in Wireless and Mobile Communications, Security for Mobile Applications, Advantages and Disadvantages of Application – level Security.

### **UNIT -II**

**8 Hours**

**Security of Device, Network, and Server Levels:** Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application-Level Security in Wireless Networks: Application of WLANs, Wireless Threats, Some Vulnerabilities and Attach Methods over WLANs, Security for 1G Wi-Fi Applications, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications

### **UNIT -III**

**8 Hours**

**Application-Level Security in Cellular Networks:** Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM Security for applications, GPRS Security for applications, UMTS security for applications, 3G security for applications, Some of Security and authentication Solutions.

### **UNIT -IV**

**8 Hours**

**Application-Level Security in MANETs:** MANETs, Some applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs, External Threats for MANET applications, Internal threats for MANET Applications, Some of the Security Solutions. Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, and Security Attacks on UC networks, Some of the security solutions for UC.

### **UNIT -V**

**8 Hours**

**Security for Mobile Commerce Application:** M-commerce Initiatives, Security Challenges in Mobile E-commerce, Types of Attacks on Mobile E-commerce, A Secure M-commerce Model Based on Wireless Local Area Network, Some of M-Commerce Security Solutions

## Text Books

1. Pallapa Venkataram, Satish Babu: —Wireless and Mobile Network Security, 1st Edition, Tata McGraw Hill, 2010.
2. Frank Adelstein, K.S.Gupta : —Fundamentals of Mobile and Pervasive Computing, 1st Edition, Tata McGraw Hill 2005.

## Reference Books

1. Randall k. Nichols, Panos C. Lekkas: —Wireless Security Models, Threats and Solutions, 1st Edition, Tata McGraw Hill, 2006.
2. Bruce Potter and Bob Fleck: —802.11 Security, 1st Edition, SPD O'REILLY 2005.
3. James Kempf: —Guide to Wireless Network Security, Springer. Wireless Internet Security – Architecture and Protocols, 1st Edition, Cambridge University Press, 2008

## Web links and Video Lectures (e-Resources)

- <https://dokumen.pub/qdownload/wireless-and-mobile-network-security-9780070700246-0070700249.html>

## Skill Development Activities Suggested

- Programming Assignment-1: Implementation of important concepts of data manipulation using NumPy and Pandas (Python)
- Programming Assignment-2: Implementation of simple Machine Learning models with Visualization using Python (Matplotlib, Scikitlearn)

## Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Identify** the issues and technologies involved in designing a wireless and mobile system that is robust against various attacks. (L1)

**CO2: Understand** the various ways in which wireless networks can be attacked and trade-offs in protecting networks. (L2)

**CO3: Understand** the state-of-the-art and open problems in wireless and mobile security, thus enhancing their potential to do research or pursue a career in this rapidly developing area. (L2)

**CO4: Apply** various security issues involved in cloud computing. (L3)

**CO5: Apply** various security issues related to GPRS and 3G. (L3)

## Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	2	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	2
CO3	-	-	3	-	-	-	-	-
CO4	-	-	-	3	2	-	-	3
CO5	-	-	2	-	-	3	-	-
<b>3-Strong; 2-Medium; 1-Low</b>								

<b>Project Work Phase - 1</b>			
Course Code	<b>P24MCA32</b>	CIE Marks	100
L:T:P	0:0:4	SEE Marks	-
Total Hours of Pedagogy	-	Total Marks	100
Credits	5	Exam Hours	03

### Project Work Phase - 1 Guidelines

- Students in consultation with the Guide / Co-guide if any, shall pursue a literature survey and complete the preliminary requirements of the selected Project work.
- Each student shall prepare a relevant introductory project document, and present a seminar.
- CIE marks shall be awarded by a committee comprising of HOD as Chairman, Guide / Co-guide if any, and a senior faculty of the department.
- The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill with viva-voce session in the ratio of 50:50
- There is no SEE for this course.

