RNS TRUST ®

RNS INSTITUTE OF TECHNOLOGY

Autonomous Institution affiliated to Visvesvaraya Technological University, Belagavi
Approved By AICTE, New Delhi. Accredited by NAAC 'A+' Grade
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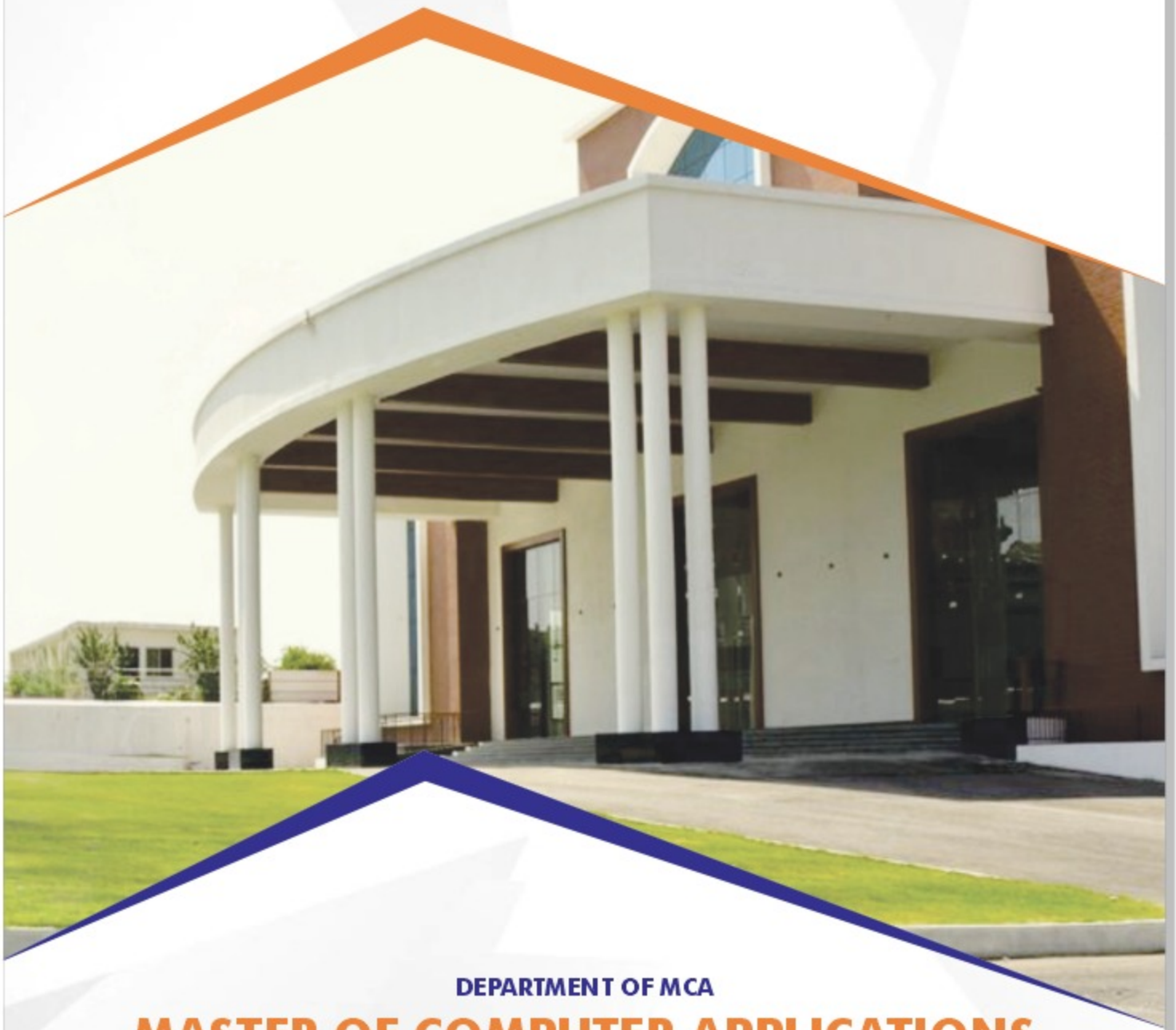

DEPARTMENT OF MCA

MASTER OF COMPUTER APPLICATIONS

Scheme and Syllabus of I - IV Semesters

2024 SCHEME

www.rnsit.ac.in

Master of Computer Applications (MCA)
Scheme and Syllabus
Batch 2024 - 2026

(As per NEP-2020)
(Effective from the academic year 2024 – 25)

About RNSIT

RNS Institute of Technology, familiar as RNSIT was established in the year 2001. It is the brainchild of Dr. R. N. Shetty, a well-known industrialist, and a great philanthropist. The institution was established with the sole purpose of imparting quality education in Engineering, Technology and Management. Being one of the premier engineering colleges in the country RNSIT is marching towards placing itself in the global map by excelling in academics and placements.

Lush green campus, state of the art infrastructure, well equipped laboratories, hundreds of activities, numerous new initiatives, consistent VTU ranks, path breaking placements, cultural extravaganza, Sports events, 4000 + students and 300 + faculty – with all these RNSIT has become dream destination for engineering aspirants across the country.

Vision

"Building RNSIT into a World Class Institution"

Mission

- To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by
- Attracting quality Students and preparing them with a strong foundation in fundamentals to achieve distinctions in various walks of life leading to outstanding contributions
- Imparting value based, need based, choice based, and skill based professional education to the aspiring youth and carving them into disciplined, World class Professionals with social responsibility
- Promoting excellence in Teaching, Research and Consultancy that galvanizes academic consciousness among Faculty and Students
- Exposing Students to emerging frontiers of knowledge in various domains and make them suitable for Industry, Entrepreneurship, Higher studies, and Research & Development
- Providing freedom of action and choice for all the Stakeholders with better visibility

DEPARTMENT OF MASTER OF COMPUTER APPLICATIONS

About the Department

Master of Computer Applications is a postgraduate course with an intake of 120. It is a two-year program spread over four semesters. The inception of the MCA program at RNSIT was in 2003 designed to nurture multidisciplinary UG graduates into high-quality professionals. This course is designed for students who wish to explore a career either a step towards Ph.D. or IT Industry. The program aims to tap the potential of young talented minds for challenging IT opportunities. Department has constituted Center of Excellence in IoT and Cyber Security to progress itself towards rapid advancements in various specialized fields. MCA Department has conducted 20 FDPs, 2 International Conferences, 1 National conference, and over 100 invited talks for the benefit of faculties and students.

MCA Department is a blend of enthusiastic youngsters and a group of experienced, committed, and dedicated staff and experts with an enviable infrastructure. The first batch of MCA rolled out in the year 2006 and subsequent batches have resulted in top-class alumni and entrepreneurs. MCA program at RNSIT has emerged as one of the top priorities for students opting at PGCET. The program is approved by AICTE and affiliated to VTU

Vision of the Department

"Synergizing Computer Applications for the Real World."

Mission of the Department

- Produce technologists of the highest calibre to engage in design search and development, to enable the nation to be self-reliant
- Give conceptual orientation in basic computer applications and mathematics, motivate the students for lifelong learning
- Integrate project experiences at every level of the postgraduate curriculum to give a firm practical foundation.

Program Educational Objectives

- **PEO1:** Exhibit their expertise in problem Solving skills through design, analysis, Implementation and evaluation of hardware and software systems.
- **PEO2:** Engage in the Computer Science and Applications related Profession locally and globally by contributing ethically to the competent and professional practices.
- **PEO3:** Effectively adapt as individuals and as team members in multidisciplinary projects involving technical, managerial, economic and social constraints.
- **PEO4:** Demonstrate Leadership and Entrepreneurship Skills by incorporating organizational goals and providing facilities for peer members with defined objective
- **PEO5:** Develop Communication Skills necessary to function productively to achieve successful professional career with integrity and societal commitments

Program Outcomes

- **PO1:** Foundation Knowledge: Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- **PO2:** Problem Analysis: Identify, review, formulate and analyze problems for primarily focusing on customer requirements using critical thinking frameworks.
- **PO3:** Development of Solutions: Design, develop and investigate problems with an innovative approach for solutions incorporating ESG/SDG goals.
- **PO4:** Modern Tool Usage: Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- **PO5:** Individual and Teamwork: Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- **PO6:** Project Management and Finance: Use the principles of project management such as scheduling, work breakdown n structure and be conversant with the principles of Finance for profitable project management.
- **PO7:** Ethics: Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- **PO8:** Life-long learning: Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

Program Specific Outcomes

- PSO1: Solve real world computing system problems of various industries by understanding and applying the principles of mathematics, computing techniques and business concepts.
- PSO2: Design, develop, test, deploy and maintain applications for desktop, web, mobile, cloud and cross platforms using modern tools and technologies.
- PSO3: Achieve their career goals in the software industry or pursue higher studies and enhance their professional knowledge.
- PSO4: Practice professional ethics, integrity, leadership and social responsibility.

Outline

In line with affiliated University (VTU 2024 Scheme), it is proposed to have 80 credits for the award of MCA degree.