### Course outcomes

**On completion of this course, the students should be able to:**

**CO1: Formulate** problem definition by acquiring information from various sources (L6)

**CO2: Demonstrate** the gaps analyzed in the project work (L2)

**CO3: Analyse** the objective, impact and relevance of the project (L4)

**CO4: Develop** the report efficiently while adhering to ethical standards (L3)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	1	2	-	3	3
CO2	3	3	2	2	2	1	3	3
CO3	1	-	2	-	2	-	3	-
CO4	1	2	2	2	1	-	-	-

**3-Strong; 2-Medium; 1-Low**

### Scheme of Evaluation

Course code	Title	Internal (CIE)		Total Marks
		Presentation	Report	
P24MCA32	Project WorkPhase - 1	50	50	100

## Rubrics for Project Work Phase - 1 Presentation Assessment (Marks: 50)

Particulars	Excellent (9-10)	Good (6-8)	Satisfactory (3-5)	Poor (0-2)
<b>Knowledge of the topic at analyze level</b>	Demonstrates in depth knowledge; answered all questions with elaboration	Adequate knowledge on most of the topics. Answered all questions but failed to elaborate	Superficial knowledge of topic; only able to answer basic questions	Does not have any knowledge; Unable to answer questions
<b>Organization of the presentation</b>	Presented in logical sequence; introduction and background give proper context key points and conclusions are clear and well presented	Most information presented in logical sequence; clear introduction; adequate background; some irrelevant information	Problems with sequencing, lacks clear transitions; incomplete or overly detailed introduction, emphasis given to less important information	Little or no organization, difficult to follow; missing or ineffective introduction; confusing background; key points unclear
<b>Level of Understanding</b>	Sufficient for understanding and presented very effectively	Sufficient for understanding and presented well	Sufficient for understanding but not clearly presented	Too brief or insufficient for understanding or too detailed
<b>Presentation Skills</b>	Clear articulation, steady delivery rate, good posture and eye contact, confident and appropriately Dressed	Clear articulation but not very polished. Able to recover from minor mistakes. Appropriately dressed	Occasional eye contact, incorrect pronunciations, and Voice fluctuation.	Inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire
<b>Visuals</b>	Visually pleasing and easy to read; good use of white space, colour, backgrounds; images and Graphics support.	Adequate layout, but with some fonts, colours, backgrounds difficult to read	Difficult to read, cluttered appearance; images improperly sized; some distracting graphics or animations	Confusing layout, text extremely difficult to read; many graphics, sounds, animations distract from the presentation

**Rubrics for Project Work Phase - 1 Report Assessment (Marks: 50)**

<b>Particulars</b>	<b>Excellent (9-10)</b>	<b>Good (6-8)</b>	<b>Satisfactory(3-5)</b>	<b>Poor (0-2)</b>
<b>Problem formulation</b>	State the problem clearly and identify underline issues	Adequately define the problem	Fails to define the problem adequately	Doesn't identify the problem
<b>Objective, relevance, impact</b>	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them in a focused and logical manner	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them	Purpose and objectives are stated ambiguously	The report does not clearly address any of them;
<b>Literature Study</b>	Detailed and extensive explanation of the specifications and the limitations of the existing systems	Collects a great deal of information and good study of the existing systems	Moderate study of the existing systems collects some basic information	Explanation of the existing study and the limitations of the existing systems not very satisfactory; limited information
<b>References</b>	Sources are Acknowledged with full reference details.	Sources are acknowledged with bare reference details.	Sources are acknowledged with partial reference details.	Sources are not acknowledged.
<b>Grammar &amp; Spelling, Report Format</b>	Very few spelling errors, correct punctuation, grammatically correct, complete sentences; All required elements of the report are present and completed efficiently.	Occasional lapses in spelling, punctuation, grammar, but not enough to seriously distract the reader; All required elements of the report are present and completed to a satisfactory standard.	Less technical details, sentences are not framed properly and with a few spelling mistakes; All required elements are provided but in a haphazard way	Numerous spelling errors, non-existent or incorrect punctuation, and/or severe errors in grammar that interfere with understanding; Key elements of the report are not provided. Overall presentation of the document is not to a professional standard.