Credit Definitions:

One hour Lecture (L) per week 1 credit
Two hours Tutorial (T) per week 1 credit
Two hours Practical(P) per week 1 credit

Credit Distribution among Curricular Components

Credits for the Two-Year MCA Program – Scheme 2024										
Total										
Semester	PCC	PEC	BSC	IPCC	PCCL	NCMC	TS	PROJ	INT	Total Credits
I	6	-	3	8	1	PP	-	-	-	**18**
II	16	-	-	4	2	PP	-	-	-	**22**
III	-	6	-	4	-	-	-	14	-	**24**
IV	-	3	-	-	-	-	2	-	11	**16**
Total	**22**	**13**	**3**	**12**	**3**	**-**	**2**	**14**	**11**	**80**

Note: PCC: Professional Core Course. **PEC**- Professional Elective Course, **BSC**-Basic Science Courses, **IPCC**-Integrated Professional Core Courses, **PCCL-** Professional Core Course Lab, **NCMC**-Non-Credit Mandatory Course, **TS:** Technical Seminar, **INT:** Industry/ Research Internship leading to the project work /startup **PROJ:** Project work outcome of Internship.

Department of Master of Computer Applications
FIRST SEMESTER CREDIT SCHEME

I SEMESTER (MCA)

Sl. No	Course Type	Course Code	Course Title	Teaching Hours per Week			Termwork (TW)+Self learning (SL) per semester	Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ SDA		Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA						
1	BSC/ PCC/ IPCC	MMC101 (IPCC)	Programming and Problem Solving in C	3	2	0	45	03	50	50	100	4
2		MMC102 (BSC)	Discrete Mathematics and Graph Theory	3	0	0	45	03	50	50	100	3
3		MMC103 (PCC)	Object Oriented Programming using JAVA	3	0	0	45	03	50	50	100	3
4		MMC104 (IPCC)	Python Programming	3	2	0	45	03	50	50	100	4
5		MMC105 (PCC)	Operating System	3	0	0	45	03	50	50	100	3
6	PCCL	MMCL106	JAVA Programming Laboratory	0	2	0	15	03	50	50	100	1
7	NCMC	MRMI107	Research Methodology and IPR (Online)	Online courses (online.vtu.ac.in)								PP
8	**NCMC**	**MMAT108**	**Mathematics for MCA Students**	2	2	0	15	03	100	-	100	PP
	Total								**300**	**300**	**600**	**18**

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:** None Credit Mandatory Course, **L**: Lecture, **P**: Practical, **T/SDA**: Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students) **MRMI107**: Research Methodology and IPR (Online) for the students who have not studied this course in the Undergraduate level. This course is not counted for vertical progression; Students must qualify for the award of the master's degree.

Basic Science Courses **(BSC):** Courses like Mathematics/ Science are the prerequisite courses that the concerned engineering stream board of Studies will decide. Professional Core Course **(PCC):** Courses related to the stream of engineering, which will have both CIE and SEE components, students must qualify in the course for the award of the degree. **Integrated Professional Core Course (IPCC):** Refers to a Professional Theory Core Course Integrated with practical 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. **Professional Core Course Laboratory (PCCL):** 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

- Interact with industry (small, medium, and large).
- Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
- Involve in case studies and field visits/ fieldwork.
- Adapt to the use of standards/codes etc., to narrow the gap between academia and industry.
- Handle advanced instruments to enhance technical talent.
- Gain confidence in the modelling of systems and algorithms for transient and steady-state operations,
- thermal study, etc.
- 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.

MRMI107-Research Methodology and IPR- 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 MMAT108-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.

SECOND SEMESTER CREDIT SCHEME

II SEMESTER (MCA)

Sl. No	Course Type	Course Code	Course Title	Teaching Hours per Week			Term work (TW)+Self learning (SL) per semester	Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ SDA		Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA						
1	PCC/ IPCC/	MMC201 (IPCC)	Machine Learning and Data Analytics using python	3	2	0	45	03	50	50	100	4
2		MMC202 (PCC)	Database Management Systems (DBMS)	3	0	2	45	03	50	50	100	4
3		MMC203 (PCC)	Data Structure and Algorithms	3	0	2	45	03	50	50	100	4
4		MMC204 (PCC)	Software Engineering	3	0	2	45	03	50	50	100	4
5		MMC205 (PCC)	Web Application Development	3	0	2	45	03	50	50	100	4
6	PCCL	MMCL206	DBMS and Web Technologies Laboratory	0	2	0	15	03	50	50	100	1
7	PCCL	MMCL207	Data Structure and Algorithms Laboratory	0	2	0	15	03	50	50	100	1
8	NCMC	MAEC208	Ability Enhancement Courses with Seminar-I									PP
	Total								**350**	**350**	**700**	**22**

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**: None Credit Mandatory Course, **L:** Lecture**, P:** Practical**, T/SDA:** Tutorial / Skill Development Activities (Hours are for Interaction between faculty and students)

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 must qualify in the course for the award of the degree. **IPCC: Integrated Professional Core Courses:** Refers to a Professional Theory Core Course Integrated with practical 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

- Interact with industry (small, medium, and large).
- Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
- Involve in case studies and field visits/ fieldwork.
- Accustomed to the use of standards/codes etc., to narrow the gap between academia and industry.
- Handle advanced instruments to enhance technical talent.
- Gain confidence in the modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
- Work on different software/s (tools) to simulate, analyse 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.

MAEC208- Ability Enhancement Courses with Seminar-I - None Credit Mandatory Course (NCMC), Students must select the Topic like ERP, R Programming, Scripting language, Web Development Application, etc. They must develop a small prototype and demonstrate to all the class.

THIRD SEMESTER CREDIT SCHEME

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Term work (TW) + Self learning (SL) per semester	Examination				
				Theory	Tutorial/Subject activity (T)	Practical (P)		Duration in hours	CIE Marks	SEE Marks	Total Marks	Credits
				L	T	P	TW					
1	IPEC	MMCx301A	Specialization(X)-Course I	3	0	2	45	03	50	50	100	04
2	PEC	MMCx302B	Specialization(X)-Course II	3	0	0	45	03	50	50	100	03
3	PEC	MMCx303C	Specialization(X)-Course III	3	0	0	45	03	50	50	100	03
4	PROJ	MPRJ304	Project Work	28 hours per week				03	100	100	200	14
TOTAL									**250**	**250**	**500**	**24**

Students can opt for any one specializations from the list below:

Specialization	Data Science (A)		Cyber Security (B)	
No	**Course Code**	**Course Title**	**Course Code**	**Course Title**
1	MMCA301A	Exploratory Data Analysis	MMCB301A	Computer Networks and Security
2	MMCA302B	Data Visualization	MMCB302B	Ethical Hacking
3	MMCA303C	Big Data Analytics with python	MMCB303C	Blockchain Technologies

Specialization	AI & ML (C)		Web and Mobile Application Development (D)	
No	**Course Code**	**Course Title**	**Course Code**	**Course Title**
1	MMCC301A	Natural Language Processing	MMCD301A	Web Development using Full Stack
2	MMCC302B	Machine Learning Techniques	MMCD302B	Cloud computing
3	MMCC303C	Generative and Agentic AI	MMCD303C	Mobile Application Development

PEC - Professional Elective Course

PROJ-Project work

Project work is a significant component aimed at fostering research, practical application of knowledge, and innovation. The evaluation process generally follows these steps:

1. Selection and Approval of Project Work:

- 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

2. 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.

3. 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.

4. 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. The panel 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 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 policies.
- This structured evaluation ensures a comprehensive assessment of the students' practical and research capabilities, preparing them for further research or professional practice

FOURTH SEMESTER CREDIT SCHEME

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Field Work	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
1	PEC	MMC401	(Online Courses) 12 weeks duration	4 Hours per week		--	--	--	100	3
2	TS	MMC402	Technical Seminar	4 Hours per week		03	100	--	100	2
3	INT	MINT403	Research Internship/Industry Internship /Startup Internship	24 Hours per week		03	100	100	200	11
TOTAL							**200**	**100**	**400**	**16**

PEC- Professional Elective Course**, INT:** Industry/ Research Internship leading to the project work /startup

TS: Technical Seminar: Students shall mandatorily present the seminar based on the new technologies. 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 fail in the seminar course and have to complete the same during the subsequent semester.

Paper Publication under Scopus/WOS/Patent is a part of Evaluation.

Mxxx401: Student must take 12 weeks online course in NPTEL/MOOC/Coursera

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 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

Startup Internship: A startup internship is a dynamic opportunity for students, recent graduates, or early-career professionals to gain hands-on experience working in a fast-paced, entrepreneurial environment. Interns typically collaborate with small, agile teams and are often given significant responsibilities across various functions such as marketing, product development, operations, customer support, or software development.

Semester- I

Programming and Problem Solving in C			
Course Code	**MMC101**	CIE Marks	50
Teaching Hours/Week (L: P: SDA/T) Term work (TW)+ Self learning (SL) per semester	3:2:0 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

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

Module-1	**9 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	
Module-2	**9 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.	
Module-3	**9 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.	
Module-4	**9 hours**
STRUCTURES 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.	
Module-5	**9 hours**

FILE PROCESSING Files – Types of file processing: Sequential access, Random access –Sequential access file - Random access file - Command line arguments.

Sl. NO	Experiments
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 R 100 as meter charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of the 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.

Suggested Learning Resources:

TEXTBOOKS:

1. Reema Thareja, "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.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st 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.

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Demonstrate knowledge on C Programming constructs
CO2	Develop simple applications in C using basic constructs
CO3	Develop and implement applications using arrays and strings
CO4	Analyse and implement modular applications in C using functions
CO5	Design applications in C using structures and pointers

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPCC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

- The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

Discrete Mathematics and Graph Theory			
Course Code	**MMC102**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	3:0:0 45	SEE Marks	50
Total Hours of Pedagogy	90 Hours	Total Marks	100
Credits	3	Exam Hours	03

Course Learning objectives:

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

Module-1	**9 hours**
Basic Structures: Sets, Principle of Inclusion, Exclusion and Pigeonhole principal Functions and Matrices: Eigenvalues and Eigenvectors.	
Module-2	**9 hours**
Mathematical Logic, Propositional Logic, Applications of Propositional Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference Introduction to Proofs	
Module-3	**9 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.	
Module-4	**9 hours**
Eulerian and Hamiltonian graphs: Euler graphs, Operations on graphs, Hamiltonian paths and circuits, Directed graphs – types of digraphs, Digraphs and binary relation. Graph Coloring: Coloring- Chromatic	
Module-5	**9 hours**
Random variable and probability distribution: Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co- variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems.	