Rubrics for Project Work Phase - 1 Presentation Assessment (out of 50 marks) =

Rubrics for Project Work Phase - 1 Report Assessment (out of 50 marks) =

Total Marks (Out of 100 marks) =

Signature of the Guide / Co-ordinator

Name:

Signature of the HOD

<b>Research Internship/Industry-Internship/Startup-Internship</b>			
Course Code	<b>P24MCA33</b>	CIE Marks	100
L :T :P	-	SEE Marks	100
Total Hours of Pedagogy	-	Total Marks	200
Credits	11	Exam Hours	03

### **Guidelines for Research Internship/Industry-Internship/Startup-Internship**

The students shall undergo internship in the industry for a period of 8 weeks in 3<sup>rd</sup> semester.

- The internship shall be undertaken in an industry/ R&D laboratory/ recognized academic institution.
- Upon completion, students shall present their work and submit the internship report at the end of the 3<sup>rd</sup> semester, which will be evaluated for 100 marks by an internal constituted by the Head of the Department (HOD).
- The internship report must be prepared in the format prescribed by the Department.
- A semester end examination will be conducted as part of the evaluation process for 100 marks.

### **Course Outcomes**

**On completion of this course, the students should be able to:**

**CO1: Analyse** the industry/research work environment with emphasis on organizational structure, job process in various departments (L4)

**CO2: Interpret** modern tools and technologies used in company (L2)

**CO3: Demonstrate** the industry/ research/ startup study through self-learning capabilities with presentation and detailed report (L2)

### **Mapping with Program Outcomes**

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	-	-	-
CO2	-	-	2	3	2	-	-	-
CO3	-	-	-	-	3	-	2	3

**3-Strong; 2-Medium; 1-Low**

### **Scheme of Evaluation**

Course code	Title	Internal (CIE)		SEE	Total Marks
		Presentation	Report		
P24MCA33	Research Internship/Industry-Internship/Startup-Internship	50	50	100	200

## Industry Internship (P24MCA33)

### Rubrics for Internship Presentation Assessment (Marks: 50) (CIE)

Particulars	Excellent (9-10)	Good (5-8)	Satisfactory (3-5)	Poor (0-2)
<b>Knowledge on Industry experience /Research work</b>	Demonstrates in depth knowledge about Industry / Research processes; answered all questions with elaboration	Knowledge to a limited extent on major processes. Able to answer most of the questions though not elaborate	Superficial knowledge of topic; only able to answer basic questions	Does not have any knowledge; Unable to answer questions
<b>Organization of the presentation</b>	Presented in logical sequence; Introduction and background given in proper context; Key points and conclusions are clear and less references and citations	Presented in logical sequence; Introduction and background given in proper context; Key points and conclusions are not clear and well presented most cited and references	Emphasis given to less important information	Little or no organization, difficult to follow; missing or ineffective introduction; confusing background; key points unclear
<b>Usage of Modern tools and technologies</b>	Effectively utilized appropriate tools and technologies for implementation.	Developed applications, though not very effectively. Fair enough.	Sufficient for understanding but not clearly elaborated about usage of tools and technologies	Too brief or insufficient for understanding or too detailed
<b>Presentation Skills</b>	Clear articulation about tools/technology, steady delivery rate, good posture and eye contact, confident and appropriately dressed	Good Articulation about tools/ technology and not very polished. Not able to realize minor mistakes. Presentable attire	Refers to slides to make points, occasional eye contact, incorrect pronunciations, and Voice fluctuation.	No clarity in sentence, Inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire
<b>Visuals</b>	Visually pleasing and easy to read; good use of white space, colour, backgrounds; images and Graphics support.	Good visuals but can be improved largely.	Difficult to read, cluttered appearance; images improperly sized; some distracting graphics or animations	Confusing layout, text extremely difficult to read; many graphics, sounds, animations distract from the presentation

### Rubrics for Internship Report Assessment (Marks: 50)

Particulars	Excellent (9-10)	Good (5-8)	Satisfactory (3-5)	Poor (0-2)
<b>Purpose and Objective of Internship</b>	The purpose and objective of the Internship report is made clear, and the report addresses the objective(s) in a focused and logical manner.	Documented well but with slight ambiguity in analyzing the problems	Purpose and objectives are stated ambiguously	The report does not clearly address the objective(s) of Internship
<b>Documenting the essence of Tools / Technology used</b>	Complete information is provided about tools/technology.	Average technical details on tools / technology usage.	Less technical details.	No details about tools/technology
<b>Code Implementation and validation</b>	Implementation and validation of code is adequately explained and expected results are properly shown	Implementation and validation of code explanation is good and expected results are okay	Implementation, validation of Code explanation and expected results are not up to the mark	Implementation and validation of code explanation is not done and expected results are incorrect
<b>Conclusion and References</b>	well summarized and concluded; Multiple references, Citations appropriately placed, Formatted correctly	summary and conclusion is written good; References limited or a few missed citations, format mostly correct.	summary and conclusion is written poorly; References sparse - poor formatted	Inappropriate conclusion and references.
<b>Report Format Grammar &amp; Spelling</b>	All required elements of the report are present and completed efficiently; Very few spelling errors, correct punctuation, grammatically correct, complete sentences.	All required elements are present but some of them are not given completely; Grammatical mistakes not corrected.	All required elements are provided but in a haphazard way; sentences are not framed properly and with a few spelling mistakes	Key elements of the report are not provided. Overall presentation of the document is not to a professional Standard; severe errors in grammar that interfere with understanding.

#### CIE

Rubrics for Internship Presentation Assessment (out of 50 marks) =  
 Rubrics for Internship Report Assessment (out of 50 marks) =  
 Total Marks (Out of 100 marks) =

Signature of the Guide/Co-ordinator  
 Name:

Signature of the HOD

**Rubrics for Internship Presentation Assessment (Marks: 100) (SEE)**

<b>Particulars</b>	<b>Excellent (16-20)</b>	<b>Good (11-15)</b>	<b>Satisfactory (5-10)</b>	<b>Poor (0-4)</b>
<b>Relevance of the topic in the industry and importance of the work carried out</b>	Topic is cutting edge of the field; Work carried out refers specifically to the relevant theory and in a comprehensible manner	Topic is of currently importance; Work carried out clearly refers to the relevant theory and is explained in a comprehensible manner	Topic is only tangentially related to the field; Work carried out partially refers to the relevant theory and is explained in a limited manner	Topic is outdated or irrelevant to the field; Work carried out does not refer to the relevant theory and is not explained clearly
<b>Learning of the topic</b>	Demonstrated excellent learning	Demonstrated very Good	Demonstrated Good	Demonstrated poor learning
<b>Task Carried</b>	Technical components are thoroughly substantiated and well covered	Use of technical components and practices is satisfactory and adequately covered	Use of technical components is somewhat satisfactory	Very limited use of technical components
<b>Presentation Skills</b>	Clear articulation about tools/ technology, steady delivery rate, good posture and eye contact, confident and appropriately dressed	Good articulation about tools/ technology but not very polished; Unable to notice minor mistakes; attire is presentable	Relies on slides to make points, occasional eye contact, some incorrect pronunciations, and noticeable voice fluctuation.	Lacks clarity in sentence, inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire
<b>Organization of the report</b>	Report is very well written and complete in all aspects	Report clearly written and well organized	Report is adequately written with some information covered	Report is poorly organized and lacks sufficient information.

**SEE**

Total Marks (Out of 100 marks)

=

Signature of the Internal Examiner

Signature of the External Examiner

Name:

Name:

## IV SEMESTER

Online Course			
Course Code	<b>P24MCA41</b>	CIE Marks	100
L :T :P	-	SEE Marks	-
Total Hours of Pedagogy	-	Total Marks	100
Credits	03	Exam Hours	-

### Guidelines for MOOC

- The student has to choose 12 weeks NPTEL online course recommended by the Department.
- The student can register MOOC anytime during I/II/III/IV semester, but evaluation / consideration will be done only at the end of 4<sup>th</sup> semester.
- The CIE marks awarded for MOOC is based on seminar report, presentation skill with question answer session and NPTEL score in the ratio 30:30:40 respectively.