Suggested Learning Resources:

Textbooks:

1. Kenneth H Rosen, "Discrete Mathematics and its Applications", McGraw Hill publications, 7th 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.

References Books

1. J.K Sharma "Discrete Mathematics", Mac Millian Publishers India, 3rd edition,2011.
2. Garry Chart and Ping Zhang, Introduction to Graph Theory, Tata McGraw-Hill, 2006.
3. Frank Harary, Graph Theory, Narosa Publishing House, Latest edition.

Web links and Video Lectures (e-Resources):

1. https://archive.nptel.ac.in/courses/111/106/111106086/
2. https://onlinecourses.nptel.ac.in/noc20_cs82/preview

Skill Development Activities Suggested

1. Translating English Sentences into logical statements
2. Applying Graph theory concepts to design State and National highways across the Country

Course outcome (Course Skill Set)

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

Sl. No.	Description
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.
CO2	Understand the basics of graph theory and their various properties
CO3	Understand basic concepts of mathematical logic for analyzing propositions and proving theorems and Use sets and its operations algebraically for solving real world problems.
CO4	Apply graph theory concepts to solve real world problems in Computer Networking, Telecommunication Infrastructure, Transportation etc.
CO5	Model problems using graphs and to solve these problems algorithmically

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Object Oriented Programming using Java			
Course Code	**MMC103**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	3:0:0 45	SEE Marks	50
Total Hours of Pedagogy	90 Hours	Total Marks	100
Credits	3	Exam Hours	03

Course Learning objectives:

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

Module-1 **9 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

Module-2 **9 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, Character Extraction, 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

Module-3 **9 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.

Module-4 **9 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

Module-5 **9 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

Suggested Learning Resources:

Prescribed Textbooks: Java the Complete Reference Eleventh Edition by Herbert Schildt, Tata McGraw- Hill Edition, 2019

References Books

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

Web links and Video Lectures (e-Resources):

1. https://ia800303.us. archive.org/ 26/items/ JavaJavaJavaObjectorientedProblemSolving/ jjj- os.pdf
2. http://people.reed.edu/ ~jerry/121/materials/ artsciencejava.pdf
3. https://upload.wikimedia. org/wikipedia/ commons/e/e7/ Java_Programming.pdf
4. https://onlinecourses.swayam2.ac.in/aic20_sp1 3/preview
5. https://onlinecourses.swayam2.ac.in/aic20_sp1
6. 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 outcome (Course Skill Set)

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

Sl.No.	Description
CO1	Solve the given problem by applying OOP using java
CO2	Apply the fundamentals of Inheritance
CO3	Identify and list the different applications of event handling
CO4	Apply the concept of interface and abstract classes to define generic classes
CO5	Design the user defined exceptions by exception handling keywords (try, catch, throw, throws and finally)

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Python Programming			
Course Code	**MMC104**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning ((SL) per semester	3:2:0 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

1. The subject helps to improve the analytical skills of object-oriented programming
2. Formal introduction to Python programming
3. Overall development of problem solving and critical analysis

Module-1 **9 hours**

Object Oriented Programming: Introductions, OOP, classes, class attributes, instances, instance attributes, Constructor and Destructor, Encapsulation

Introduction to Python Programming Language: Introduction to python, program output, input, comments, operators, variables and assignment, numbers, if statement, while loop, for loop, and the range

Module-2 **9 hours**

Data Types: Operations and methods on strings, tuples, lists, sets and dictionaries. **Functions: Built-in Functions:** Lambda, MAP, Filters and User defined Functions **Magic Methods:** Magic method syntax, available methods

Module-3 **9 hours**

Basics of Polymorphism and Inheritance: Operator and function overloading, Introduction to Inheritance, types of Inheritance, sub classing and scope, overriding methods

Modules and Packages: What are modules, modules and packages, creation of packages, importing modules, importing packages.

Introduction to Numpy module: numpy basics, numpy data types, creation of ND array, nested sequences, numpy array iteration, concatenation

Module-4 **9 hours**

Reading and Writing Files: Introduction to File operation, opening a File, Techniques for Reading Files, Writing Files.

Context Managers: Context manager syntax, when you should write context managers.

Error and Exceptions: Introduction to exceptions in python, detecting and handling exceptions, exceptions as strings, raising exceptions, assertions, standard exceptions

Module-5	**9 hours**
Decorators: Understanding Decorators, Decorator Syntax, Decorators Functions, Decorator classes. Generators: Understanding Generators, Generator syntax, Generator Examples **OOP for Database Programming:** Introduction, Architecture, Steps for Connecting Database, Basic Operations with Examples	

LABORATORY

Students should implement using Python Language. Apply Unit testing and integration testing (As per problem definition). Develop various test cases, execute them and analyze the test results

1.	Implement 10 operations on string and Tuple
2.	Implement 10 operations on sets and lists
3.	Demonstrate dictionary concepts for a given scenario
4.	Implement importing of user defined modules using Magic Methods
5.	Implement any two types of Inheritance
6.	Implement overloading concept
7.	Implement overriding concept
8.	Demonstrate any five-exception handling mechanism using files
9.	Write a python program to Insert, Search, and Retrieve data into Employee Database
10.	Write a program to create Fibonacci series using generators and stack the same with decorator to find the time taken by the generator

Suggested Learning

Resources: Textbooks:

1. Hetland, Magnus Lie, Beginning Python: from novice to Professional, Apress, 3rd Edition, 2017, ISBN 978-1-4842-0029-2.
2. Sneeringer, Luke, Professional Python, John Wiley & Sons, 2016, ISBN -978-1-119-07085-6 Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming, SHROFF Publishers and Distributors Pvt, 3rd Edition, 2018, ISBN: 13:978935213681-0.
3. Wesley J Chun, Core Python Programming, Pearson Education, 3rd Edition, 2012, ISBN 13: 978-0-13-267820-9.

Web links and Video Lectures (e-Resources):

1. https://ia800303.us. archive.org/ 26/items/ JavaJavaJavaObjectorientedProblemSolving/ jjj- os.pdf
2. http://people.reed.edu/ ~jerry/121/materials/ artsciencejava.pdf
3. https://upload.wikimedia. org/wikipedia/ commons/e/e7/ Java_Programming.pdf
4. https://onlinecourses.swayam2.ac.in/aic20_sp1 3/preview
5. https://onlinecourses.swayam2.ac.in/aic20_sp1
6. 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 outcome (Course Skill Set)

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

Sl No.	Description
CO1	Understand the basic concepts of object-oriented programming
CO2	Identify and apply relevant object-oriented concepts in any real-world scenario.
CO3	Develop applications using arrays and strings
CO4	Design and implement modular applications in C using functions
CO5	Design python applications for given problem.

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPCC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

- The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

Operating Systems			
Course Code	**MMC105**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work(TW)+ Self learning(SL) per semester	3:0:0 45	SEE Marks	50
Total Hours of Pedagogy	90 Hours	Total Marks	100
Credits	3	Exam Hours	03

Course Learning objectives:

1. Explain the need and services of the operating system
2. Explore how the operating system handles processes and manages memory.

Module-1 **9 hours**

Introduction to Operating Systems: System Structure What operating systems do, Operating System Operations, Computing Environments, Operating System Services, System Calls, Types ofSystem Calls, System Programs, Operating System Structure, System Boot, Concept Process Concept, Inter process Communication

Module-2 **9 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

Module-3 **9 hours**

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

Module-4 **9 hours**

Memory Management Strategies: Basic Hardware, Swapping, Contiguous Memory Allocation, Segmentation, Paging,

Virtual Memory Management: Background, Demand Paging, Page Replacement

Module-5 **9 hours**

File System: File concept, Access methods, Directory overview Implementing File System Allocation methods, Free Space Management

Suggested Learning Resources:

Textbooks:

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

References Books

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

Web links and Video Lectures (e-Resources):

1. https://www.google.com/search?q=Abraham+Silberschatz%2C+Peter+Baer+Galvin%2C+Greg+Gagne%3A+Operating+Systems+Principles%2C+10th+Edition%2C+Wiley+%E2%80%93+India%2C+2019.&oq=Abraham+Silberschatz%2C+Peter+Baer+Galvin%2C+Greg+Gagne%3A+Operating+Systems+Principles%2C+10th+Edition%2C+Wiley+%E2%80%93+India%2C+2019.&gs_lcrp=EgZjaHJvbWUyBggAEEUYOdIBCDEwOTJqMGo3qAIAsAIA&sourceid=chrome&ie=UTF-8
2. https://www.youtube.com/results?search_query=Harvey+M+Deital%3A+Operating+Systems%2C+3rdEdition%2C+Addison+Wesley%2C+1990.

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 (Course Skill Set)

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

Sl. No.	Description
CO1	Describe the elements and various functionalities of the operating system
CO2	Apply the techniques of process management and synchronization.
CO3	Demonstrate handling deadlocks and prevention.
CO4	Analyze various memory management strategies and file handling methods.
CO5	Evaluate best process scheduling algorithm for designing a OS.