NPTEL score is calculated as follows

**NPTEL Score x 1.5 = [Subject to a Maximum of 100 Marks]**

**[Ex. -1: If NPTEL Score is 52 then the CIE will be = (52 x 1.5) = 78**

**Ex. -2: If NPTEL Score is 80 then the CIE will be = (80 x 1.5) = 100**

### Scheme of Evaluation

Course code	Title	Internal (CIE)			Total Marks
		Presentation	Report	NPTEL Score	
P24MCA41	Online Course	30	30	40	100

<b>Technical Seminar</b>			
Course Code	<b>P24MCA42</b>	CIE Marks	100
L :T :P	03	SEE Marks	-
Total Hours of Pedagogy	-	Total Marks	100
Credits	03	Exam Hours	-

### Guidelines for Technical Seminar

- Each student must present a unique topic on Emerging Technologies.
- The CIE marks awarded for Technical Seminar shall be based on the evaluation of Seminar Report and Presentation skill with viva-voce session in the ratio of 40:60.

### Course Outcomes

**On completion of this course, the students should be able to:**

**CO1: Analyze** relevant topic in computer science / research-based knowledge.(L4)

**CO2: Extend** self-learning skills.(L2)

**CO3: Compilation** of information with effective presentation & report writing. (L6)

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	-	-	-	-	-
CO2	-	2	-	3	3	-	-	3
CO3	-	-	-	3	3	-	-	3

**3-Strong;2-Medium;1-Low**

### Scheme of Evaluation

Course code	Title	Internal (CIE)		Total Marks
		Presentation	Report	
P24MCA42	Technical Seminar	60	40	100

## Rubrics for Technical Seminar Presentation Assessment (Marks: 60)

Particulars	Excellent (11-12)	Good (9-10)	Satisfactory (5-8)	Poor (0-4)
<b>Knowledge of the topic at analyze level</b>	Demonstrates in depth knowledge; answered all questions with elaboration	Adequate knowledge on most of the topics. Answered all questions but failed to elaborate	Superficial knowledge of topic; only able to answer basic questions	Does not have any knowledge; Unable to answer questions
<b>Organization of the presentation</b>	Presented in logical sequence; introduction and background give proper context key points and conclusions are clear and well presented	Most information presented in logical sequence; clear introduction; adequate background; some irrelevant information	Problems with sequencing, lacks clear transitions; incomplete or overly detailed introduction, emphasis given to less important information	Little or no organization, difficult to follow; missing or ineffective introduction; confusing background; key points unclear
<b>Level of Understanding</b>	Sufficient for understanding and presented very effectively	Sufficient for understanding and presented well	Sufficient for understanding but not clearly presented	Too brief or insufficient for understanding or too detailed
<b>Presentation Skills</b>	Clear articulation, steady delivery rate, good posture and eye contact, confident and appropriately Dressed	Clear articulation but not very polished. Able to recover from minor mistakes. Appropriately dressed	Occasional eye contact, incorrect pronunciations, and Voice fluctuation.	Inaudible or too loud, no eye contact, delivery rate is too slow or too fast, not in formal attire
<b>Visuals</b>	Visually pleasing and easy to read; good use of white space, colour, backgrounds; images and Graphics support.	Adequate layout, but with some fonts, colours, backgrounds difficult to read	Difficult to read, cluttered appearance; images improperly sized; some distracting graphics or animations	Confusing layout, text extremely difficult to read; many graphics, sounds, animations distract from the presentation