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CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

JAVA Programming Laboratory			
Course Code	**MMCL106**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	0:2:0 15	SEE Marks	50
Credits	1	Exam Hours	03

Course Learning objectives:

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

Sl.NO	Experiments
1	Write a Java program to print the following triangle ofnumbers1 1 2 1 2 3 1 2 3 4 1 2 3 4 5
2	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)
3	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
4	Write a Java program to demonstrate a division by zero exception
5	Write a Java program to implement Inner class and demonstrate its Access protection.
6	Write a Java program to demonstrate Constructor Overloading and Method Overloading.
7	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.
8	Write a Java applet program, which handles keyboard event.
	Demonstration Experiments (For CIE) if any
9	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

10	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 another program.

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Describe object-oriented programming concepts to solve real world problems
CO2	Explain the concept of class and objects with access control to represent real world entities
CO3	Apply the concept of interface and abstract classes to define generic classes.
CO4	Develop the concepts inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords.
CO5	Design the user defined exceptions by exception handling keywords (try, catch, throw, throws and finally)

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation in **1-Credit Lab Course**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	**50**	**25**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Mathematics for MCA Students (Mandatory Learning Course) A bridge course for graduates joined for MCA Programme without study of Mathematics at Mathematics at 10+2 level or at Graduation level			
Course Code	**MMAT108**	CIE Marks	100
Teaching Hours/Week (L:P: S: T) Term work (TW)+ Self learning (SL) per semester	3:2:0 15	SEE Marks	-
Total Hours of Pedagogy	90 Hours	Total Marks	100

Course Learning objectives:

- 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 analyze 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.

Module-1: Set Theory **9 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.

Module-2: Logic and Propositions **9 hours**

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

Module-3: Matrices and Determinant **9 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.

Module-4: Sequence and Series **9 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.

Module-5: Probability Theory **9 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.

Suggested Learning Resources:

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://academicearth.org/
- VTU EDUSAT PROGRAMME-20

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz
- Group assignment
- Seminars

Course outcome (Course Skill Set)
At the end of the course, the student will be able to:

Sl. No.	Description
CO1	Widen the knowledge of Basic concepts in Set Theory and Apply the fundamentals of set theory and Relations to the given problem
CO2	Understand mathematical reasoning to read, comprehend and construct mathematical arguments
CO3	Understand the Basic Concepts in Matrices and Formulate the problems in Matrix expression
CO4	Determine the sum of the first N terms of an arithmetic and Geometric series
CO5	Get the basic concepts of probability and find the probability of simple and compound events

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	60	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 60 marks.
Assessment (B)	20	-	Two Assignments / Skill development Activity methods scaled to 20 marks.
Seminar (C)	20		Course Seminar suitably planned to attain the COs and POs for 20 Marks (duration 01 hours).
Total CIE (A+B+C)	**100**	**40**	The sum of Two tests, two assignments, and a seminar will be out of 100 marks
• The minimum marks to be secured in CIE is 40 (40%) out of allotted 100 marks to qualify and become eligible for the award of a degree.			

Semester- II

Machine learning and Data analytics using Python			
Course Code	**MMC201**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	3:2:0 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

1. Understand foundational concepts in machine learning and data analytics.
2. Gain proficiency in Python for data analysis and machine learning tasks.
3. Learn and apply various machine learning algorithms and techniques.
4. Develop skills in data pre-processing, visualization, and model evaluation.
5. Prepare students for industry roles involving data-driven decision making and predictive modelling.

Module-1 **9 hours**

Introduction to Machine Learning and Python:

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.

Teaching Learning Process:

Lectures with PowerPoint presentations, Hands-on coding exercises using Jupiter notebooks, Interactive discussions and problem-solving sessions, Assignments and quizzes for assessment.

Module-2 **9 hours**

Supervised Learning:

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.

Teaching Learning Process:

Lab exercises on regression and classification models, Practical coding sessions with real-time problem-solving, Group projects on developing and evaluating supervised learning models, Continuous assessment through quizzes and coding challenges.

Module-3 **9 hours**

Unsupervised Learning: 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

Teaching Learning Process:

Lab exercises on clustering and dimensionality reduction, Practical coding sessions with unsupervised learning techniques, Group projects on applying unsupervised learning to real- world data, Continuous assessment through quizzes and practical tests.

Module-4 **9 hours**

Advanced Machine Learning Techniques:

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).

Module-5 **9 hours**

Data Analytics and Real-World Applications:

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

Teaching Learning Process:

Lab exercises on EDA and time series analysis, Practical sessions on deploying machine learning models, Group discussions on real-world case studies, Final project presentation and assessment.

Sl. NO	Experiments
1	Implement and demonstrate the FIND-S Algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate- Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3	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.
4	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file Compute the accuracy of the classifier, considering few test data sets.
5	Write a program to implement k-Nearest Neighbour 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 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.

Suggested Learning Resources:

TEXTBOOKS:

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

REFERENCES:

1. "Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor Flow " by Sebastian Raschka and Vahid Mirjalili.
2. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by AurélienGéron.
3. "Introduction to Machine Learning with Python".

Web links and Video Lectures (e-Resources):

1. https://youtu.be/7eh4d6sabA0?si=JWHNJRVS6NhQOPYe
2. https://youtu.be/kqtD5dpn9C8?si=LBep4HWaMFRrAPsD
3. https://youtu.be/4SJ7bEILPJk?si=5LurvjzUOuCew1W9

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 (Course Skill Set)

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

Sl. No.	Description
CO1	Demonstrate an understanding of machine learning concepts and techniques.
CO2	Perform data preprocessing and exploratory data analysis using Python.
CO3	Develop and evaluate machine learning models using Python libraries.
CO4	Apply machine learning algorithms to real-world data Problems.
CO5	Integrate data analytics and machine learning models into practical applications.

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPCC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

Database Management Systems (DBMS)			
Course Code	**MMC202**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work(TW)+ Self learning(SL) per semester	3:0:2 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	**4**	Exam Hours	03

Course Learning objectives:

1. Analyze the basic concepts and the applications of database systems.
2. Evaluate the different issues involved in the design and implementation of Database System.
3. Explain the basic concepts of relational data model, entity relationship model, relational database design, relational algebra and database language SQL and Postgres SQL.
4. Design and build a simple database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS

Module-1 **9 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

Module-2 **9 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 record, order by, group by, triggers, Set Operations, Aggregate Functions, Nested Sub queries, Views, Procedures.

Module-3 **9 hours**

Normalization – Introduction, non-loss decomposition and functional dependencies, First, Second, and third normal forms – dependency preservation, Boyce/Codd normal form.

Higher Normal Forms - Introduction, Multi-valued dependencies and fourth normal form, Join dependencies and fifth normal form

Module-4 **9 hours**

Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent Executions – Serializability- Recoverability – Implementation of Isolation – Testing for Serializability - Lock – Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity.

Module-5 **9 hours**

Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Check Points - Buffer Management – Failure with loss of non-volatile storage.

Suggested Learning Resources:

Textbooks:

1. Database System Concepts, Silberschatz, Korth, Mc Graw hill, 7th edition.
2. Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, TATA McGraw-Hill 3rd Edition.
3. Fundamentals of Database Systems, Elmasri and Navathe, 6th Edition, 2011, Pearson Education, ISBN-13: 978-0136086208.

References 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.

Web links and Video Lectures (e-Resources):

1. dev.mysql.com
2. www. Postgressql.org.
3. https://www.w3schools.com/mysql/mysql_rdbms.asp
4. https://www.w3schools.in/dbms/intro

Skill Development Activities Suggested

- The ability to design, develop, and administer complex databases using tools such as SQL (Structured Query Language)
- Configuring authentication and authorization. Easily configure user accounts, define access policies, modify restrictions, and access scopes

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
CO2	Use Structured Query Language (SQL) for database manipulation and demonstrate the basic of query evaluation.
CO3	Develop queries to interact with databases using relational algebra expression.
CO4	Develop queries using tuple and domain relation expression from queries.
CO5	Design and build simple database systems and relate the concept of transaction, concurrency control and recovery in database.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Data Structure and Algorithms			
Course Code	**MMC203**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	3:0:2 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

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

Module-1 **9 hours**

Introduction to Data Structures and Algorithms:

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. **Stacks:** Definition and operations: Push, pop, peek, Applications: Expression evaluation, backtracking, function calls.

Teaching Learning Process:

Lectures with PowerPoint presentations, Hands-on coding exercises in C, Interactive discussions and problem-solving sessions, Assignments and quizzes for assessment.

Module-2 **9 hours**

Queues, and Recursion, Linked Lists:

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. **Linked Lists: Singly linked list:** Creation, insertion, deletion, traversal, doubly linked list and circular linked list, Applications of linked lists.

Teaching Learning Process:

Case studies and real-world examples, Practical coding sessions, Group discussions and problem-solving exercises, Mid-term project focusing on stack and queue applications.

Module-3 **9 hours**

Trees and Graphs:

Trees: Definition and terminology: Root, leaf, internal node, height, depth, Binary Search trees: Traversal (preorder, inorder, postorder), creation, insertion, deletion,

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' algorithm, Floyd-Warshall algorithm.

Teaching Learning Process:

Lab exercises on tree and graph implementations, Interactive coding sessions with real-time problem-solving, Group projects to develop tree and graph applications, Continuous assessment through quizzes and coding challenges.

Module-4	**9 hours**

Algorithm Design Techniques: Divide and conquer, Greedy algorithms,

Sorting and Searching Algorithms: Sorting Algorithms: Basic concepts and classification, Comparison-based sorting: Bubble sort, selection sort, insertion sort, quicksort, Merge-sort, 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).