## Rubrics for Seminar Report Assessment (Marks: 40)

Particulars	Excellent (9-10)	Good (6-8)	Satisfactory (3-5)	Poor(0-2)
<b>Objective, relevance, impact and conclusion</b>	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them in a focused and logical manner.	The purpose and objective, relevance and impact of the topic is made clear, and the report addresses them.	Purpose and objectives are stated ambiguously	The report does not clearly address any of them.
<b>Grammar &amp; Spelling</b>	Very few spelling errors, correct punctuation, grammatically correct, complete sentences.	Occasional lapses in spelling, punctuation, grammar, but not enough to seriously distract the reader.	Less technical details, sentences are not framed properly and with a few spelling mistakes	Numerous spelling errors, non-existent or incorrect punctuation, and/or severe errors in grammar that interfere with understanding.
<b>References</b>	Sources are Acknowledged with full reference details.	Sources are acknowledged with bare reference details.	Sources are acknowledged with partial reference details.	Sources are not acknowledged.
<b>Report Format</b>	All required elements of the report are present and completed efficiently.	All required elements of the report are present and completed to a satisfactory standard.	All required elements are provided but in a haphazard way	Key elements of the report are not provided. Overall presentation of the document is not to a professional standard.

Rubrics for Seminar Presentation Assessment (out of 60 marks) =

Rubrics for Seminar Report Assessment (out of 40 marks) =

Total Marks (Out of 100 marks) =

Signature of the Guide / Coordinator

Name:

Signature of the HOD

Project Work Phase - 2			
Course Code	P24MCA43	CIE Marks	100
L:T:P	0:0:6	SEE Marks	100
Total Hours of Pedagogy	03	Total Marks	200
Credits	10	Exam Hours	03

### Guidelines for Project Work Phase - 2

- This is an individual project for duration of minimum of 4½ months.
- The candidate should carry out the project in any industry or R&D institution or educational institution under a Guide/Co-guide.
- The candidate has to present the work carried out before the examiners during the final examination.
- The work out carried out should be free from plagiarism.
- The literature study may be clearly written which may be summary of existing project and highlight of the functionalities that are proposed to this project.
- Student shall indicate the different research papers, documents refereed as a part of the literature study.
- Students are encouraged and appreciated to do paper publication in an indexed Journal such as scopus, web of science etc. / journal with impact factor / conference in leading avenues like IEEE, Springer etc. during their project work as an added advantage.
- The student shall present the progress about the project to the panel of members constituted by the Head of the Department (HOD).
- The project report shall be prepared in the format prescribed by the Department and must undergo a plagiarism check in the Central Library using Drillbit software. The report is acceptable if the plagiarism is less than or equal to 10%.

### Course Outcomes

On completion of this course, the students should be able to:

**CO1: Apply** Software Engineering principles on a software project.

**CO2: Analyse** and solve problems related to societal, environment, industry, organization etc.

**CO3: Apply** creative thinking skills for software designs.

**CO4: Develop** applications/solutions to solve problems using modern tools and technologies.

**CO5: Compile** detail report with ethical values and effective presentation.

### Mapping with Program Outcomes

CO's	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	-	-	-	1	-	-
CO2	-	3	2	-	2	-	1	2
CO3	3	3	3	2	-	-	-	-
CO4	-	2	3	3	2	1	-	2
CO5	-	-	2	3	3	-	2	2

**3-Strong; 2-Medium; 1-Low**

### Scheme of Evaluation

Course code	Title	Internal (CIE)		External (SEE)		Total Marks
		Presentation	Report	Dissertation Evaluation	Viva Voce	
P24MCA43	Project Work Phase - 2	70	30	50	50	200