Teaching Learning Process: Demonstrations and hands-on coding practice, Problem-solving sessions with practical use cases Case studies on the application of sorting and searching algorithms, Assignments and group activities to solidify understanding.

Module-5	**9 hours**

Advanced Data Structures and Applications:

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.

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.

Teaching Learning Process:

Practical sessions on advanced data structures, Industry guest lectures, Project-based learning with real-world applications, Final project presentation and assessment.

Suggested Learning Resources:

Textbooks:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
2. Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009. Pearson.

References 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, 2nd 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. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
7. Computer Algorithms/C++, Ellis Horowitz, Sartaj Sahni 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 and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=BBpAmxU_NQo
2. https://www.youtube.com/watch?v=8hly31xKli0
3. https://archive.nptel.ac.in/courses/106/106/106106127/

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 (Course Skill Set)
At the end of the course the student will be able to:

Sl. No.	Description
CO1	**Understand** the fundamental data structures like arrays, linked lists, stacks, queues, Trees, Graphs to solve problems.
CO2	**Design and implement** fundamental linear data structures such as arrays, linked lists, stacks, and queues
CO3	**Design and implement** non-linear data structures like **trees and graphs**.
CO4	**Apply** advanced data structures like heaps, Segment trees and Fenwick trees to solve complex problems.

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CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Software Engineering			
Course Code	**MMC204**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work(TW)+ Self learning(SL) per semester	3:0:2 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	4	Exam Hours	03

Course Learning objectives:

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

Module-1 **9 hours**

SOFTWARE PROCESS AND AGILE DEVELOPMENT: Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile Process-Extreme programming-XP Process-Case Study.

Module-2 **9 hours**

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

Module-3 **9 hours**

SOFTWARE DESIGN: 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 design-Case Study

Module-4 **9 hours**

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

Module-5 **9 hours**

PROJECT MANAGEMENT: 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.

Suggested Learning Resources:

books:

1. Ian Sommerville- Software Engineering, 9th edition, Pearson publications.
2. Rajib Mall, —Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited,
   2009
3. Pankaj Jalote, —Software Engineering, A Precise Approach, Wiley India, 2010.Pankaj Jalote, Software Engineering, A Precise Approach, Wiley India, 2010.

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 (Course Skill Set)
At the end of the course the student will be able to:

Sl. No.	Description
CO1	Describe the fundamental software process models and the principles of requirement analysis.
CO2	Utilize design patterns and architectural styles to construct software systems.
CO3	Implement the software testing methodologies to ensure the quality and reliability of software.
CO4	Analyze the integration of software project management practices with DevOps principles to improve software delivery and operational efficiency.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Web Application Development			
Course Code	**MMC205**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work(TW)+ Self learning(SL) per semester	3:0:2 45	SEE Marks	50
Total Hours of Pedagogy	120 Hours	Total Marks	100
Credits	04	Exam Hours	03

Course Learning objectives:

1. To understand the fundamental concepts and technologies of web application development.
2. To gain proficiency in front-end and back-end web development.
3. To learn and apply modern web frameworks and libraries.
4. To develop skills in creating responsive and dynamic web applications.
5. To prepare students for industry roles requiring expertise in web development.

Module-1 **9 hours**

Introduction to Web Development and HTML5:

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 Apache.

Teaching Learning Process: Lectures with PowerPoint presentations, Hands-on coding exercises in HTML5, Interactive discussions and problem-solving sessions, Assignments and quizzes for assessment.

Module-2 **9 hours**

CSS3 and Responsive Web Design:

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.

Teaching Learning Process: Practical sessions on CSS3 and responsive design, Interactive coding exercises to implement responsive layouts, Group projects on developing responsive web pages, Continuous assessment through quizzes and assignments.

Module-3 **9 hours**

JavaScript and DOM Manipulation:

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).

Teaching Learning Process: Lab exercises on JavaScript and DOM manipulation, Practical coding sessions with real-time problem-solving, Group projects on creating interactive web applications, Continuous assessment through quizzes and coding challenges.

Module-4 **9 hours**

Front-End Frameworks and AngularJS:

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

AngularJS Basics: Introduction to AngularJS, Modules, controllers, and scope, Directives, expressions, and filters

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

Teaching Learning Process: Practical sessions on AngularJS basics and advanced topics, Interactive coding exercises to build AngularJS applications, Group projects on developing single-page applications, Continuous assessment through quizzes and practical tests.

Module-5 **9 hours**

Back-End Integration and Deployment:

Back-End Development: Introduction to server-side programming, Overview of server sub 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 full- stack 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.

Teaching Learning Process:

Lab exercises on back-end development and integration, Practical sessions on deploying web applications, Group discussions on web application security, Final project presentation and assessment.

Suggested Learning Resources: Textbooks:

1. Web Programming By Chris Bates, Wiley Publications
2. HTML5 Black Book by Dreamtech
3. Angular JS By Krishna Rungta
4. Bootstrap essentials by Snig by Packt-open source.

Skill Development Activities Suggested

- Activity Based Learning (Suggested Activities in Class)/ Practical Based learning The students with the help of the course teacher can take up activities which will enhance their activity-based learning like Quizzes, Assignments and Seminars.

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Demonstrate an understanding of web technologies and protocols.
CO2	Develop and deploy web applications using HTML5, CSS3, JavaScript, and modern frameworks.
CO3	Apply responsive design principles using frameworks like Bootstrap.
CO4	Implement dynamic web applications using AngularJS.
CO5	Integrate front-end and back-end technologies to create full- stack web applications.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation.

2, 3 and 4-Credit Theory Courses

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

DBMS and Web Technologies Laboratory			
Course Code	**MMCL206**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	0:2:0 15	SEE Marks	50
Credits	1	Exam Hours	03

Course Learning objectives:

1. To Provide a strong foundation in database concepts, technology, and practice.
2. To Practice SQL programming through a variety of database problems.
3. To Understand the relational database design principles.
4. To Demonstrate the use of concurrency and transactions in database.
5. To Design and build database applications for real world problems.
6. To become familiar with database storage structures and access techniques

Sl.No	Experiments
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, Authorname, Country, age) BORROW(USN, Bookid, Borrowed_Date) Execute the following Queries: 1. List the details of Students who are all studying in 2nd Sem MCA. 2. List the students who are not borrowed any books. 3. Display the USN, Student name, Branch_name, Book_name, Author_name, Books_Borrowed_Date of 2nd Sem MCA Students who borrowed books. 4. Display the number of books written by each Author. 5. Display the student details who borrowed more than two books. 6. Display the student details who borrowed books of more than one Author 7. Display the Book names in descending order of their names. 8. 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 alphabet "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: 1. Display the youngest player (in terms of age) Name, Team name, age in which he belongs of the tournament. 2. List the details of the stadium where the maximum number of matches were played. 3. List the details of the player who is not a captain but got the man_of _match award at least in two matches. 4. Display the Team details who won the maximum matches. 5. 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. A constituency 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 candidate are uniquely identified by using candidate_id, having Name, phone_no, age, state. A candidate belongs to only one party. There are many parties. Each party is uniquely identified by using Party_id, having Party_Name,Party_symbol. A candidate can compete 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: 1. List the details of the candidates who are contesting from more than one constituency which are belongs to different states. 2. Display the state name having maximum number of constituencies. 3. 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 years old, then insert the tuple into the voter else display the "Not an eligible voter msg". 4. Create a stored procedure to display the number_of_voters in the specified constituency. Where the constituency name is passed as an argument to the stored procedure. 5. Create a TRIGGER to UPDATE the count of " Number_of_voters" of the respective constituency in "CONSTITUENCY" 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 manytourists either in the same date or at different dates. Queries: 1. List the state name which is having maximum number of tourist places. 2. List details of Tourist place where maximum number of tourists visited. 3. List the details of tourists visited all tourist places of the state "KARNATAKA". 4. Display the details of the tourists visited at least one tourist place of the state but visited all states tourist places. 5. Display the details of the tourist place visited bythe 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) Meta element 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
	Demonstration Experiments (For CIE) if any

9	Consider the following database of student enrollment in courses and books adopted for each course.STUDENT (regno#: string, name: string, major: string, bdate: date) COURSE (course#: int, cname: string, dept: String) TEXT (book_ISBN#: int, book_title: string, publisher: string, author: string) ENROLL (regno#: string, course#: int, sem: int, marks: int) BOOK_ADOPTION (course#: int, sem: int, book_ISBN: int) Create the above tables by properly specifying the primary keys and the foreign keys Enter at least 7 to 10 records to each table. Execute SQL queries for the following requirements: List out the student details, and their course details. The records should be ordered in a semester- wise manner. List out the student details under a particular department whose name is ordered in a semester wise List out all the book details under a particular course Find out the Courses in which number of students studying will be more than 2. Find out the Publisher who has published more than 2 books.
10	Develop, test and validate an XHTML document that has checkboxes for apple (59 cents each), orange (49 cents each), and banana (39 cents each) along with submit button. Each check box should have its own onclick event handler. These handlers must add the cost of their fruit to the total cost. An event handler for the submit button must produce an alert window with the message „your total cost is $xxx", where xxx is the total cost of the chose fruit, including 5 percent sales tax. This handler must return „false" (to avoid actual submission of the form data). Modify the document to accept quantity for each item using textboxes.

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Describe database objects.
CO2	Illustrate a database schema for a given problem.
CO3	Apply entity-relationship diagrams to solve given database applications.
CO4	Evaluate SQL queries in Oracle for the given problem.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation in **1-Credit Lab Course**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	**50**	**25**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Data Structures and Algorithms Laboratory			
Course Code	**MMCL207**	CIE Marks	50
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	0:2:0 15	SEE Marks	50
Credits	1	Exam Hours	03

CO - Course objectives: This course will enable students to:

1. Understand the fundamentals of Linear and Non-linear data structures in problem solving.
2. Gain knowledge of data storage of each data structure and its access techniques.
3. Illustrate the working of stack and queue.
4. Design and analyze nonlinear data structures like tree and graph.
5. Develop ability to implement different Sorting and Search methods.

Sl.NO	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)
	Demonstration Experiments (For CIE) if any
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	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).

Course outcome (Course Skill Set)

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

Sl. No.	Description
CO1	Implement and analyze fundamental data structures such as Stack, Queue, and Linked List to solve computational problems efficiently.
CO2	Develop and apply searching algorithms (linear and binary search) to retrieve data effectively from linear data structures.
CO3	Design and implement various sorting techniques (like Bubble, Selection, Insertion, Merge, Quick Sort) and compare their performance on different datasets.
CO4	Construct and traverse tree data structures (binary trees, binary search trees) to represent hierarchical data and perform operations such as insertion, deletion,

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation in **1-Credit Lab Course**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE Practical (A)	30	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 30 marks.
CIE Practical Test (B)	20	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 20.
Total CIE Practical (A+B)	**50**	**25**	**Sum of Marks of Experiments, Record and Test shall be CIE marks awarded for a maximum of 50.**
SEE (C)	**50**	**20**	**SEE is a lab exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Semester- III

Data Science (A)

Course: Exploratory Data Analysis			
Course Code	**MMCA301A**	CIE Marks	**50**
Teaching Hours/Week (L: P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:2:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**120 Hours**	Total Marks	**100**
Credits	**04**	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.

Module-1 **9 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.

Module-2 **9 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.

Module-3 **9 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).

Module-4 **9 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).

Module-5	**9 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.

Suggested Learning Resources:

Prescribed Textbooks:

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

References 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**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand the role and importance of Exploratory Data Analysis in the data science pipeline.
CO2	Analyze univariate and bivariate datasets using appropriate summary statistics and visualization techniques.
CO3	Apply data analysis techniques to explore relationships between multiple variables and derive insights using Python.
CO4	Apply data transformation and cleaning methods to prepare raw data for further analysis.

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPEC):

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

SL No.	Laboratory Programs
1.	Use Python (Pandas, Seaborn, Matplotlib) to analyze a health dataset with BMI, age, gender, and lifestyle factors. Perform statistical summaries and visualize the relationships to identify groups
2.	Perform exploratory analysis on an IoT smart home dataset (temperature, humidity, motion, timestamp). Clean missing values, visualize trends, detect anomalies, and summarize
3.	Using Python (Pandas, Matplotlib, Seaborn), clean the Titanic dataset and create histograms of age, bar charts of passenger class, heatmaps of feature correlations, and pair plots of survival
4.	Create an interactive dashboard with Dash and Plotly that displays real-time stock prices, volumes, and moving averages with filters for selecting different stocks.
5.	Upload a large text dataset to HDFS and write a Hadoop MapReduce program to count word frequencies. Explain how YARN manages the job execution.
6.	Develop a PySpark streaming app to consume live Kafka data, apply Spark MLlib classification, and store results in MongoDB or Cassandra. Demonstrate the end-to-end workflow.

Course: Data Visualization			
Course Code	**MMCA302B**	CIE Marks	**50**
Teaching Hours/Week (L: P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Learning objectives:

- Understand foundational concepts of data mining, including data preprocessing, pattern discovery, and classification techniques.
- Apply data mining algorithms to extract useful patterns, trends, and insights from large datasets.
- Analyze and interpret mined data using appropriate visualization techniques and tools.
- Develop skills to evaluate the performance of various data mining models and choose suitable techniques based on problem context.

Module-1 **9 Hours**

Foundations of Data Mining and Data Preprocessing Introduction to Data Mining & Preprocessing Techniques: Introduction to data mining: Motivation, architecture, KDD process. Types of data: Structured, semi-structured, unstructured. Data preprocessing: Cleaning, integration, reduction, transformation, Missing Values and Noisy Data. Data summarization and visualization techniques for preprocessing analysis. Implementation using Python: Pandas, NumPy for basic preprocessing

Module-2 **9 Hours**

Data Mining Techniques and Algorithms Mining Techniques: Classification, Clustering & Association: Classification: Decision Trees, k-NN, Naive Bayes – concepts and implementation. Clustering: k-Means, Hierarchical clustering. Association rule mining: Market basket analysis, Apriori algorithm, FP-Growth. Evaluation methods: Confusion matrix, precision, recall, ROC.

Module-3 **9 Hours**

Data Visualization Techniques Static and Interactive Data Visualization with Python: Principles of effective data visualization. Visualization tools and libraries: Matplotlib, Seaborn, Plotly, Bokeh. Histograms, bar charts, scatter plots, heatmaps, and pair plots. Dashboard creation using Jupyter notebooks and interactive widgets. Case studies and real-world examples using multi-dimensional data.

Module-4	**9 Hours**
Visualizing Streaming and Real-Time Data Real-Time Analytics and Streaming Data Visualization Overview of streaming data: Sources, characteristics, and tools. Real-time processing with Apache Kafka, PySpark Streaming (introductory overview). Visualization strategies for streaming data. Tools: Dash by Plotly, Streamlit, Grafana. Case studies: Sensor data, web server logs.	
Module-5	**9 Hours**
Advanced Data Mining Applications and Trends Emerging Trends and Applications in Data Mining social media and text data. Sentiment analysis and NLP basics using Python. Time series analysis and visualization. Anomaly detection and predictive analytics. Ethical issues and future trends in data mining	

Suggested Learning Resources:

Textbooks:

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, Morgan Kaufmann.
2. Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and Python, O'Reilly Media.
3. Tim Grobmann, Mario Dobler, Data Visualization with Python, O'Reilly Media.

References Books:

1. Joel Grus , Data Science from Scratch: First Principles with Python, O'Reilly Media Second Edition, ISBN: 978-1492041139
2. Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media, ISBN: 978-1491912058

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=RlD5q_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:

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand foundational concepts of data mining and apply preprocessing techniques using Python.
CO2	Implement key data mining techniques such as classification, clustering, and association rule mining
CO3	Design and develop effective static and interactive data visualizations using Python libraries.
CO4	Apply real-time visualization strategies for streaming data using tools like Dash, Streamlit, and Grafana.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation

2, 3 and 4-Credit Theory Courses

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Course: Big Data Analytics Using Python			
Course Code	**MMCA303C**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	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 analyzing large-scale data using distributed computing techniques.

Module-1 **9 Hours**

Big Data Fundamentals and Ecosystem Overview

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

Module-2 **9 Hours**

Hadoop Architecture and MapReduce Programming 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 integration with Python

Module-3 **9 Hours**

Apache Spark for Big Data Analytics

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.

Module-4	**9 Hours**

NoSQL and Big Data Storage Systems

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.

Module-5	**9 Hours**

Big Data Tools and Industry Applications

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. Realtime analytics introduction using Kafka and Spark Streaming. Ethics and challenges in Big Data (privacy, bias, governance).

Suggested Learning Resources:

Prescribed Textbooks:

1. Tom White – Hadoop: The Definitive Guide, O'Reilly Media.
2. Vignesh Prajapati – Big Data Analytics with R and Hadoop, Packt Publishing.

Reference Books:

1. Chuck Lam, Hadoop in Action**,** Manning Publications, ISBN: 978-1935182191
2. Bill Chambers, Matei Zaharia, Spark: The Definitive Guide – Big Data Processing Made Simple*,* O'Reilly Media ISBN: 978-1491912218

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**
- **DetailedexplanationofBigDataconceptsandtools.**
- **Big Data Analytics Using Python (YouTube - Great Learning)**
- **https://www.youtube.com/watch?v=ZkZclIFmgVY**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand the fundamental concepts, evolution, and architecture of Big Data, including the Hadoop ecosystem.
CO2	Develop and execute distributed data processing tasks using HDFS and MapReduce programming techniques.
CO3	Analyze and implement in-memory data processing using Apache Spark and perform machine learning tasks with Spark MLlib.
CO4	Compare and evaluate NoSQL data models (Key-Value, Document, Column, Graph) and perform operations on HBase, MongoDB, and Cassandra.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation

2, 3 and 4-Credit Theory Courses

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Cyber Security (B)

Course: Computer Networks and Security			
Course Code	**MMCB301A**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:2:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**120 Hours**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Learning objectives:

- 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

Module-1 **9 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;

Module-2 **9 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.

Module-3 **9 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.

Module-4 **9 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.

Module-5 **9 Hours**

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.

Suggested Learning Resources:

Prescribed Textbooks:

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.

References Books:

1. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
2. 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**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Apply the basic concepts of networks like protocol, internet and OSI layers
CO2	Analyze the working of Physical Layer.
CO3	Demonstrate the various Switching networks
CO4	Analyze the given scenario and arrive at computer network-based solution.

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPEC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

- The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

SL No.	Lab Programs
1.	Implement three nodes point – to – point network with duplex links between them. Set the queue size, vary the bandwidth and find the number of packets dropped.
2.	Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
3.	Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
4.	Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
5.	**Risk Analysis and Ethical Hacking Simulation** **Objective:** Evaluate the components of an information security program through a simulated risk analysis and ethical hacking scenario. **Tools:** Risk management software (like FAIR or OCTAVE), Ethical hacking documentation templates (OWASP).
6.	**Controlled Attack Planning Simulation** **Objective:** Plan a controlled attack scenario, considering all factors that affect the engagement and outcomes. **Tools:** Engagement planning templates (e.g., from OWASP), Threat modeling tools (e.g., STRIDE).

Ethical Hacking			
Course Code	**MMCB302B**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Learning objectives:

- Grasp the ethical implications, legal considerations and best practices associated with ethical hacking
- Learn various methodologies for conducting penetration tests, including reconnaissance, enumeration and exploitation
- Gain hands-on experience with industry-standard tools (e.g., Nmap, Metasploit, Burp Suite) and techniques for vulnerability assessment, network scanning and exploitation
- Learn how to effectively document and present penetration testing results, including creating detailed reports and presentations that outline vulnerabilities, potential impacts etc.

Module-1 **9 Hours**

Introduction: Hacking Impacts, The Hacker, **The Framework:** Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration. **Security Program:** The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking.

Module-2 **9 Hours**

The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges. **Planning for a Controlled Attack:** Inherent Limitations, Imposed Limitations, timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement.

Module-3 **9 Hours**

Preparing for a Hack: Technical Preparation, Managing the Engagement. **Reconnaissance:** Social Engineering, Physical Security, Internet Reconnaissance.

Module-4 **9 Hours**

Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase. Exploitation: Intuitive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, Rootkits, Applications, War dialing, Network, Services and Areas of Concern.

Module-5 **9 Hours**

The Deliverable: The Deliverable, The Document, Overall Structure, Aligning Findings, Presentation.

The Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy.

Suggested Learning Resources:

Prescribed Textbooks:

1. James S. Tiller, "The Ethical Hack: A Framework for Business Value Penetration Testing", Auerbach Publications, CRC Press.

References Books:

1. EC-Council, "Ethical Hacking and Countermeasures Attack Phases", Cengage Learning.
2. Michael Simpson, Kent Backman, James Corley, "Hands-On Ethical Hacking and Network

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

  https://www.youtube.com/watch?v=fNzpcB7ODxQ

  https://www.youtube.com/watch?v=uHU2uajL1EE

  https://www.youtube.com/watch?v=K6V7fc5Hj2s

  https://archive.nptel.ac.in/courses/106/105/106105217

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Explain a comprehensive ethical hacking framework, integrating planning, reconnaissance, exploitation and risk analysis to identify vulnerabilities within information security systems.
CO2	Develop a strategic plan for a controlled ethical hacking engagement that aligns with business objectives and security policies, effectively navigating inherent and imposed limitations.
CO3	Model an ethical hacking engagement by effectively conducting reconnaissance through social engineering, physical security assessments and internet reconnaissance techniques.
CO4	Develop proficiency in employing enumeration techniques to gather critical information and prepare for exploitation, utilizing intuitive testing methods, evasion strategies and a variety of tools and applications.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation

2, 3 and 4-Credit Theory Courses

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Blockchain Technologies			
Course Code	**MMCB303C**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Learning objectives:

- To Understand Blockchain terminologies with its applications design
- To learn working principles of Blockchain and methodologies used in Bitcoin
- To gain knowledge on Ethereum Network, Wallets, Nodes, Smart contract & DApps
- To learn Blockchain Based Application Architecture using Hyperledger and the Smart Contract Lifecycle

Module-1 **9 Hours**

Distributed systems, CAP theorem, Byzantine Generals problem, Consensus. The history of Blockchain, Introduction to Blockchain, Various technical definitions of block chains, Generic elements of a Blockchain, Features of a Blockchain, Applications of Blockchain technology, Tiers of Blockchain technology, Consensus in Blockchain, CAP theorem and Blockchain, Benefits and limitations of Blockchain.

Module-2 **9 Hours**

Decentralization using Blockchain, Methods of decentralization, Blockchain and full ecosystem decentralization, Smart contract, Decentralized organizations, decentralized autonomous organizations, decentralized autonomous corporations, decentralized autonomous societies Decentralized applications, Platforms for decentralization. Cryptographic primitives: Symmetric cryptography, Asymmetric cryptography, Public and private keys, Hash functions: Compression of arbitrary messages into fixed length digest, Easy to compute, Pre-image resistance, Second pre-image resistance, Collision resistance, Message Digest (MD), Secure Hash Algorithms (SHAs), Merkle trees, Patricia trees, Distributed hash tables (DHTs), Digital signatures, Elliptic Curve Digital signature algorithm (ECDSA).

Module-3 **9 Hours**

Bitcoin, Bitcoin definition, Transactions, The transaction life cycle, The transaction structure, Types of transaction, The structure of a block , The structure of a block header, The genesis block, The bitcoin network, Wallets, Smart Contracts-History, Definition, Ricardian contracts, Smart contract templates, Oracles, Smart Oracles, Deploying smart contracts on a Blockchain, The DAO.

Module-4	**9 Hours**

Ethereum 101, Introduction, Ethereum clients and releases, The Ethereum stack, Ethereum Blockchain, Currency (ETH and ETC), Forks, Gas, The consensus mechanism, The world state, Transactions, Contract creation transaction, Message call transaction, Elements of the Ethereum Blockchain , Ethereum virtual machine (EVM), Accounts, Block, Ether, Messages, Mining, The Ethereum network. Hands-on: Clients and wallets – Geth.

Module-5	**9 Hours**

Hyperledger, Hyperledger as a protocol, Fabric, Hyperledger Fabric, Sawtooth lake, Corda.

Suggested Learning Resources:

Prescribed Textbooks:

1. Imran Bashir. "Mastring Blockchain", Third Edition, Packt – 2020.

References Books:

2. Andreas M , Mastering Bitcoin: Programming the Open Blockchain – O'rielly – 2017.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106104220
- https://www.geeksforgeeks.org/blockchain/
- https://www.tutorialspoint.com/blockchain/index.htm

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Explain the Blockchain terminologies with its applications. design
CO2	Illustrate the working principles of Blockchain and the Smart Contract Lifecycle
CO3	Demonstrate the principles and methodologies used in Bitcoin
CO4	Develop Ethereum Network, Wallets, Nodes, Smart contract and DApps.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	**Maximum Marks**	**Minimum Passing Marks**	**Evaluation Details**
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

AI & ML (C)

Course: Natural Language Processing			
Course Code	**MMCC301A**	CIE Marks	**50**
Teaching Hours/Week (L: P: SDA/T) Term work(TW)+ Self learning(SL) per semester	**3:2:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**120 Hours**	Total Marks	**100**
Credits	**04**	Exam Hours	**03**

Course Learning objectives:

- Understand the Fundamentals of Natural Language Processing
- Learn Text Pre-processing Techniques
- Implement Basic NLP Models
- Explore Word Embedding and Advanced NLP Models

Module-1 **9 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.

Module-2 **9 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 Embedding's (Word2Vec, GloVe) - Part-of-Speech (POS) Tagging: Introduction to syntactic categories

Module-3 **9 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

Module-4 **9 Hours**

Word Embedding's:

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

Module-5 **9 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-Chabot's and Conversational AI: Building simple conversational agents using NLP-Ethical Considerations: Bias in NLP models and ethical implications of NLP applications.

Suggested Learning

Resources: Textbooks:

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.

References Books:

1. **Rai, M. (2019).** Foundations of Natural Language Processing. Oxford University Press.
2. **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**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand the basic concepts of Natural Language Processing
CO2	Apply text pre-processing techniques
CO3	Apply Machine Learning Algorithms to NLP Tasks
CO4	Implement and train word embedding models (Word2Vec, GloVe) on text corpora

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPEC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.			

SL No.	Lab Programs
1.	Write a Python program for the following preprocessing of text in NLP: • Tokenization • Filtration • Script Validation • Stop Word Removal • Stemming
2.	Given the following short movie reviews, each labeled with a genre, either comedy or action: • fun, couple, love, love comedy • fast, furious, shoot action • couple, fly, fast, fun, fun comedy • furious, shoot, shoot, fun action • fly, fast, shoot, love action and A new document D: fast, couple, shoot, fly Compute the most likely class for D. Assume a Naïve Bayes classifier and use add-1 smoothing for the likelihoods.
3.	Demonstrate Information Retrieval using NLTK: • Corpora study • POS tagging
4.	Implement deep neural network for classification task (e.g., sentiment analysis or spam detection)
5.	Analyze student performance dataset: • Compute mean, median, mode, std. dev. • Create visualizations (histogram, boxplot, scatterplot)
6.	Build and demonstrate an auto encoder network using neural layers for data compression on image dataset.

Course: Machine Learning Techniques			
Course Code	**MMCC302B**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work(TW)+ Self learning(SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	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.

Module-1 **9 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

Module-2 **9 Hours**

Basics of Learning Theory : Multivariate Statistics, Essential Mathematics for Multivariate Data, Overview of Hypothesis, Feature Engineering and Dimensionality Reduction Techniques.
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

Module-3	9 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

Module-4	9 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

Module-5	9 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)

Suggested Learning Resources:

Prescribed Textbooks:

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.

References Books:

1. Tom M. Mitchell, "Machine Learning," McGraw-Hill Education, 2013. 4.
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://www.geeksforgeeks.org/machine-learning/**
- **https://www.w3schools.com/python/python_ml_getting_started.asp**
- **https://www.tutorialspoint.com/machine_learning/index.html**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understanding ML Fundamentals
CO2	Applying ML Algorithms
CO3	Model Evaluation and Optimization
CO4	Practical Implementation and Problem-Solving

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Course: Generative and Agentic AI			
Course Code	**MMCC303C**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	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

Module-1 **9 Hours**

Introduction to AI and Machine Learning

Types of Generative Models (e.g., LLM,SLM,GANs, VAEs, Autoregressive Models)- Neural Networks: Basic Architecture, Backpropagation, Activation Functions-Deep Learning Basics and its Applications-Unsupervised vs. Supervised Learning

Module-2 **9 Hours**

Introduction to Generative Adversarial Networks (GANs) and Variational Auto encoders (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

Module-3 **9 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

Module-4 **9 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

Module-5 **9 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

Suggested Learning Resources:

Prescribed Textbooks:

1. Gohil, P. (2019). Machine learning with Tensor Flow. BPB Publications.
2. Akerkar, R. (2020). Deep learning: A practitioner's approach. Springer.

References Books:

1. Arora, R. (2021). Artificial intelligence: A guide for thinking humans. Wiley India Pvt. Ltd.
2. 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=Hy4oyBthaqs**
- **https://www.youtube.com/watch?v=t64TZ5S-IeY**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand the Fundamentals concepts of Generative AI
CO2	Identify the performance of generative models using metrics
CO3	Analyze the ethical implications of generative AI
CO4	Apply algorithms to build and train generative models using frameworks

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods , if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Web and Mobile Application Development (D)

Course: Web Development using Full Stack			
Course Code	**MMCD301A**	CIE Marks	**50**
Teaching Hours/Week (L: P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:2:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**120 Hours**	Total Marks	**100**
Credits	**04**	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.

Module-1 **9 Hours**

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

Module-2 **9 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.

Module-3 **9 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.

Module-4 **9 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.

Module-5 **9 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.

Suggested Learning Resources:

Prescribed Textbooks:

1. Full Stack Open 2023 by University of Helsinki (Online Course Material)

Reference:

1. Node.js Design Patterns by Mario Casciaro and Luciano Mammino

Web links and resource:

https://youtu.be/nu_pCVPKzTk?si=DOAiec3IorQtKmjA

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Understand the fundamentals of web development using modern technologies.
CO2	Develop full-stack web applications using JavaScript,
CO3	Develop full-stack web applications using React, Node.js
CO4	Develop full-stack web applications using and MongoDB.

CO – PO MAPPING:

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

The following tables indicate the details of assessment and evaluation in theory and lab courses.

4-Credit Lab Integrated Theory Courses (IPEC)

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE- IA Tests (A)	20	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 20 marks.
Continuous and Comprehensive Evaluation (B)	10	-	Any one Assessment methods as per scaled to 10 marks.
Total CIE Theory (A+B)	**30**	**12**	**Marks of Tests and Assignments awarded for a maximum of 30.**
CIE Practical Lab	12	-	Marks awarded for Weekly Conduction of Experiments and Submission of Laboratory records, scaled to 12 marks.
CIE Practical Test	8	-	Average of marks of Two tests, each conducted for 100 marks covering all experiments, scaled to 8.
Total CIE Practical (C)	**20**	**08**	**Marks of Experiments, Record and Test awarded for a maximum of 20 marks.**
CIE: Theory + Practical (A + B + C)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks.**
SEE (D)	**50**	**20**	**SEE is a theory exam, conducted for 100 marks and scaled down to 50 marks. Exam duration shall before 3 hours.**
CIE+SEE (A+B+C+D)	**100**	**50**	**Final marks shall be the sum of marks scored in Components A, B, C and D**

- The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

SL No.	Lab Programs
1.	Write a JavaScript program to display Student Grade based on subject marks.
2.	Write a react program using Forms, useState, Controlled Components.
3.	Write a Simple Calculator program in Node.js (Command Line).
4.	Write a program to display Student Details Viewer using JSON & Web Programming"
5.	Write a program for Student Management using RESTful API (Node.js + Express)
6.	Write a Middleware program to Check for a Custom Header

Course: Cloud Computing			
Course Code	**MMCD302B**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	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

Module-1 **9 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.

Module-2 **9 Hours**

Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of parallel computing, Elements of distributed computing, Technologies for distributed

Module-3 **9 Hours**

Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.

Module-4 **9 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.

Module-5 **9 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.

Suggested Learning Resources:

Prescribed Textbooks:

1. RjkumarBuyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, TataMcGraw Hill, New Delhi, India, 2013

References 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/2LaAJq1lB1Q?si=Hi4UWAJOw1fML0YV**
- **https://youtu.be/RmuVkB3siYY?si=MT6IqmW8p3PytQGF**

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Demonstrate the fundamental and core concepts of cloud computing
CO2	Compare between parallel and distributed computing
CO3	Investigate the system virtualization and outline its role in enabling the cloud computing system model
CO4	Compare different deployment and service models of cloud to develop different varieties of applications

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	**Maximum Marks**	**Minimum Passing Marks**	**Evaluation Details**
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

Course: Mobile Application Development			
Course Code	**MMCD303C**	CIE Marks	**50**
Teaching Hours/Week (L:P: SDA/T) Term work (TW)+ Self learning (SL) per semester	**3:0:0** **45**	SEE Marks	**50**
Total Hours of Pedagogy	**90 Hours**	Total Marks	**100**
Credits	**03**	Exam Hours	**03**

Course Learning objectives:

- Programming technologies, design and development related to mobile applications.
- Topics include accessing device capabilities, industry standards, operating systems, and programming for mobile applications using an OS Software Development Kit (SDK).
- Upon completion, students should be able to create basic applications for mobile devices.

Module-1 **9 Hours**

History, Operating System, Setup, Project Basics, Create an AVD, The IDE, Main Editor, Project Tool Window, Intents, Activity, Layout File, View and ViewGroup Objects, What Intents are for, Implicit Intents, The UI Thread, Threads and Runnables, Storing Simple Data.

Module-2 **9 Hours**

Introduction to PWAs and Tooling: Intro. to Progressive Web Apps, Tools to Measure Progressive, WebApps. PWA Features - Service Workers: Promises, Fetch, Service Worker, Register the Service Worker, Updating, Service, Worker. Caching and Offline Functionality with Service Workers: The Fetch API, Cache API, going Offline, Different Caching Strategies.

Module-3 **9 Hours**

Features to Use: Adding your App to the Home Screen with Web App Manifest, Turning a Real App into a PWA Notifications: Web Notifications: Requesting Permission to Notify, sending a Notification, Tagging Notifications, Web Notifications with Service Workers

Module-4 **9 Hours**

Introducing Flutter - Defining Widgets and Elements Installing the Flutter SDK - Installing on Linux, System Requirements, Get the Flutter SDK, Check for Dependencies Understanding Widget Lifecycle Events - The Stateless Widget Lifecycle, The Stateful Widget Lifecycle Learning Dart Basics - Why Use Dart? Commenting Code, Running the main() Entry Point, Referencing Variables, Declaring Variables, Using Flow Statements, Using Functions, Import Packages, Using Classes, Implementing Asynchronous Programming

Module-5 **9 Hours**

Using Basic Widgets - Text, Container, Column, Row, Button Laying Out Your Widgets - Laying out the whole scene, MaterialApp widget The Scaffold widget, The AppBar widge Custom gestures for your custom widgets
- Decide on your gestures and behaviors, Create your custom widget, Add a Gesture Detector widget, Associate your gesture with its behavior

Suggested Learning

Resources: Prescribed

Textbooks:

1. Ted Hagos, Learn Android Studio 4: Efficient Java-Based Android Apps Development, Apress Publishing, 2nd Edition, 2020, ISBN: 9781484259368
2. Dennis Sheppard, Beginning Progressive Web App Development: Creating a Native App Experience on the Web, Apress Publishing, 2017, ISBN: 978148423090

References Books:

1. Rap Payne, Beginning App Development with Flutter, Apress Publishing, 2019, ISBN:

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 (Course Skill Set): At the end of the course the student will be able to:

SL. No.	Description
CO1	Apply core Android development concepts by creating activities, intents, and layouts, and managing threads for efficient data handling and UI updates.
CO2	Analyze the components of Progressive Web Applications (PWAs) to evaluate caching strategies and offline functionality using service workers and the Fetch API.
CO3	Design user-engaging web apps by implementing push notifications, web manifests, and custom notification behaviors with service workers.
CO4	Develop cross-platform mobile applications using Flutter by constructing interactive UIs with widgets, applying Dart programming principles, and managing tasteful and stateless widget lifecycles.

CO – PO MAPPING:

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

ASSESSMENT DETAILS (Both CIE and SEE)

The following tables indicate the details of assessment and evaluation **2, 3 and 4-Credit Theory Courses**

Assessment Type	Maximum Marks	Minimum Passing Marks	Evaluation Details
CIE – IA Tests (A)	25	-	Two tests each of 50 marks shall be conducted. Average of Two Internal Assessment Tests shall be scaled down to 30 marks.
Continuous and Comprehensive Evaluation (B)	25	-	Any two Assessment methods, if it is project based, one assignment shall be given, scaled to 25 marks.
Total CIE (A+B)	**50**	**25**	**CIE Evaluation is done for a maximum of 50 marks**
SEE (C)	**50**	**20**	**SEE is a theory exam conducted for 100 marks and scaled down to 50 marks. Exam duration shall be for 3 hours.**
CIE + SEE (A+B+C)	**100**	**50**	Final marks shall be the sum of marks scored in Components **A, B and C.**
• The minimum marks to be secured in CIE is 25 (50%) out of allotted 50 marks to appear for SEE.			

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To impart high quality education in Engineering, Technology and Management with a difference, enabling students to excel in their career by

- Attracting quality students and preparing them with a strong foundation in fundamentals so as to achieve distinctions in various walks of life leading to outstanding contributions.
- Imparting value based, need based, choice based and skill based professional education to the aspiring youth and carving them into disciplined, World class professionals with social responsibility.
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