**CONTINUOUS INTERNAL EVALUATION (CIE)**  
**Project Work Phase - 2 (P24MCA43)**

**Rubrics for Project Work Assessment (Marks: 70)**

<b>Particulars</b>	<b>Excellent (12-14)</b>	<b>Good (9-11)</b>	<b>Satisfactory (5-8)</b>	<b>Poor (0-4)</b>
<b>Identification of problem domain &amp; detailed analysis</b>	Detailed and extensive explanation of the purpose and need of the project	Good explanation of the purpose and need of the project	Average explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
<b>Literature survey and problem formulation</b>	Detailed and extensive explanation of the specifications and the limitations of the existing systems; All objectives of the proposed work are well defined;	Collects a great deal of information and good study of the existing systems; Good justification to the objectives;	Moderate study of the existing systems collects some basic information; Only some objectives of the proposed work are well defined;	Explanation of the specifications and the limitations of the existing systems not very satisfactory; limited information; Incomplete justification to the objectives proposed;
<b>Design of the proposed work</b>	Appropriate design methodology and properly justified; Steps to be followed to solve the defined problem are clearly specified	Design methodology not properly justified; Methodology to be followed is specified but detailing is not done	Design methodology not defined properly; Steps to be followed to solve the defined problem are not specified properly	Design methodology not defined properly; Steps are mentioned but unclear; Without justification to objectives
<b>Implementation and testing</b>	Implementation and validation of code is adequately explained and expected results are properly shown	Implementation and validation of code explanation is good and expected results are okay	Implementation, validation of code explanation and expected results are not up to the mark	Implementation and validation of code explanation is not done and expected results are incorrect
<b>Project Demonstration &amp; Presentation</b>	All defined objectives are achieved as per time; All modules of project are well integrated and system working is accurate; Contents of presentations are appropriate and well delivered; Proper eye contact with audience and clear voice with good spoken language	All defined objectives are achieved; Integration of all modules not done and system working is not very satisfactory; Contents of presentations are appropriate and well delivered; Clear voice with good spoken language but less eye contact with Audience	All defined objectives are achieved; Modules of project are not properly integrated; Contents of presentations are appropriate but not well delivered; Eye contact with only few people and unclear voice	Only some of the defined objectives are achieved; Modules are not in proper working form that further leads to failure of integrated system; Contents of presentations are not appropriate and not well delivered; Poor eye contact with audience and unclear voice

**Rubrics for Project Work Phase -2 Dissertation Assessment – (Marks: 30)**

<b>Particulars</b>	<b>Excellent (9-10)</b>	<b>Good (6-8)</b>	<b>Satisfactory (3-5)</b>	<b>Poor (0-2)</b>
<b>Description of Concepts and Technical Details</b>	Complete explanation of the key concepts; Strong description of the technical requirements of the project	Complete explanation of the key concepts; In-sufficient description of the technical requirements of the project	Complete explanation of the key concepts but little relevance to literature; In-sufficient description of the technical requirements of the project	Inappropriate explanation of the key concepts; Poor description of the technical requirements of the project
<b>Conclusion and Discussion</b>	Results are presented in very appropriate manner; Project work is well summarized and concluded; Future extensions in the project are well specified	Results are presented in good manner; Project work summary and conclusion not very appropriate; Future extensions in the project are specified	Results presented are not much satisfactory; Project work summary and conclusion not very appropriate; Future extensions in the project are specified	Results are not presented properly; Project work is not summarized and concluded; Future extensions in the project are not specified
<b>Overall Report</b>	Project report is according to the specified format; References and citations are appropriate and well mentioned	Project report is according to the specified format; References and citations are appropriate but not mentioned well	Project report is according to the specified format but some mistakes; In-sufficient references and citations	Project report not prepared according to the specified format; References and citations are not appropriate

Rubrics for Project Work Phase - 2 Presentation Assessment (out of 70 marks) =

Rubrics for Project Work Phase - 2 Report Assessment (out of 30 marks) =

Total Marks for Project work Phase-2 (out of 100 marks) =

Signature of the Guide

Name:

Signature of the HOD

**SEMESTER END EXAMINATION (SEE)**  
**Project Work phase-2 (P24MCA43)**

**Rubrics for Project Dissertation Evaluation (Marks: 50)**

<b>Particulars</b>	<b>Excellent (4-5)</b>	<b>Good (3)</b>	<b>Satisfactory (2)</b>	<b>Poor (0-1)</b>
<b>Relevance of the topic in the present context</b>	Relevance and impact of the project is made clear, and the report addresses them in a focused and logical manner	Relevance and impact of the project is made clear, and the report addresses them	Relevance and impact are stated ambiguously	The report does not clearly address any of them
<b>Originality of the topic</b>	Innovative system	Add on to existing system	Changes to existing system	Code migration for existing system
<b>Literature study</b>	Detailed and extensive explanation of the specifications and the limitations of the existing systems	Collects a great deal of information and good study of the existing systems	Moderate study of the existing systems collects some basic information	Explanation of the existing study and the limitations of the existing systems not very satisfactory; limited information
<b>Problem definition with functional requirements</b>	State the problem clearly and identify underline issues; strong description of the functional requirements of the project	Adequately define the problem; In-sufficient description of the functional requirements of the project	Fails to define the problem adequately; In-sufficient description of the functional requirements of the project	Doesn't identify the problem; poor description of the functional requirements of the project
<b>Experimental observation / Theoretical modelling,</b>	Shows excellent understanding of experimental procedure and theory thoughts	Shows good understanding of experimental procedure and theory thoughts	Shows minimal understanding of experimental procedure e and theory thoughts	Shows no understanding of experimental procedure e and theory thoughts
<b>Result presentation, Discussion</b>	Results are presented in very appropriate manner;	Results are presented in good manner;	Results presented are not much satisfactory;	Results presented are not much satisfactory;

<b>Conclusion, Future scope and References</b>	Project work is well summarized and concluded; Future enhancement in the project are well specified; Sources are Acknowledged with full reference details	Project work is well concluded; Future enhancement in the project are Specified; Sources are acknowledged with bare reference details	Project work summary and conclusion not very appropriate; Future enhancement in the project are specified; Sources are acknowledged with partial reference details	Project work summary and conclusion not very appropriate; Future enhancement in the project are not specified; Sources are not acknowledged
<b>Overall presentation of the Thesis</b>	All required elements of the report are present and completed efficiently	All required elements of the report are present and completed to a satisfactory standard	All required elements are provided but in a haphazard way	Key elements of the report are not provided. Overall presentation of the document is not to a professional standard
<b>Plagiarism Check</b>	Uniqueness 90% and above	-	-	-
<b>Paper Publication</b>	Paper is presented in conference / published in reputed journals	Paper is accepted in conference / journal	Paper is submitted in conference / journal and waiting for the review	Paper is not submitted to any conference / journal

Total Marks for Project Work phase-2 Dissertation Assessment (out of 50 marks) =

Signature of the Internal Examiner

Signature of the External

ExaminerName:

## Rubrics for Viva-Voce (Marks: 50)

Particulars	Excellent (9-10)	Good (6-8)	Satisfactory (3-5)	Poor (0-2)
<b>Presentation of background of work undertaken</b>	Detailed and extensive explanation of the specifications and the limitations of the existing systems	Collects a great deal of information and good study of the existing systems	Moderate study of the existing systems collects some basic information	Explanation of the specifications and the limitations of the existing systems not very satisfactory; limited information
<b>Presentation of suitability of work chosen</b>	Detailed and extensive explanation of the purpose and need of the project	Good explanation of the purpose and need of the project	Average explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
<b>Presentation of finalization of work</b>	Division of problem into modules and good selection of computing framework; Appropriate design methodology and properly justified	Division of problem into modules and good selection of computing framework; Design methodology not properly justified	Division of problem into modules but inappropriate selection of computing framework; Design methodology not defined properly	Partial division of problem into modules and inappropriate selection of computing framework; Design methodology not defined properly
<b>Presentation of results, discussion of results and conclusion</b>	Results are presented in very appropriate manner; Project work is well summarized and concluded	Results are presented in good manner; Project work is well concluded;	Results presented are not much satisfactory; Project work summary and conclusion not very appropriate	Results presented are not much satisfactory; Project work summary and conclusion not very appropriate;
<b>Overall performance</b>	Contents of presentations are appropriate and well delivered; Proper eye contact with audience and clear voice with good spoken language	Contents of presentations are appropriate and well delivered; Clear voice with good spoken language but less eye contact with Audience	Contents of presentations are appropriate but not well delivered; Eye contact with only few people and unclear voice	Contents of presentations are not appropriate and not well delivered; Poor eye contact with audience and unclear voice

Total Marks for Project Work phase-2 Viva-Voce Assessment (out of 50 marks) =

Signature of the Internal Examiner

Signature of the External Examiner

Name:

Name: