



**RV College of
Engineering®**



Master of Computer Applications (MCA)

Scheme and Syllabus of I to IV Semester
(2024 Scheme)

99TH
NIRF RANKING
IN ENGINEERING
(2024)

1501+
Times Higher Education World University
Rankings (2024)
601+
Asia University Ranking 2024

EduFuture Excellence Award
**Best Private Engineering
University (South)**
by Zee Digital

1001+
Subject Ranking
(Engineering)

801+
Subject Ranking
(Computer Science)

IIRF 2024
Engineering Ranking India:
NATIONAL RANK - 07
STATE RANK - 02
ZONE RANK - 04

AAA
Rating in NPTEL Local Chapter
(Jan - Apr 2024)
State Ranking -1
National Ranking -16

CURRICULUM STRUCTURE

11 CREDITS
PROFESSIONAL CORE
COURSE

04 CREDITS
BASIC SCIENCE

16 CREDITS
INTEGRATED PROFESSIONAL
CORE COURSE

27 CREDITS
PROJECT WORK

01 CREDITS
AEC

19 CREDITS
PROFESSIONAL
ELECTIVES

02 CREDITS
SEMINAR

80
CREDITS
TOTAL

*ABILITY ENHANCEMENT COURSES (AEC),
UNIVERSAL HUMAN VALUES (UHV), INDIAN
KNOWLEDGE SYSTEM (IKS), YOGA.

17
Centers of
Excellence

11
Centers of
Competence

1569
Publications On
SCI

440
Publications On Web Of
Science

2842
Citations
Last 3 Years

70
Patents Filed

29
Skill Based
Laboratories
Across Four Semesters

40
Patents Granted
Last 3 Years

61
Published Patents

MOUS: 90+ WITH
INDUSTRIES / ACADEMIC
INSTITUTIONS IN INDIA & ABROAD

₹5 crores
Sponsored Projects

₹14 crores
Consultancy Projects



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(2024 Scheme)



MASTER OF COMPUTER APPLICATIONS

DEPARTMENT VISION

Pioneering in ICT Enabled Quality Education and Research with a focus on Sustainable and Inclusive Applications

DEPARTMENT MISSION

1. To adapt novel methodologies for quality education through experiential learning.
2. To empower students with continuous, holistic education, emphasizing on discipline, ethics and social commitment.
3. To become a vibrant knowledge center for research and software development.
4. To continuously build capacity steering towards industry- institute collaborative research and entrepreneurial competencies.
5. To utilize and develop free and open-source software tools for sustainable and inclusive growth.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- PEO1** Practice software engineering principles and standards to develop software to meet customer requirements across verticals
- PEO2** Contribute to build sustainable and inclusive applications using mathematical, simulation and meta heuristic models
- PEO3** Demonstrate entrepreneurial qualities through individual competence and team work
- PEO4** Achieve successful professional career with integrity and societal commitments leading to lifelong learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

- 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, test, develop and maintain desktop, web, mobile and cross platform software applications using modern tools and technologies

**GLOSSARY OF ABBREVIATIONS**

1.	AS	Aerospace Engineering
2.	BS	Basic Sciences
3.	BT	Biotechnology
4.	CH	Chemical Engineering
5.	CHY	Chemistry
6.	CIE	Continuous Internal Evaluation
7.	CS	Computer Science & Engineering
8.	CV	Civil Engineering
9.	EC	Electronics & Communication Engineering
10.	EE	Electrical & Electronics Engineering
11.	EI	Electronics & Instrumentation Engineering
12.	ET	Electronics & Telecommunication Engineering
13.	GE	Global Elective
14.	HSS	Humanities and Social Sciences
15.	IM	Industrial Engineering & Management
16.	IS	Information Science & Engineering
17.	L	Laboratory
18.	MA	Mathematics
19.	MBT	M. Tech in Biotechnology
20.	MCE	M. Tech. in Computer Science & Engineering
21.	MCN	M. Tech. in Computer Network Engineering
22.	MCS	M. Tech. in Communication Systems
23.	MDC	M. Tech. in Digital Communication
24.	ME	Mechanical Engineering
25.	MHT	M. Tech. in Highway Technology
26.	MIT	M. Tech. in Information Technology
27.	MMD	M. Tech. in Machine Design
28.	MPD	M. Tech in Product Design & Manufacturing
29.	MPE	M. Tech. in Power Electronics
30.	MSE	M. Tech. in Software Engineering
31.	MST	M. Tech. in Structural Engineering
32.	MVE	M. Tech. in VLSI Design & Embedded Systems
33.	N	Internship
34.	P	Projects (Minor / Major)
35.	PHY	Physics
36.	SDA	Skill Development Activity
37.	SEE	Semester End Examination
38.	T	Theory
39.	I	Theory Integrated with Laboratory
40.	VTU	Visvesvaraya Technological University

**POST GRADUATE PROGRAMS**

Sl. No	Core Department	Program	Code
1.	BT	M. Tech in Biotechnology	MBT
2.	CS	M. Tech in Computer Science & Engineering	MCE
3.	CS	M. Tech in Computer Network Engineering	MCN
4.	CV	M. Tech in Structural Engineering	MST
5.	CV	M. Tech in Highway Technology	MHT
6.	EC	M. Tech in VLSI Design & Embedded Systems	MVE
7.	EC	M. Tech in Communication Systems	MCS
8.	EE	M. Tech in Power Electronics	MPE
9.	ET	M. Tech in Digital Communication	MDC
10.	IS	M. Tech in Software Engineering	MSE
11.	IS	M. Tech in Information Technology	MIT
12.	ME	M. Tech in Product Design & Manufacturing	MPD
13.	ME	M. Tech in Machine Design	MMD
14.	MCA	Master of Computer Applications	MCA

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2.	MCA112IA	Web Application Development	03
3.	MCA113IA	Object Oriented Programming using Java	06
4.	MCA114AX	Professional Elective Course (Group-A)	09
5.	MCA415SL	Skill Lab	16
6.	HSS116EL	Technical English	18
7.	MMA001TA	Bridge Course Mathematics	20

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PROFESSIONAL ELECTIVE COURSE-GROUP-B			
1.	MCA224B1	Data Analytics	29
2.	MCA224B2	Business Intelligence & Visualization	33
3.	MCA224B3	Internet of Things Applications	37
4.	MCA224B4	Cloud Computing	41
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2.	MCA262IA	DevOps Automation	58
3.	MCA263DX	Professional Elective Course (Group-D)	61
4.	MCA461P	Minor Project	70
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2.	MCA293E2	AI in Practice	78
3.	MCA293E3	IT Security	80
4.	MCA293E4	Project Management	82



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MASTER OF COMPUTER APPLICATIONS

I SEMESTER MCA												
SL No	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
			L	T	P	Total Credits						
1.	MMA211TD	Discrete Mathematics and Probability Theory	3	1	0	4	MA	Theory	1.5	100	3	100
2.	MCA112IA	Web Application Development	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
3.	MCA113IA	Object Oriented Programming using Java	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
4.	MCA114AX	Professional Elective Course (Group-A)	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
5.	MCA415SL	Skill lab	0	0	2	2	MCA	Lab	1.5	50	3	50
6.	HSS116EL	Technical English	0	0	1	1	HSS	Lab (Online)	1.5	50	1.5	50
7.	MMA001TA	*Bridge Course Mathematics	0	0	0	0	MA	Theory	1.5	50	-	-
Total Credits						19						

* **Bridge Course:** Non-Credit Mandatory Course MMA001TA -Bridge Course Mathematics: 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.

List of Professional Electives: I Semester

SL No	Course Code	Elective - A
1.	MCA114A1	Data Science
2.	MCA114A2	Computer Networks Concepts



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II SEMESTER MCA												
SL No	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
			L	T	P	Total Credits						
1.	MCA221IA	Mobile Application Development	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
2.	MCA222TB	Analysis and Design of Algorithms	3	1	0	4	MCA	Theory	1.5	100	3	100
3.	MCA223TB	Agile Software Development	3	0	0	3	MCA	Theory	1.5	100	3	100
4.	MCA224BX	Professional Elective course (Group-B)	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
5.	MCA225CX	Professional Elective course (Group-C)	3	1	0	4	MCA	Theory	1.5	100	3	100
6.	MIM426RT	Research Methodology (NPTEL)	2	0	0	2	IM	NPTEL	-	-	ONLINE	100
7.	MCA427DL	Design Thinking lab	0	0	2	2	MCA	Lab	1.5	50	3	50
		Total Credits				23						

List of Professional Electives: II Semester

SL No	Course Code	Elective - B	SL No	Course Code	Elective - C
1.	MCA224B1	Data Analytics	1.	MCA225C1	Cyber Security
2.	MCA224B2	Business Intelligence & Visualization	2.	MCA225C2	Gen-AI
3.	MCA224B3	Internet of Things Applications	3.	MCA225C3	Extended Reality
4.	MCA224B4	Cloud Computing	4.	MCA225C4	Software Testing



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III SEMESTER MCA												
SL No	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
			L	T	P	Total Credits						
1.	MCA261IA	Full Stack Application Development	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
2.	MCA262IA	DevOps Automation	3	0	1	4	MCA	Theory+Lab	1.5	100+50	3	100+50
3.	MCA263DX	Professional Elective Course (Group-D)	3	0	0	3	MCA	Theory	1.5	100	3	100
4.	MCA461P	Minor Project	0	0	3	3	MCA	Lab	1.5	50	3	50
5.	MCA462N	Internship	0	0	6	6	MCA	Internship	1.5	100	3	100
Total Credits						20						

*To be undertaken after completion of 2nd sem and before commencement of 3rd semester (6 weeks duration)

List of Professional Electives: III Semester

SL No	Course Code	Elective - D
1.	MCA263D1	Advanced IoT
2.	MCA263D2	Deep Learning
3.	MCA263D3	Advanced Computer Networks
4.	MCA263D4	Principles UI/UX Design



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IV SEMESTER MCA												
SL No	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
			L	T	P	Total Credits						
1.	MCA491P	Major Project	0	0	14	14	MCA	Lab	1.5	100	3	100
2.	MCA492L	Technical Seminar	0	0	1	1	MCA	Lab	1.5	50	2	50
3.	MCA293EX	Professional Elective Course (Group-E)	3	0	0	3	MCA	Theory	1.5	100	3	100
		Total Credits				18						

List of Professional Electives: IV Semester

SL No	Course Code	Elective - E
1.	MCA293E1	Digital Marketing
2.	MCA293E2	AI in Practice
3.	MCA293E3	IT Security
4.	MCA293E4	Project Management



SEMESTER: I					
Course Code	:	MMA211TD	DISCRETE MATHEMATICS AND PROBABILITY THEORY	CIE Marks	: 100
Credits L-T-P	:	3-1-0	(Theory)	SEE Marks	: 100
Hours	:	45L+30T+45EL	(Professional Core Course)	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Graph Theory: Definition and examples of graphs, properties of a graph, sub graphs, regular graphs, bipartite graphs, paths and cycles, operations on graphs (union, intersection, Cartesian product), isomorphism of graphs. Eulerian graphs, Hamiltonian graphs, directed graphs, in degrees and out degrees in digraphs. Travelling salesman problem.					
UNIT – II					9 Hours
Logic: Basic connectivity and Truth table, Logical equivalence, logical implications, Quantifiers – Predicates: Predicative logic, Free and Bound variables, Rules of inference, Consistency. Proofs of theorems-direct, indirect, and proof by contradiction.					
UNIT – III					9 Hours
Number Theory: Divisibility, the greatest common divisor, properties of prime numbers, the fundamental theorem of arithmetic, modular arithmetic, remainder arithmetic, multiplicative inverses and cancelling, Euler's theorem. RSA Public key encryption.					
UNIT – IV					9 Hours
Statistics and Probability theory: Curve fitting by method of least squares, fitting of curves – polynomial, (exponential, power function). Correlation and linear regression analysis. Basic concepts of probability, conditional probability, Bayes' theorem.					
UNIT – V					9 Hours
Probability Distributions: Random variables- discrete and continuous, probability mass function, probability density function, and cumulative density function. Binomial distribution, Poisson distribution, Exponential distribution, and Normal distribution.					
Course Outcomes: After going through this course, the student will be able to:					
CO1	:	Explore the fundamental concepts of graph theory, logic, number theory, statistics, and probability theory.			
CO2	:	Apply theoretical concept of graph theory, logic, number theory, statistics, and probability theory for different domains in optimization, data science, cryptography and machine learning.			
CO3	:	Analyze the solution of the modern engineering problems solved using appropriate techniques of graph theory, statistics, and probability theory to optimize the solutions of engineering problem.			
CO4	:	Develop the overall mathematical knowledge gained to demonstrate and analyze the Problems arising in real world situations.			

**Reference Books**

1. Ralph P Grimaldi, B.V.Ramana, Discrete and Combinatorial Mathematics, An applied Introduction, Pearson Education, 5th Edition, 2007, ISBN-10: 8177584243, ISBN-13:9788177584240.
2. Kenneth H Rosen, Discrete Mathematics & its applications, McGraw-Hill, 7th Edition, 2010, ISBN-10: 0073383090, ISBN-13: 978-0-073383095.
3. Ronald E. Walpole & Raymond H. Myers, Probability & Statistics for Engineers & Scientists, Pearson Education, 9th Edition, 2016, ISBN-13: 978-0134115856
4. J.A. Bondy and U.S.R. Murty, Graph theory with Applications, Springer, 1st Edition, 2008

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in a test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	MAXIMUM MARKS FOR THE CIE	100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	MAXIMUM MARKS FOR THE SEE	100



SEMESTER: I					
Course Code	:	MCA112IA	WEB APPLICATION DEVELOPMENT	CIE Marks	: 100 + 50
Credits L-T-P	:	3-0-1	<i>(Theory & Practice)</i>	SEE Marks	: 100 + 50
Hours	:	45L+45EL+30P	<i>(Professional Core Course with Integrated Lab)</i>	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Mark-up Language: HTML5 tags- Formatting, Commenting, Code, Anchors, Backgrounds, Images, Hyper-links, Lists, Tables, Semantic Elements in HTML, Multimedia, Forms Front End Design: Cascading Style Sheet (CSS): Introduction to CSS – Basic syntax and structure, In-line Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, manipulating text, Margins and Padding, Positioning using CSS					
UNIT - II					9 Hours
Deep customization of Bootstrap: Using the Base CSS: Implementing the Bootstrap Base CSS, Headings, Body copy, Typographic elements, Emphasis inline elements, Alignment classes, Emphasis classes, Addresses, Blockquotes, Abbreviations, Lists, Tables, Basic styling, Buttons, Forms, Inline forms, Horizontal forms, Code, Images, Font families. Basics of JavaScript: Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions					
UNIT - III					9 Hours
Introduction to Databases: Database Languages and Architecture: Introduction to data, information, databases, database management system; Characteristics of database approach, Data models, Schema and instances, Three schema architecture and Data Independence, Database Languages and Interfaces, Database System Environment, Centralized and Client/ Server Architectures of DBMSs Conceptual Data Modeling: A Sample Database Application, Entity Types, Entity Sets, Attributes, Relationship Types, Relationship Sets, Roles, and Structural Constraints, Weak Entity Types, Refining the ER Design for the Company Database, ER Diagrams, Naming Conventions, and Design Issues					
UNIT - IV					9 Hours
Structured Query Language: Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, More Complex SQL Retrieval Queries- Nested Queries, Tuples, and Set/ Multi set Comparisons, exists and unique, join tables and outer joins, aggregate functions, Schema Change Statements in SQL					
UNIT - V					9 Hours
Relational Model: Relational Model Concepts, Relational Model Constraints and Relational Database Schemas and Keys, Update Operations, Transactions, and Dealing with Constraint Violations, Relational Database Design Using ER-to-Relational Mapping Normalization: Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Cod Normal form					



LABORATORY		30 Hours
1. Design a static web portal using HTML5 semantic elements and Bootstrap of online book stores. The website should consist the pages like Home page, User profile page, Books catalogue etc 2. Demonstrate usage of HTML5 and JavaScript DOM to manipulate content dynamically on an inventory management webpage designed using HTML5 and customized Bootstrap 3. Develop a registration form using HTML5 and customized Bootstrap. Validate user input using regular expressions (RegEx) 4. Design, Create and Implement the relational databases for any one of the Domains like Tourism, Human Resource Management, Debris Management and Others 5. Design, Create and Implement the relational databases for any one of the Domains like Health Care, Energy, Agriculture, Telecom and others		
Course Outcomes: After going through this course, the student will be able to:		
CO1	:	Apply the basic constructs of the web programming and database concepts
CO2	:	Determine and compare the relevant components that can be applied to a given problem
CO3	:	Design and implement the web and database solutions for the given scenario
CO4	:	Analyze the web and database components in building an application
Reference Books		
1. Robert W. Sebesta, Programming the World Wide Web, Pearson Education, 10 th Edition, 2018, ISBN: 9780133775983		
2. Lindsay Basset, Introduction to JavaScript Object Notation, O'Reilley Media, Inc., August 2015, ISBN:9781491929483		
3. Aravind Shenoy, Ulrich Sossou, Learning Bootstrap O'Reilly Media, 2020, ISBN 978-1-78216-184-4		
4. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Addison, Wesley, 7 th Edition, 2017, ISBN 13: 978-0-136-08620-8		

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in a test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100

RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	30
2	Open-ended Lab Experiment	10
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150
Note: Students may be asked to demonstrate the concept learnt during regular lab through any similar problem statement.		



SEMESTER: I					
Course Code	:	MCA113IA	OBJECT ORIENTED PROGRAMMING USING JAVA	CIE Marks	: 100 + 50
Credits L-T-P	:	3-0-1	(Theory & Practice)	SEE Marks	: 100 + 50
Hours	:	45L+45EL+30P	(Professional Core Course with Integrated Lab)	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Object Oriented Design: Introduction to Object-Oriented Concepts, How to Think in Terms of Objects, The Anatomy of a Class, Class Design Guidelines.					
Designing with Objects Inheritance: Mastering Inheritance and Composition, Designing with Interfaces and Abstract Classes, Building Objects and Object-Oriented Design, categories of Design Patterns, The SOLID Principles of Object Oriented Design.					
UNIT - II					9 Hours
Java Programming Fundamentals: Introduction to Java Programming, Applications of Java Programming, The Java Development Kit, The Java Keywords, Identifiers in Java, User input using Scanners, The Scope and Lifetime of Variables, operators, Conditional and Control Statements, Arrays, String Handling, Classes,					
Objects and Methods: How Objects are Created, Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Using Parameters, Constructors, this Keyword, Understanding Static.					
UNIT - III					9 Hours
Inheritance, Interface, Packages: Inheritance: Fundamentals, Overloading, Overriding, super keyword, Using final. Interface: Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces. Package: Fundamentals, Importing Packages, Creating user defined packages					
UNIT - IV					9 Hours
Exception Handling: Exception Handling: Fundamentals, Hierarchy, Catching subclass Exceptions, try blocks can be nested, Throwing an Exception, Throwable, using finally, Java's Builtin Exceptions					
Threads: The Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Thread Priorities, Synchronization, using Synchronization Methods, Thread Communication using notify (), wait () and notify All(), suspending, Resuming and stopping Threads					
UNIT - V					9 Hours
Collections framework: Collections Overview, The collection Classes.					
Generics: Generics Fundamentals Bounded Types, Generic Methods, Generic Constructors, And Some Generic Restrictions.					
RESTful API: Java APIs For JSON Processing, Introduction to the Basics of RESTful Architecture Design Strategy, Guidelines, Best Practices.					



LABORATORY		30 Hours
Write a Java program to demonstrate the following concepts 1. a. scope of variable b. this keyword 2. a. constructor overloading and method overloading b. static keyword 3. The concepts of packages 4. a. Abstraction b. Run Time Polymorphism 5. Multiple interfaces 6. User defined Exception Handling using throw, throws 7. Thread Life Cycle 8. Producer & consumer design pattern using thread wait & notify methods. 9. Write a Java Program to demonstrate Generic classes and methods 10. Demonstrate RESTful web API to create a web resource which can be accessed using REST URI's and demonstrate the concept of GET, POST, PUT, and DELETE		
Course Outcomes: After going through this course the student will be able to:		
CO1	:	Apply object-oriented principles to design and implement real-world Java applications.
CO2	:	Design Java-based solutions to achieve modular and reusable code structures.
CO3	:	Analyze real-world problems and implement robust solutions using Java concepts.
CO4	:	Demonstrate Java's Collections Framework and Generics to create efficient, scalable, and type-safe data structures for software applications.
Reference Books		
1. Matt Weisfeld, Object-Oriented Thought Process, Addison-Wesley Professional, 5 th Edition, 2019, ISBN: 9780135182130		
2. Gazihan Alankus, Rogério Theodoro de Brito, Basheer Ahamed Fazal, Vinicius Isola, Miles Obare, Java Fundamentals, Packt Publishing; 1 st Edition (15 March 2019), ISBN-13:978-1789801736		
3. Herbert Schildt, Dale Skrien, Java Fundamentals, A Comprehensive Introduction , Tata McGraw Hill, 1 st Edition, 2017, ISBN-13:978-1259006593		
4. Jeff Friesen, Java Threads and the Concurrency Utilities, 1 st Edition, Apress, ISBN-13:978-1484216996		
5. Ian F. Darwin, Java Cookbook: Problems and Solutions for Java Developers Shroff/O'Reilly, 2020, 4 th Edition, ISBN-13:978-9352139774		

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100
RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	30
2	Open-ended Lab Experiment	10
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150
Note: Students may be asked to demonstrate the concept learnt during regular lab through any similar problem statement.		



SEMESTER: I					
Course Code	:	MCA114A1	DATA SCIENCE	CIE Marks	: 100 + 50
Credits L-T-P	:	3-0-1	<i>(Theory & Practice)</i>	SEE Marks	: 100 + 50
Hours	:	45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) -A</i>	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Introduction to Data Science: Data Science, Brief History of Data Science, increasing attention to data science, Fundamental fields of study to data science, Data science and Related Terminologies, Types of Analytics, Application of Data Science, Data Science Process Model, Python environment and basics of Python: Jupyter notebook, setting working directory in python, variables, data types, operators, functions in python					
UNIT – II					9 Hours
Python for Data Science – Python libraries, Numpy Library, Pandas Library; Introduction to Exploratory Data Analysis: Steps in data preprocessing, Understanding the data -Steps involved in EDA using Python Programming, looking at the data, visualizing the data, Treatment of Outliers, Data visualization using Python-Matplotlib Library, Seaborn Library, Dimensionality Reduction, Independent and Dependent Variable					
UNIT – III					9 Hours
Machine Learning and Supervised Learning Models: Types of Machine learning algorithms, Supervised and Unsupervised Learning Algorithms, Supervised Learning algorithm, Unsupervised learning algorithm, Overfitting and under fitting, correctness, The bias-variance tradeoff, Feature Extraction, and selection					
UNIT – IV					9 Hours
Supervised Learning Algorithms: K-Nearest Neighbors, Similarity Based on Distance Function, KNN Model Building, Model performance measures, Naïve Bayes algorithm Linear Regression, Building linear regression, Interpretation of Linear Regression coefficients, Validation of Linear regression, Decision Tree, Tree Structure, Criteria for splitting decision node, Random Forest					
UNIT – V					9 Hours
Unsupervised Learning: Introduction, Association Rule Mining, Clustering, Distance Measures, Distance Matrix, Linkage Methods, two forms of clustering, K Means clustering, Evaluation of Clusters, Text Analytics: Unstructured data, Word Cloud, Sentiment Analysis, Web and Social media Analytics					

LABORATORY	30 Hours
1. Implement NumPy and pandas' operations for Data Science concept(five each) 2. Consider the automobile dataset and perform exploratory data analysis. a. Identify the dimension, structure, and summary of the data set b. Preprocess the dataset and treat them (like missing values, 'na', ?). Justify the treatment c. Plot the histogram for continuous variables (at least two) to analyze the data. d. Draw a violin plot do describe the distribution of a numerical variable to analyze the data. e. Recognize the outliers using box plot (Display the box plot before and after outlier treatment) f. Display a heat map to display the relationship among the attributes g. Standardize the continuous variable (if any) 3. For the data set in Q2, a. Show the distribution of continuous variables using histogram b. Identify the relationship between two continuous variables using scatter plot c. Find and display the frequency of the categorical values using count plot d. Apply point plots to display one continuous and one categorical variable 4. Consider the health care dataset that consists of several imaging details from patients that had a biopsy to test for breast cancer. The variable diagnosis classifies the biopsied tissue as M = malignant or B = benign. Describe and pre-process the dataset. Use KNN supervised learning model to predict Diagnosis using texture mean and radius mean . Analyze the model using different k values and display the performance of the model 5. Consider the student performance dataset. Predict the student performance as "Pass" or "Fail" by implementing a decision tree. Perform data preprocessing and visualize the data. Identify the important features affecting the student performance and Analyze the efficiency of the decision tree using different metrics. Plot the decision tree. 6. For the dataset in Q5, apply random forest algorithm to predict the student performance. a. Plot the important variables using seaborn b. Tune the random forest for training and test data based on best parameters and implement it c. Analyze the model performance and display the output 7. For the placement dataset apply Naïve bayes classification a. Plot the prior probability and posterior probability b. Build the Naïve Bayes classifier c. Analyze the model performance 8. For the market basket dataset, apply apriori algorithm and identify the best rules based on Support and confidence values. 9. For the Mall-Customers dataset Implement k-means clustering algorithm and visualize the Clusters 10. Create different word cloud for the provided text file.	

Course Outcomes:		
After going through this course, the student will be able to:		
CO1	:	Apply fundamental concepts of data science in real world applications
CO2	:	Analyze the data science concepts for various scenarios
CO3	:	Demonstrate the different data science concepts for various domains like education, business, healthcare etc.
CO4	:	Evaluate and analyze the performance of the models for real world applications

Reference Books		
1. B Uma Maheswari, R Sujatha, Introduction to Data Science Practical Approach with R and Python, Wiley Publications, 1 st Edition, 2021, ISBN:- 9789354640506, ISBN-13: 9789354640513 (EBook)		
2. Joel Grus, Data Science from Scratch, First principles with Python, O'Reilly, 2 nd Edition, 2019, ISBN: 9781492041108, 1492041106.		
3. Laura Igual, Santi Seguí, Springer Publications, Introduction to Data Science- A Python Approach to Concepts, Techniques and Applications, 2024, ISSN: 1863-7310 ISSN 2197-1781 (electronic)		
4. Sayan Mukhopadhyay, Advanced Data Analytics Using Python, Apress, 2018, ISBN-13 (pbk): 978-1-4842-3449-5 ISBN-13 (electronic): 978-1-4842-3450-1		
5. https://archive.nptel.ac.in/courses/106/106/106106212/		
RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100



RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	30
2	Open-ended Lab Experiment	10
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150

Note: Students may be asked to demonstrate the concept learnt during regular lab through any similar problem statement.



SEMESTER: I					
Course Code	: MCA114A2	COMPUTER NETWORKS CONCEPTS	CIE Marks	:	100 + 50
Credits L-T-P	: 3-0-1	<i>(Theory & Practice)</i>	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) -A</i>	SEE Duration	:	3 Hours
UNIT – I					9 Hours
The Unix/Unix Like Operating System architecture and commands: Unix Architecture, General purpose networking commands (ping, ifconfig, ARP, SSH) Introduction: Introduction, Network Hardware, Network Software: Protocol Hierarchies, Design Issues for the Layers Reference Models: The OSI Reference Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models, Physical Layer-Guided Transmission Media					
UNIT – II					9 Hours
Data Link Layer: Data link Layer Design issues, Error Detection codes, Sliding Window Protocols (Stop and Wait, Go-Back-N (GBN) and Selective Repetitive (SR)) Medium Access Control: The Channel Allocation Problem, Multiple Access Protocols, Ethernet					
UNIT – III					9 Hours
The Network Layer: Network Layer Design issues, Routing algorithms- The Optimality Principal, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms. The Network Layer in the internet- IP version 4 Protocol, IP version 6 protocol: The Main IPv6 Header, Extension Headers, Internet Control Protocols: ICMP, ARP, DHCP					
UNIT – IV					9 Hours
The Transport Layer: The Transport Service: Services Provided to the Upper Layers, Transport service primitives, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols- TCP: TCP service model, TCP protocol, Segment Header, Connection establishment, connection release, TCP sliding window, UDP, RPC					
UNIT – V					9 Hours
The Application Layer: The Domain Name System, Name Servers, Electronic Mail: Architecture and Service, MIME, SMTP, POP, The World-Wide-Web, Streaming Audio and Video					



LABORATORY		30 Hours
1. Create a LAN with three or more nodes implementing star topology and demonstrate basic networking commands with classful addressing. 2. Create a Wireless LAN with two access points and demonstrate wireless distributed network Demonstration of Virtual LAN using GNS 3 3. Create a network with four routers and four hosts on different networks. Demonstrate RIP routing protocol using GNS 3 4. Create a network with four routers and four hosts on different networks. Demonstrate OSPF routing protocol using GNS 3 5. Build DHCP server using dns-masq with and without MAC binding with IPV4 and IPV6 Create a LAN using physical networks/virtual machine and install FTP server to demonstrate file transfer 6. Demonstrate secured file transfer and computing over wired network and wireless network with SCP and SSH key based computing 7. Create a LAN using physical networks/virtual machine and install FTP server to demonstrate file transfer 8. Demonstrate secured file transfer and computing over wired network and wireless network with SCP and SSH key based computing 9. Build a Firewall to Restrict Network Access using IP tables 10. Demonstrate Proxy - Server setup for a web server and SSH port forwarding		
Course Outcomes:		
After going through this course, the student will be able to:		
CO1	:	Apply the concept of layered approach in designing computer networks in real time
CO2	:	Analyze the design issues, services, interfaces and protocols for data flow in computer networks
CO3	:	Demonstrate the protocols and services designed for the layered approach
CO4	:	Evaluate the principles and protocols of computer networks for real time
Reference Books		
1. Andrew S. Tanenbaum, David J Wetherall, —Computer Networks, Pearson Publication, 6 th Edition, 2021, ISBN-13: 9780137523214		
2. Behrouz A Forouzan, Firouz Mosharraf, —Computer Networks A Top-Down ApproachI, McGraw-Hill, 1 st Edition, 2023, ISBN 13: 9789355324900		
3. Sumitabha Das, Unix: Concepts and Applications, McGraw-Hill, 4 th Edition, 2017, ISBN 13:978-0070635463		
4. Stallings, William. Data and computer communications. Pearson Education India, 9 th Edition, 2013, ISBN13: 978-9332518865		



RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	CIE THEORY TOTAL	100
RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	30
2	Open-ended Lab Experiment	10
3	Lab Test	10
	CIE LAB TOTAL	50
	MAXIMUM MARKS FOR THE CIE	150

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	SEE THEORY TOTAL	100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	SEE LAB TOTAL	50
	MAXIMUM MARKS FOR THE SEE	150
Note: Students may be asked to demonstrate the concept learnt during regular lab through any similar problem statement.		



SEMESTER: I					
Course Code	:	MCA415SL	SKILL LAB	CIE Marks	: 50
Credits L-T-P	:	0-0-2		SEE Marks	: 50
Hours/Week	:	4	(Practice)	SEE Duration	: 2 Hours
Contents					
Week 1: Typing Skills - 50 words per minute Students are to practice typing with both the hands using any typing tutor and achieve a minimum speed of 50 words per minute					
Week 2 & 3: GNU Linux - Ubuntu Installation, File System, package installation, etc Students are introduced to GNU Linux environment, ubuntu installation, Linux File system, basic internal commands					
Week 4 & 5: Git Hub -Introduction, create, store, change, merge, and collaborate on files					
Week 6 & 7: Linux Shell Scriptings - using shell variables, special variables, operators, arrays, loop and loop controls, regular expressions, sed, awk, grep					
Week 8 & 9: Data Structures- Linked list, stack, queue, searching, sorting					
Week 10 & 11: COE based (IoT) introduction					
Week 12: Activities – to record video and present to the students To hear and write, read and write, do others understand your writing which matches your understanding Logic, flowchart and articulation					
Course Outcomes:					
After going through this course, the student will be able to:					
CO1	:	Demonstrate enhanced typing speed and accuracy, achieving a minimum standard of 40 words per minute, using appropriate typing techniques. (Cognitive Level: Apply)			
CO2	:	Utilize Git commands to manage version control effectively, including branching, merging, and resolving conflicts, in day-to-day collaborative development tasks. (Cognitive Level: Apply)			
CO3	:	Collaborate on software development projects using GitHub, demonstrating proficiency in pull requests, issues tracking, and project boards. (Cognitive Level: Apply)			
CO4	:	Develop and execute Linux shell scripts to automate common system administration tasks, such as file management, process monitoring, and backup operations. (Cognitive Level: Apply)			
CO5	:	Create modular and reusable Python scripts using libraries and packages for data manipulation and automation. (Cognitive Level: Create)			
CO6	:	Apply fundamental data structures such as arrays, linked lists, stacks, and queues to solve computational problems effectively. (Cognitive Level: Apply)			
Reference Books					
1. Sumitabha Das, Unix Concepts and Applications, McGraw Hill, 4 th Edition, 2017, ISBN:9780-07-063546-3					
2. Ganesh Naik, Learning Linux Shell Scripting, Packt Pub, 2 nd Edition, May 2018					
3. Horowitz, Sahni and Anderson-Freed,“Fundamentals of Data Structures in C”, University Press,2 nd Edition, 2007, ISBN: 0-929306-40-6. ISBN: 978-0-929306-40-7					
4. https://github.com/skills/introduction-to-github					



RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
1	Progressive skill assessment	15
2	Demonstration of skill set	20
3	Final presentation and report	15
MAXIMUM MARKS FOR THE CIE		50

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Write Up	15
2	Demonstration of skill set	25
3	Viva	10
MAXIMUM MARKS FOR THE SEE		50



SEMESTER: I					
Course Code	: HSS116EL	TECHNICAL ENGLISH	CIE Marks	:	50
Credits L-T-P	: 0-0-1	Online English Laboratory Course	SEE Marks	:	50
Hours	: 30P	Humanities and Social Sciences	SEE Duration	:	1.5 Hours
UNIT – I					10 Hours
The Basics. Business Documents, Questions, and the Technical Pursuit. Engineering Concepts and Complexity; The Future Tense for Technical Work. White Papers; Modifiers and Qualifiers.					
UNIT – II					10 Hours
Making Recommendations; Interpreting Data, Ethical Persuasion for Technical Projects; Cause and Effect; Calls for Proposals. Technical Complexity in Communication. Numbers, Plain English, Jargon, and Technical Terms, Active and Passive Structures					
UNIT – III					10 Hours
Organization Needs; Seeing the Big Picture; Negotiating. Audience Needs and Assessment; Standards versus White Papers; Objectivity, communicating within Expected Genres; Identifying Trustworthy Sources or Bias in. A Review of Major Course Takeaways					

Course Outcomes:**After going through this course, the student will be able to:**

CO1	:	Demonstrate clarity and precision in technical communication by structuring information effectively, balancing technical terms with plain English, and adapting to diverse audiences.
CO2	:	Analyze and produce professional documents, such as white papers, business proposals, and reports, while applying ethical persuasion, data interpretation, and evidence-based reasoning.
CO3	:	Evaluate and refine communication strategies by assessing audience needs, recognizing trustworthy sources, and navigating organizational and technical complexities.
CO4	:	Apply critical thinking and negotiation skills to align communication with organizational goals, anticipate future challenges, and support informed decision-making.



References
1. IEEE – EBSCO Technical English for Professionals – Online platform
2. Valerie Lambert, Elaine Murray, English for Work – Everyday Technical English, Pearson Education, 2003, ISBN- 0 582 53963 3
3. David Bonamy, Christpher Jacques, Technical English – First Course Book, Pearson Education, 2008
4. S Sumant. Technical English I, The McGraw Hill, 2011, ISBN -978 81 8209 308 9

Assessment and Evaluation Pattern (Online Mode)		
	CIE (Online Mode)	SEE (Online Mode)
Weightage	50%	50%
Test – I	Each test will be conducted for 50 marks adding to 100 marks. Final test marks will be reduced to 40 marks	Final assessment will be conducted for 50 marks
Test – II		
Experiential Learning	10 Marks	
Communication Skills- Activity based test – Script writing, Essay Writing, Role plays. Any other activity that enhances the Communication skills. The students will be assigned with a topic by the faculty handling the batch. The students can either prepare a presentation/write essay/role play etc. for the duration (4-5 minutes per student). Parameters for evaluation of the Presentation a.Clarity in the presentation/Speaking/ Presentation skills. b. Concept / Subject on which the drama is enacted/ scripted		
Maximum Marks	50 Marks	50 Marks
Total marks for the course	50	50



SEMESTER: I				
Course Code	:	MMA001TA	BRIDGE COURSE MATHEMATICS	CIE Marks : 50
Credits L-T-P	:	0-0-0	(Theory)	SEE Marks : NO SEE
Hours	:	30L	(Audit Course)	SEE Duration : -
UNIT - I				6 Hours
Set Theory: Basics of set theory, Cartesian product of sets, Relations, Properties of relations, Equivalence relations. Function composition and Inverse function (basic problems).				
UNIT - II				6 Hours
Sequence and Series: Sequences, Series, Arithmetic Progression (AP), Sum of Finite number of terms in AP, Arithmetic Means (AM), Geometric Progression (GP), sum to n terms of GP, Geometric Mean (GM), relation between AM and GM(basic problems).				
UNIT - III				6 Hours
Matrices and Determinants: Matrices, Types of matrices, Scalar multiplication, Addition of matrices, Product of Matrices Transpose of a matrix, Determinant of a matrix, Singular matrix and Inverse of a matrix (basic problems).				
UNIT - IV				6 Hours
Calculus: Limits- properties of limits, limits of Trigonometric Functions, Continuity (basic problems).				
Derivatives: Algebra of derivative of functions, polynomial, trigonometric function, product rule, quotient rule (basic problems).				
Integrals: Properties of integrals, Fundamental Theorem of Calculus (basic problems).				
UNIT - V				6 Hours
Statistics: Basic statistical concepts, qualitative and quantitative data, Classification of data, Construction of frequency distribution. Measure of central tendency—mean, median and mode. Measures of dispersion—standard deviation (basic problems)				
Course Outcomes: After going through this course, the student will be able to:				
CO1	:	Explore the fundamental concepts of Set theory, Sequence and Series, Matrices and Determinants, Calculus and Statistics (PO1, PO4, PO6)		
CO2	:	Apply theoretical concept of Set theory, Sequence and Series, Matrices and Determinants, Calculus and Statistics to Formulate the problems in engineering problem, (PO1, PO2, PO4, PO6)		
CO3	:	Analyze the solution of the modern engineering problems solved using appropriate techniques of Set theory, Sequence and Series, Matrices and Determinants, Calculus and Statistics to optimize the solutions of engineering problem. (PO1, PO3, PO4, PO6)		
CO4	:	Develop the overall mathematical knowledge gained to demonstrate and analyze the Problems arising in real world situations. (PO1,PO2, PO3, PO4, PO6)		

Reference Books

1. Ralph P Grimaldi, B.V.Ramana, Discrete and Combinatorial Mathematics, An applied Introduction, 5th Edition, Pearson Education, 2007, ISBN-10: 8177584243, ISBN-13:9788177584240.
2. Kenneth H Rosen, Discrete Mathematics & its applications, 7th Edition, McGraw-Hill, 2010, ISBN-10: 0073383090, ISBN-13: 978-0-073383095.
3. Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q) and TWO Tests (T) component **[20 (Q) + 30 (T) = 50 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 30 Marks, adding up to 60 Marks. FINAL TEST MARKS WILL BE REDUCED TO 30 MARKS.	30
	MAXIMUM MARKS FOR THE CIE	50



SEMESTER: II					
Course Code	: MCA2211A	MOBILE APPLICATION DEVELOPMENT	CIE Marks	:	100 + 50
Credits L-T-P	: 3-0-1	<i>(Theory & Practice)</i>	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	<i>(Professional Core Course with Integrated Lab)</i>	SEE Duration	:	3 Hours
UNIT – I					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					
UNIT – II					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.					
UNIT - III					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.					
UNIT - IV					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					
UNIT - V					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 widget 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					



LABORATORY		30 Hours
1. Develop an app to display a Progress Bar and show a message with Alert Dialog 2. Create an app to navigate from one activity to another using an intent object and passing data 3. Build a simple web page using PWA by adding a Service Worker 4. Create a login page to authenticate a user using PWA with Manifest file 5. Demonstrate online and offline web page load using PWA, Service Worker and Caching 6. Build an application to do a stock display using PWA using a raw JSON file 7. Code a Click Counter App in Flutter using a basic UI layout with state management 8. Create a Message Toggle Application using the basics widgets in Flutter 9. Demonstrate the use the Gesture Detector widget to respond to double-tap and swipe events using Flutter 10. Build a simple counter app with increment and decrement buttons to show subsequent values on screen		
Course Outcomes: After going through this course, the student will be able to:		
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 stateful and stateless widget lifecycles.
Reference Books		
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: 9781484230909 3. Rap Payne, Beginning App Development with Flutter, Apress Publishing, 2019, ISBN: 9781484251805 4. Marco L. Napoli, Beginning Flutter: A Hands-On Guide to App Development, Wiley Publications, 2019, ISBN: 9781119550822		



RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 Marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100
RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
2	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	:	MCA222TB	ANALYSIS AND DESIGN OF ALGORITHM	CIE Marks	: 100
Credits L-T-P	:	3-1-0	(Theory)	SEE Marks	: 100
Hours	:	45L+45EL+30T	(Professional Core Course)	SEE Duration	: 3 Hours
UNIT – I					9 Hours
The Role of Algorithms in Computing: Algorithms, Algorithms as a technology, Insertion sort, analyzing algorithms, designing algorithms, Characterizing Running Times, Big O-notation, omega-notation, and theta-notation, Asymptotic notation: formal definition, Standard notations and common functions. Mathematical Analysis of substitution method to solve Non-Recursive and Recursive Algorithms					
UNIT – II					9 Hours
Divide and Conquer: Binary Search, Merge Sort, Quick Sort and its performance. Decrease and Conquer: Analysis of running time complexity- Topological Sorting, Depth First Search using stack, Breadth First Search using Queue					
UNIT – III					9 Hours
Greedy Method: Representation of Graphs, Knapsack Problem, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths Space-Time Tradeoffs: Introduction, sorting by Counting, Input Enhancement in String Matching. Limitation of Algorithmic Power: Lower-Bound Arguments, Decision Trees					
UNIT – IV					9 Hours
Advanced Design and Analysis Techniques: Dynamic Programming- Elements of dynamic programming, longest common subsequence, Optimal binary search trees. Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem Sorting and Order Statistics: Sorting in Linear Time, Medians and Order Statistics, Heapsort.					
UNIT – V					9 Hours
Amortized Analysis: Aggregate analysis, The accounting method, The potential method, Dynamic tables. Backtracking: n – Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem Branch and Bound-Assignment Problem, Travelling Salesman Problem					
Course Outcomes: After going through this course, the student will be able to:					
CO1	:	Apply the basic concepts of algorithm design and analysis. Use mathematical techniques to evaluate and compare the efficiency of algorithms			
CO2	:	Design efficient algorithms using appropriate algorithmic strategies. Select the right technique based on problem characteristics			
CO3	:	Analyze the efficiency of algorithms and justify the performance using time complexity. Compare alternative solutions using asymptotic analysis			
CO4	:	Evaluate algorithmic approaches and apply them to solve real-world optimization and decision problems effectively			

Reference Books

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Person Education, 3rd Edition, 2021, ISBN-13: 9780137541133
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", The MIT Press, Cambridge, Massachusetts London, England, 4th Edition, 2022, ISBN: 9780262046305
3. George T. Heineman, –Learning Algorithms: A Programmer's Guide to Writing Better Code, O'Reilly Media Inc 1st Edition, 2021, ISBN: 9781492091066
4. Lekh Raj Vermani and Shalini Vermani, –An Elementary Approach to Design and Analysis of Algorithms, World Scientific Publishing Europe Ltd., 2019, ISBN-13:978-1786346759

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: II					
Course Code	:	MCA223TB	AGILE SOFTWARE DEVELOPMENT	CIE Marks	: 100
Credits L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L+45EL	(Professional Core Course)	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Agile Software Development: Agile methodology frameworks for software Development Scrum Framework: What is Agile software Development? What is Scrum? Why should you choose Scrum? Foundation of Scrum, Pillars of Empiricism, Scrum Values, identifying a Scrum Team; Introducing the Scrum Master; Working with the Product Owner; Scrum Events: Spring planning, Implementation and review					
UNIT – II					9 Hours
Scrum Events- Getting ready to Sprint; Deciding on the Sprint duration; Setting the Sprint Goal Defining Done as working and potentially shippable software; Starting the Sprint with Sprint Planning- for the Scrum Master, Product Owner and Developers. Keeping on the right track with the Daily Scrum, Inspecting the product during a Sprint Review, Inspecting the team with the Sprint Retrospective					
UNIT – III					9 Hours
Scrum artifacts- Understanding the value of the Scrum Artifacts, Creating, Managing and refining product backlog; Making a commitment- the Product Goal- Creating backlog items as user stories, Creating Product backlog items as features, Refining the Product Backlog, Creating and Managing the Sprint Backlog; Producing a Product Increment					
UNIT – IV					9 Hours
Scrum in Action - Planning and Estimating with Scrum: Choosing an Estimation Scale, Creating a Baseline. Playing Planning poker, Estimating backlog items using a Bucket method, Envisioning the product journey with a product roadmap; Sprint Journey: Refining the Product Backlog, learning how to apply order to the product backlog. Scrum master duties for Product Backlog Refinement. Tracking progress with a Scrum Board, Defects in Sprint;					
UNIT – V					9 Hours
Facets of Scrum: Software development practices for Scrum- Source control model for continuous integration, Continuous delivery and continuous deployment, leveraging testing methods for Scrum, Applying Scrum to remote teams					
Course Outcomes: After going through this course, the student will be able to:					
CO1	:	Apply Agile practices in managing real-world projects.			
CO2	:	Analyze project scenarios to select the most appropriate Agile framework for optimal delivery of business value			
CO3	:	Assess performance using Agile metrics to ensure project alignment with objectives.			
CO4	:	Design a comprehensive Agile workflow tailored to a specific project, integrating user stories, iterative plans, and prioritization strategies.			

Reference Books	
1. Fred Heath, The Professional Scrum Master (PSM I) Guide, Packt Publishing 2021, ISBN 13: 978-1800205567	
2. Susheela Hooda Vandana Mohindru Sood Yashwant Singh, Sandeep Dalal and Manu Sood, Agile Software Development, Trends, Challenges and Applications Wiley Publications, 2023, ISBN:9781119896395	
3. Mike Cohn, Succeeding with Agile: Software development Using Scrum, Addison Wesley, 2010	
4. Clinton Keith, Agile Game Development with Scrum, Addison-Wesley Professional, 2020, ISBN:978-0-321-61852-8	

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: II					
Course Code	: MCA224B1	DATA ANALYTICS	CIE Marks	:	100 + 50
Credits L-T-P	: 3-0-1	<i>(Theory & Practice)</i>	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) -B</i>	SEE Duration	:	3 Hours
UNIT – I					9 Hours
Introduction to Data Analytics: Hadoop Eco System Hadoop Fundamentals Data, Data Analysis and storage, Comparison with other systems – Relational Database Management Systems The Hadoop Distributed File system: The Design of HDFS, HDFS Concepts – Blocks, Name nodes and Data nodes, Block Caching, HDFS, Federation, HDFS High Availability, The Command-Line Interface, Hadoop File system – Interfaces Data Flow: Anatomy of a File Read, Anatomy of a File Write					
UNIT – II					9 Hours
Map Reduce: Distributed Processing Framework- A Weather Dataset – Data format, Analyzing the data with Unix Tools, Analyzing the Data with Hadoop – Java MapReduce, Scaling Out Working of Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Shuffle and Sort, Task Execution Map Reduce Formats - Input Formats, Output Formats					
UNIT – III					9 Hours
Pig Introduction: Scripting - Execution types, Running Pig programs, Grunt, Pig Latin Editors, Comparison with databases Pig Latin: Structure, Statements, Expressions, Types, Schemas, Functions, Macros, Data processing Operators – Parameter Substitution – Preprocessing, Loading and storing of data, Filtering Data, Grouping and Joining Data, Sorting Data, Combining and splitting Data Pig in Practice: Parallelism, Anonymous Relations Push Notifications: Subscribing a User to Push Notifications, Saving the PushSubscription Object, Triggering the Push Notification, Catching Push Events in the Service Worker					
UNIT – IV					9 Hours
Hive Introduction: The Hive shell, Hive services, the Meta store, Comparison with Traditional Databases – Schema on Read Versus Schema on Write, Updates, Transactions and Indexes Hive QL: Data Types, operators and functions Tables: Managed Tables and External Tables, Partitions and Buckets, Storage Formats, Importing Data, Altering Tables, Dropping Tables Querying Data: Sorting and Aggregating, Joins, Sub queries, Views					
UNIT – V					9 Hours
Spark Applications: Jobs, Stages, and Tasks, A Scala Standalone Application, Resilient Distributed Datasets - Creation, Transformations and Actions, Persistence, Serialization Shared Variables: Broadcast Variables, Accumulators, Anatomy of a Spark Job Run – Job submission, DAG Construction					



LABORATORY	30 Hours
1. Introduction to Hadoop Ecosystems. Review the commands available for the Hadoop Distributed File System: a. Copy file foo.txt from local disk to the user's directory in HDFS b. Get a directory listing of the user's home directory in HDFS c. Get a directory listing of the HDFS root directory d. Display the contents of the HDFS file user/fred/bar.txt e. Move that file to the local disk, named as baz.txt f. Create a directory called input under the user's home directory g. Delete the directory input old and all its contents h. Verify the copy by listing the directory contents in HDFS 2. Map Reduce Program on Counting a. Write a Java Program using Mapper and Reducer function to find the number of records in the give dataset b. Submit the job to cluster c. Track the job information 3. Map Reduce Program using Temperature Dataset a. Write a Java program for finding Maximum recorded temperature by the year from Weather Dataset b. Submit the job to cluster c. Find the status of the Job and terminate it 4. Programs on Pig Script Using movie lens data a. List all the movies and the number of ratings b. List all the users who have rated the same movie and find the number of ratings c. List all the Users who have rated the movies (Users who have rated at least one movie) d. Find the count of the Movie which has the ratings more than 3 e. Find the max, min, average ratings for all the movie 5. Program on Advanced Concepts in Pig a. Group by Year and dump the result in a bag b. Write a pig script to find the maximum temperature c. Write a pig Script to find the average temperature of a state for 3 years and store the result in HDFS 6. Demonstrate Anonymous Relation and Parameter Substitution to find Maximum Temperature in a given Dataset using Pig script 7. Demonstrate the Managing tables in Hive by considering appropriate schema for Movielens data set 8. Extract facts using Hive on movie lens data a. Write a query to select only those records which correspond to starting, browsing, Completing, or purchasing movies. Use a CASE statement to transform the RECOMMENDED column into integers where 'Y' is 1 and 'N' is 0. Also, ensure GENREID is not null. Only include the first 25 rows. b. Write a query to select the customer ID, movie ID, recommended state and most recent Rating for each movie 9. Demonstrate the Spark query for displaying the data frame.	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Apply the different building blocks of Big Data Technologies to a given problem
CO2	:	Design and Analyze the programming aspect of Big Data Technologies to obtain solution to the problem through lifelong learning
CO3	:	Demonstrate solutions for societal and environmental concern problems using modern engineering tools through writing effective queries
CO4	:	Assess the use of Big Data Technologies as an Individual /as a team member for the real world data analytics

Reference Books

1. Tom White, "Hadoop – The Definitive Guide; Storage and Analysis at Internet scale", O'Reilly, Shroff Publishers, Distributors Pvt. Ltd., 4th Edition, 2015, ISBN – 978-93-5213-067-2
2. Seema Acharya, Subhashini Chellappan, Big Data and Analytics, Wiley Publications, 1st Edition, 2015, ISBN:978-81-265-5478-2
3. Raj Kamal, Preethi Saxena, Big Data Analytics, Introduction to Hadoop, Spark and Machine Learning, McGraw hill Education, 2019, ISBN:978-93-5316-496-6, 2022.
4. DT Editorial Services "Big Data – Black Book" Dreamtech Press, Edition – 2015, ISBN – 978-93-511-9-757-7

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 Marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	CIE THEORY TOTAL	100



RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	:	MCA224B2	BUSINESS INTELLIGENCE & VISUALIZATION	CIE Marks	: 100 + 50
Credits L-T-P	:	3-0-1	<i>(Theory & Practice)</i>	SEE Marks	: 100 + 50
Hours	:	45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) -B</i>	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Introduction to Business Intelligence and Data Visualization Business Intelligence and its Architecture: BI by other names, How BI provides business value, BI Market, Battle Scars, The Research, Best Practices for successful Intelligence Components of BI Architecture: Operational and Source Systems, Data Transfer – from Operational to Data Warehouse, Data Warehouse, DW tables, Technology platform Defining Data Visualization: The Components of Understanding – The Importance of Conviction - Visualization work flow – The importance of process – Process in practice – Different tools for Data Visualization					
UNIT – II					9 Hours
Data Types and Power BI Working with data: Data Literacy – Data Assets and Tabulation types – Data types – Statistical Literacy – Data Acquisition – Data Examination Overview of Power BI: Understanding Power BI – Features – Connect to Different Data Sources Using Power BI and Data Modeling					
UNIT – III					9 Hours
Usage of Data for visualization Data Representation: Introducing visual encoding – Chart Types – Influencing Factors and Considerations – Visualization using Graphs, Plots, Charts and Geospatial Maps using Power BI					
UNIT – IV					9 Hours
Data Handling and Interaction Interactivity – Features of Interactivity: Data Adjustments and Presentation Adjustments – Influencing Factors and Considerations Handling data: Data Analysis and Expressions (DAX) – Calculated Columns – Representation using Data Columns					
UNIT – V					9 Hours
Visualization and Query handling: Visualization Literacy – Viewing: Learning to See – Creating: The Capabilities of the Visualizer Creating Reports and Publishing Reports – Design Dashboards and Publishing using Gateways, Basic power BI queries					



LABORATORY		30 Hours
1. Analysis of revenue in sales dataset and build dashboard with following criteria: - Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue. - Create a line chart to show the revenue based on the month of the year. - Create a bin of size 10 for the age measure to create a new dimension to show the revenue. - Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field. - Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category. - Create a calculated field to show the average revenue per state & display profitable and non-profitable state. 2. Analysis of Amazon Prime Dataset and create the dash board with following criteria: - Create a Donut chart to show the percentage of movie and tv shows - Create a area chart to shows by release year and type. - Create a horizontal bar chart to show Top 10 genre - Create a map to display total shows by country - Create a text sheet to show the description of any movie/movies. 3. Develop a dashboard to analyze waste generation and recycling patterns in urban areas of India. The dashboard will focus on key metrics such as waste types, recycling rates, disposal methods, and community engagement in sustainability practices 4. Develop a dashboard to monitor wildlife populations and their habitats in India, focusing on key metrics such as population trends, habitat conditions, and human impact factors (like deforestation, pollution, or poaching). 5. Develop a dashboard and service to monitor and optimize urban mobility by analyzing traffic patterns, public transportation usage, and air quality in Indian cities.		
Course Outcomes:		
After going through this course, the student will be able to:		
CO1	:	Apply the principles of Business Intelligence and Data Visualization techniques on the different data types.
CO2	:	Demonstrate the relevant visual encoding techniques like chart, graph, plot etc for real time examples using visualization tools
CO3	:	Perform data analysis, graphical representation, and interpretation to various phenomena in real life applications
CO4	:	Design, customize and publish interactive reports / dashboards using various visualization techniques

Reference Books	
1. Cindi Howson, Successful Business Intelligence, McGraw-Hill Publications, 2 nd edition, 2017, E-ISSN: 0-07-149851-6, ISBN:978-9339213220	
2. Andy Kirk, Data Visualization, A Handbook for Data Driven Design, SAGE Publications, India Pvt Ltd, first edition, 2016, ISBN 978-1-4739-1213-7, ISBN 978-1-4739-1214-4 (pbk)	
3. Suren Machiraju, Suraj Gaurav, Power BI Data Analysis and Visualization, De GPRESS, 2018, ISBN 978-1-5474-1678-3 , e-ISBN (PDF) 978-1-5474-0072-0 , e-ISBN (EPUB) 978-1-5474-0074-	
4. Jonathon Schwabish, Better data visualizations: a guide for scholars, researchers, and wonks, Columbia University Press, Feb 2021, LCCN 2020017814 (print) LCCN 2020017815 (ebook) ISBN 9780231193108 (hardback) ISBN 9780231193115 (trade paperback) ISBN 9780231550154 (eBook)	

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 Marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	CIE THEORY TOTAL	100
RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
3	Lab Test	10
	CIE LAB TOTAL	50
	MAXIMUM MARKS FOR THE CIE	150



RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	: MCA224B3	INTERNET OF THINGS APPLICATIONS	CIE Marks	:	100 + 50
Credits L-T-P	: 3-0-1	<i>(Theory & Practice)</i>	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) –B</i>	SEE Duration	:	3 Hours
UNIT – I					9 Hours
Introduction to Internet of Things: Fundamentals of Electronics and devices for Internet of Things: Rectification process, Diode characteristics, Digital electronics, Transistor behavior and Oscillators Physical and Logical design of IoT Technologies that enable Internet of Things Applications and Use cases, IoT Deployment Levels. Network and Communication, Standards related to Internet of Things, Protocols in Internet of things					
UNIT – II					9 Hours
Programming with Arduino UNO and ESP32 : Understanding the Eco system of Arduino, Pin- out configuration, Digital input and output, Analog input and output, working with sensors and actuators. Arduino serial communication. Communication interfaces (SPI and I2C) wired and wireless communication with Arduino using Bluetooth modules					
UNIT – III					9 Hours
Programming with Raspberry Pi and Pico W: Understanding the eco system of Raspberry Pi4 and Pico W, Pinout configuration, python modules like Rpi.GPIO and gpiozero. Digital input and output, working with sensors and actuators. Raspberry Pi or Pico serial communication. Communication interfaces (SPI and I2C).wired and wireless communication with raspberry Pi or Pico W. Serial communication from raspberry Pi4 to Arduino and vice versa. Monitoring and Controlling between raspberry pi.					
UNIT – IV					9 Hours
Working with IoT Platform and Dashboard: Configuring any hosted service like blynk or Adafruit or Things board with development boards, sensors and actuators. Development of Local IoT Dashboards: Integrating node-red with sensors and actuators, customizing node red using java script and integrating alerting services with node red. Setup and configure MQTT publisher , broker and subscriber using Raspberry pi 4 and esp32 generate visualization and analytics based on the data logged about the sensors, Working with things board and setting up IoT dashboards locally and configure sensor, actuators and development boards with things board					
UNIT – V					9 Hours
Case study : Industrial IoT Applications, Study on Industrial IoT application related to controlled environment agriculture, energy monitoring and harvesting, production system, vision based applications, water quality monitoring, health monitoring of plants, machines or humans and location based applications					

LABORATORY		30 Hours
Practice Lab : Fundamentals of Electronics using SEELab3 kit and Introduction to variety of devices and development boards used to develop IoT Applications Full wave rectifier using PN junction: Refer Section 3.3 in the SEELab3 kit manual Diode V-I functional analysis Refer Section 3.13 in the SEELab3 kit manual Logic gates: Refer Section 3.11 in the SEELab3 kit manual PNP & NPN transistor nature: Refer Section 3.13 and 3.15 in the SEELab3 kit manual IC555 oscillator: Refer Section 3.6 in the SEELab3 kit manual Identifying the IoT Kit elements: sensors, actuators and development boards and other accessories, Study about the principle of operations, operating conditions, cost, tolerance and durability of different devices in the kit 1. Develop the weather station using Arduino UNO and Esp32 integrating different sensors Note: Students should develop their own models and integrate sensors to mimic the weather station. Custom wind speed and direction calculation, Visualization about the same with history of data to be provided 2. Demonstrate MQTT publisher, MQTT BROKER and MQTT Subscriber using Raspberrypi4 ESP32 or Pico W and Esp32. Save the sensor data published in a SD card and also integrate visualization and basic analytics. Note: The data to be published could be related to water quality parameters or data could be related to plant, machine or person health parameters 3. Develop a custom IoT dashboard or things board using node-red and integrate alerting services based on the sensor values Note : node red installation, customization of widget and integrating the alerting services has to be demonstrated by integrating to those application other than scenarios given in program1 and program2		
Course Outcomes: After going through this course the student will be able to:		
CO1	:	Apply fundamental programming skills to explore various libraries developed for different development boards like Arduino Uno, esp32, raspberry pi 4 or Raspberry Pico W to repeat monitor different sensor values, log the monitored data and control actuators.
CO2	:	Design automation scripts using different programming and scripting languages like bash script/python script/JavaScript to monitor and control the sensor and actuators to integration with development boards
CO3	:	Develop custom IoT dashboards and integrate sensors, actuators and alerting services using tools like node red and Things board
CO4	:	Analyze various IoT integration protocols, standards and tools available as hosted service for IoT data visualization and analysis using hosted cloud based IoT platform and dashboard services

Reference Books

1. Arshdeep Bahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Orient Blackswan Private Ltd, July 1st 2015, ISBN : 8173719543.
2. Hands-on ESP32 with Arduino IDE: Unleash the power of IoT with ESP32 and build exciting projects with this practical guide, Packt Publisher, Zulfiqar, 1st Edition, 2024.
3. Elector, The Official ESP32 Book, ISBN: 978-1-907920-63-9.
4. The Official Raspberry Pi Handbook, The Magpi Magazine, 2023.

URL resources

<https://nodered.org/>
<https://thingsboard.io/>
<https://www.raspberrypi.com/>
<https://www.raspberrypi.com/documentation/microcontrollers/pico-series.html>
<https://www.espressif.com/en/products/socs/esp32>
<https://csparkresearch.in/seelab3>
<https://www.arduino.cc/>

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component
[20 (Q) + 40 (T) + 40 (EL) = 100 Marks]

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100

RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)

Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150



RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	: MCA224B4	CLOUD COMPUTING	CIE Marks	:	100 + 50
Credits L-T-P	: 3-0-1	<i>(Theory & Practice)</i>	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	<i>(Professional Elective Course with Integrated Lab) -B</i>	SEE Duration	:	3 Hours
UNIT – I					9 Hours
Introduction & Concepts: Introduction to Cloud Computing: Characteristics of Cloud Computing, Cloud Models, Cloud Service Examples, Cloud-based Services & Applications. Migrate into a Cloud: Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud					
UNIT – II					9 Hours
Cloud Concepts & Technologies: Virtualization, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, Software Defined Networking, Network Function Virtualization, Identity and Access Management, Service Level Agreements, Billing.					
UNIT – III					9 Hours
Cloud Application Design: Introduction, Design Considerations for Cloud Applications, Reference Architectures for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.					
UNIT – IV					9 Hours
Introducing Docker: Docker components, Containers, Getting Started with Docker, working with our first container, Container naming, starting a stopped container, attaching to a container, Creating demonized containers, seeing what's happening inside our container, Inspecting the container's processes, stopping a demonized container, finding out more about our container, Deleting a container					
UNIT – V					9 Hours
Cloud Security: Introduction, CSA (Cloud Security Architecture) Authentication, Authorization, Identity & Access Management, Data Security, Key Management, Auditing. Virtual Machine Security, Security of Virtualization, Security risk posted by a management OS					



LABORATORY		30 Hours
1. Launch a Linux or Window Server by creating VPC, Route Table in a cloud 2. Create Storage space using Storage Services in cloud 3. Demonstrate the working of Load Balancer and Elastic Ips in cloud. 4. Demonstrate Identity and access management (IAM) in cloud 5. Create RDS Server and connect using MySQL Workbench 6. Deploy PHP Code on EC2 instance that retrieve data from RDS Server 7. Build static website and host application from desktop on cloud 8. Demonstrate VS code Integration with cloud 9. Deploy Java application by connecting to RDS Server in cloud 10. Demonstrate auto scaling group concept in cloud		
Course Outcomes: After going through this course, the student will be able to:		
CO1	:	Apply cloud concepts and technologies to solve practical computing problems
CO2	:	Analyze cloud application design methodologies and approaches for building efficient cloud-based systems.
CO3	:	Evaluate the effectiveness of cloud solutions, understanding its components and processes.
CO4	:	Design secure cloud services for cloud applications
Reference Books		
1. Arshdeep Bahga, Vijay Madisetti, Cloud Computing A Hands-on Approach”, University Press , 2014 , Edition, ISBN: 9788173719233 2. Thomas Erl, Eric Barc, Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition – Pearson Paperback – 29 February 2024.ISBN 978-81-969-4321-9. 3. Rajkumar Buyya, Christian Vecciola, Thamarai Selvi, & Moreeló Monroy, Mastering Cloud Computing, 2nd Edition, McGrawHILL Paperback – 1 June 2024.ISBN-13:978-93-5532- 950-9 4. Douglas Comer, The Cloud Computing Book: The Future of Computing Explained Paperback – Import, 24 July 2023, CRC PRESS ISBN-13: 978-0367706845 5. Ian Miell, Aidan Sayers, Docker in Practice (2nd Edition) Paperback – 30 July 2019, Manning Publications ISBN-13: 978-1617294808		



RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 Marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100

RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
3	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	: MCA225C1	CYBER SECURITY	CIE Marks	:	100
Credits L-T-P	: 3-1-0	(Theory)	SEE Marks	:	100
Hours	: 45L+45EL+30T	(Professional Elective Course) -C	SEE Duration	:	3 Hours
UNIT – I					9 Hours
Introduction: Defining Cyberspace and Cyber security, Standard of Good Practice for Information Security, NIST Cyber security Framework. System Access: System Access Concepts, User Authentication, Password-Based Authentication, Possession-Based Authentication, Biometric Authentication, Risk Assessment for User Authentication, Access Control, Customer Access					
UNIT – II					9 Hours
Phishing: Introduction, Phishing – Methods of Phishing, Phishing Techniques, Spear Phishing, Types of Phishing scams, Phishing Toolkits and Spy Phishing, Phishing Countermeasures. Identity Theft: Personally Identifiable Information (PII), Types of Identity Theft, Techniques of ID theft, Countermeasures, how to efface your online identity					
UNIT – III					9 Hours
Tools and Methods used in Cybercrime: Introduction, Proxy Server and Anonymizers, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attacks on wireless and mobile networks, mobile devices					
UNIT – IV					9 Hours
Introduction to Vulnerability Assessment and Penetration Testing: Why you need to understand your enemy's tactics, recognizing the gray areas in security, Vulnerability Assessment and Penetration Testing. Penetration Testing and Tools: Social Engineering Attacks: How a social engineering attack works, conducting a social engineering attack, common attacks used in penetration testing, preparing yourself for face-to-face attacks, defending against social engineering attacks.					
UNIT – V					9 Hours
Blockchain: History, types of blockchain, Consensus, Decentralization using blockchain, methods of decentralization, roots of decentralization, blockchain and full ecosystem decentralization, Smart contracts, decentralized organizations, Plot forms for decentralization					
Course Outcomes: After going through this course the student will be able to:					
CO1	:	Apply the basic concepts of Cyber security and Blockchain Technology to protect assets			
CO2	:	Analyze vulnerabilities and identify solutions to address threats in cyber systems			
CO3	:	Demonstrate the effectiveness of Cyber security methods and Blockchain Technology for real time needs			
CO4	:	Design and develop secure solutions for real world problems			

**Reference Books**

1. William Stallings, Effective Cybersecurity: A Guide to Using Best Practices and Standards, Addison-Wesley Professional, 2018, ISBN-13: 978-0134772806
2. Nina Godbole Sunit Belapure, Cyber Security, Wiley India, 2012, ISBN: 9788126521791
3. Imran Bashir, "Mastering Blockchain", Packet Publishing Ltd., 3rd Edition, 2020, ISBN:978-1-78883-904-4
4. Allen Harper, Stephen Sims, Michael Baucom, "Gray Hat Hacking: The Ethical Hackers Handbook", Tata McGraw-Hill. 3rd Edition, 2020, ISBN-13- 978-1839213199

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: II					
Course Code	:	MCA225C2	Gen-AI	CIE Marks	: 100
Credits L-T-P	:	3-1-0	(Theory)	SEE Marks	: 100
Hours	:	45L+45EL+30T	(Professional Elective Course) -C	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Basics of Generative AI: Introduction to AI, Types of Generative Models (Autoregressive, Variational, Adversarial) Applications of Generative AI (Art and Creativity, Image and Video Generation, Text Generation, Music Composition), Generative AI vs Discriminator AI, Popular Generative Models – GPT, DALL·E, StyleGAN, NLP foundation.					
UNIT – II					9 Hours
Introduction to Prompt Engineering: Principles for designing effective prompts (such as Persona Pattern, Root Prompts). Techniques for controlling the style, tone, and content of generated text, strategies for incorporating external knowledge into prompts, Approaches to handle complex or multi-part prompts.					
UNIT – III					9 Hours
Overview of Large Language Models: LLMs and their architecture. Benefits, Challenges and Limitations. Best LLM and frameworks – GPT-4, Gemini, Lang Chain; Evolution of generation–GANs, GAN architecture – Generator and Discriminator networks, Types of GANs – DCGAN, WGAN, StyleGAN, Cycle GAN and attention mechanisms, Variable Auto Encoders					
UNIT – IV					9 Hours
Advanced NLP Techniques: Understanding BERT architecture and pre-training objectives. Fine-tuning BERT for downstream NLP tasks. Exploration of advanced Transformer architecture and techniques.					
Applications and Future Directions: Real-world applications of large language models. Challenges and limitations of current approaches. Emerging trends and future directions in Generative AI.					
UNIT – V					9 Hours
Security aspects in Gen AI: Misuse of Generated content, Adversarial Attacks, IP Theft, Bias Detection and Mitigation, Data privacy and Security, Fairness, Transparency, and accountability, Regularity and legal considerations in LLMs, Ethical Principles in AI.					
Course Outcomes: After going through this course, the student will be able to:					
CO1	:	Apply the concepts and principles of Gen-AI for diverse AI applications			
CO2	:	Design and demonstrate proficiency in using Gen- AI tools, features, frameworks and models for real-world Scenarios			
CO3	:	Apply LLM Models and Frameworks to generate text, audio, image, and video content			
CO4	:	Analyze and address the ethical, security, and legal challenges associated with generative AI tools and models			

Reference Books

1. Dr. Priyanka Singh, Hariom Singh, Generative AI Essentials: Unlocking creativity and innovation with generative AI, First Edition, Copyright © BPB Publications, India ISBN: 978-93-65897-074, 2025
2. Olivier Caelen and Marie-Alice Blete, Developing Apps with Chat GPT and GPT-4, Build Intelligent Chatbots, Content Generators and More, Content Generators, and More, First Edition, Copyright © 2023 Olivier Caelen and Marie-Alice Blete. All rights reserved
3. Numa Dhamani and Maggie Engler, Introduction to Generative AI, First Edition, Manning Shelter Island, ISBN: 9781633437197, 2024
4. David Foster, Generative Deep Learning, O'Reilly Media, 2023, ISBN-978-1098134181
5. Lewis Tunstall, Leondro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 2022, ISBN-978-9355420329
6. Ben Auffarth, Generative AI with Lang Chain: Build Large Language Model (LLM) apps with Python, ChatGPT and other LLMs, Packt Publishing, 2023, ISBN-978-1835083468

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl. No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: II				
Course Code	: MCA225C3	EXTENDED REALITY	CIE Marks	: 100
Credits L-T-P	: 3-1-0	(Theory)	SEE Marks	: 100
Hours	: 45L+45EL+30T	(Professional Elective Course) -C	SEE Duration	: 3 Hours
UNIT – I				9 Hours
Introduction to Virtual and Augmented Reality: What is VR/AR about? – The perfect Virtual Reality, The Simulation of the World, Suspension of Disbelief, Motivation. Virtual Reality-Technology-centered characterizations of VR, VR as an Innovative Kind of Human-Computer Interaction, Mental Aspects of the VR Experience. VR Systems, Augmented Reality- Introduction, Registration, Visual Output- Handheld Devices, AR Systems				
UNIT – II				9 Hours
Virtual Worlds: Requirements on 3D Object Representations for Virtual Worlds, Creation of 3D Models, Preparation of 3D Models for VR/AR, Integration of 3D Models into VR/AR Runtime Environments. Surface models- Polygonal Representations, Polygons, Polygon Meshes, Triangle Strips. Solid Models- Boundary Representation (B-Reps), Primitive Instancing, Appearance Materials, Textures and Shaders				
UNIT – III				9 Hours
Unity 3D Game engine: Working in Unity- Getting Around in Unity, Working with Game Objects, Working with Components, Working with Prefabs, Working with Scenes, Managing Assets, Building Unity Projects, Accessing Preferences, Installing Unity Packages, Physics materials, Mesh colliders, Box collider, Materials, Textures				
UNIT – IV				9 Hours
Animation and Object Behavior: Keyframe Animation, Physics based Animation of Rigid Bodies, Object Behavior, Behavior and Animation in Scene Graphs. Light sources, Sound, Background, Special purpose systems- Virtual Humans, Particle Systems, Terrain, Vegetation				
UNIT – V				9 Hours
VR/AR Input Devices and Tracking: Fundamentals of Input Devices, Basics of Visual Output, Camera based Tracking- Marker-based Methods, Tracking Using black and white markers, Marker Free tracking				
Course Outcomes: After going through this course, the student will be able to:				
CO1	:	Apply Game objects and their representations for building XR world		
CO2	:	Design the XR story board for the application requirements		
CO3	:	Build and Analyze XR model components		
CO4	:	Demonstrate knowledge of working with Game Engine		

Reference Books

1. Ralf Doerner, Wolfgang Broll, Paul Grimm, Bernhard Jung, "Virtual and Augmented Reality (VR/AR)- Foundations and Methods of Extended Realities (XR)", © Springer, ISBN 978-3-030-79061-5 ISBN 978-3-030-79062-2 (eBook)
2. Paris Buttfield-Addison, Jon Manning, Tim Nugent, "Unity Development Cookbook-Real Time Solutions from Game Development to AI", O'Reilly Media, Inc., August 2023, ISBN: 9781098113711
3. Suman Dutta, "Immersive Realm of Extended Reality", bpb publications 2024 Edition, ISBN: 9789355517227 eISBN: 9789355519450
4. Web links and Video Lectures (e-Resources)
<https://learn.unity.com/pathway/unity-essentials>
<https://learn.unity.com/pathway/mobile-ar-development>
<https://learn.unity.com/pathway/vr-development>

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100

SEMESTER: II					
Course Code	:	MCA225C4	SOFTWARE TESTING	CIE Marks	: 100
Credits L-T-P	:	3-1-0	(Theory)	SEE Marks	: 100
Hours	:	45L+45EL+30T	(Professional Elective Course) -C	SEE Duration	: 3 Hours
UNIT – I					9 Hours
Basics of Software Testing: Basic Definitions, Evolution of Software Testing, Goals of Software Testing, Levels of Testing, Model for Software Testing, Software testing life cycle, Software testing methodologies: Waterfall testing, Agile Testing. Software failure case studies					
UNIT – II					9 Hours
Testing techniques Black-Box Testing Techniques: Boundary Value Analysis, Equivalence Class Testing, State Table-Based Testing, Decision Table-Based Testing, Cause-Effect Graphing Based Testing, Error Guessing, White-Box Testing Techniques: Need, Basis Path Testing, Graph Matrices, Loop Testing, Data Flow Testing, Mutation Testing, Static Testing, Progressive vs. Regressive Testing, Regression Testing Techniques.					
UNIT – III					9 Hours
Model-Driven Test Design (MDTD): Software testing foundations, Testing activities, Coverage Criteria, Test Design, Test Automation, Test Execution, Test Evaluation, Software Testing Guidelines, Importance of MDTD Test Automation: Need for Automation, Categorization of Testing Tools, Selection of Testing Tools, Guidelines for Automated Testing, Test Automation Framework: JUnit, Data-Driven Tests					
UNIT – IV					9 Hours
Managing the Testing Process: Test Organization, Structure of Testing Group, Test Planning, Detailed Test Design and Test Specifications, Testing Metrics for Monitoring and Controlling the Testing Process, Test Suite Prioritization, Types of Test Case Prioritization Test Implementation: Integration order, Test Doubles: Stubs and Mocks, Object oriented Testing, Debugging Process and Techniques.					
UNIT – V					9 Hours
Cross-Platform Software Testing Vs Multiplatform Software Testing: Cross-Platform Software Testing: Understanding Cross-Platform Testing, Need, Challenges, Step-By-Step to Cross-Platform Testing, Cross-Platform Testing vs Cross-Device Testing, Overview of some best Cross-Platform Testing Tools in the Market(Appium, Eggplant) Multiplatform Software Testing: Objectives, Concerns, Background on Testing in a Multiplatform Environment, Workbench, Input, Do Procedures and Tasks, Check Procedures, Output, Guidelines, Cross-Platform Software Testing Vs. Multiplatform Software Testing					

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Apply various software testing techniques to ensure software quality in real-world scenarios.
CO2	:	Analyze test automation frameworks and tools to select the most suitable approach for diverse testing needs.
CO3	:	Demonstrate effective test case prioritization and debugging techniques to optimize the testing process.
CO4	:	Synthesize cross-platform and multi-platform testing strategies to address the challenges of diverse software environments

Reference Books

1. Naresh Chauhan, SOFTWARE TESTING Principles and Practices, OXFORD UNIVERSITY PRESS, 2016, ISBN-13 : 978-0199465873
2. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press, 2nd Edition, 2016, ISBN-13: 978-1107172012
3. Arnon Axelrod, Complete Guide to Test Automation, Apress, 1st edition, Copyright © 2018, ISBN-13 (pbk): 978-1-4842-3831-8, ISBN-13 (electronic): 978-1-4842-3832-5
4. Paul C. Jorgensen, Byron DeVries, "Software Testing, A Craftsman's Approach", Auerbach Publications, 5th Edition, 2021, ISBN-13: 978-0367358495.
5. Web links and Video Lectures (e-Resources):
<https://testgrid.io/blog/cross-platform-testing/>
<https://contextqa.com/cross-platform-testing/>

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: II					
Course Code	:	MIM426T	RESEARCH METHODOLOGY	CIE Marks	: NA
Credits L-T-P	:	2-0-0	<i>(Theory - NPTEL Online Course)</i>	SEE Marks	: 50
Hours	:	16L		SEE Duration	: 2 Hours
This course is indicative only and it is subject to change based on the courses running at that time by NPTEL					
Duration of the ONLINE Course - 8 Weeks					
Week 1: A group discussion on what is research; Overview of research Week 2: Literature survey, Experimental skills Week 3: Data analysis, Modelling skills Week 4: Technical writing; Technical Presentations; Creativity in Research Week 5: Creativity in Research; Group discussion on Ethics in Research Week 6: Design of Experiments Week 7: Intellectual Property Week 8: Department specific research discussions					
Reference Books:					
1. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Integration of Principles, Methods and Techniques, 17 th Impression, Pearson India Education Services Pvt. Ltd, 2018. ISBN: 978-81-7758-563-6 2. William M. K. Trochim, James P. Donnelly, The Research Methods Knowledge Base, 3 rd Edition, Atomic Dog Publishing, 2006, ISBN: 978-1592602919 3. Kothari C.R., Research Methodology Methods and Techniques, 4 th Edition, New Age International Publishers, 2019, ISBN: 978-93-86649-22-5. 4. Levin, R.I. and Rubin, D.S., Statistics for Management, 8 th Edition, Pearson Education: New Delhi, 2017, ISBN-13- 978-8184957495.					
GENERAL GUIDELINES					
1. NPTEL is an acronym for National Programme on Technology Enhanced Learning which is an initiative by seven Indian Institutes of Technology (IIT Bombay, Delhi, Guwahati, Kanpur, Kharagpur, Madras and Roorkee) and Indian Institute of Science (IISc) for creating course contents in engineering and science. 2. NPTEL is offering online certification courses through its portal - https://swayam.gov.in/nc_details/NPTEL 3. Enrollment to courses and exam registration can be done in ONLINE mode only. The link is available on NPTEL website http://npTEL.ac.in/ 4. Students need to enroll for the NPTEL course and clear the exam. 5. In case students fail to get the certificate, they need to enroll for the same course once again, in the subsequent NPTEL semester and clear the exam. 6. If the same course is not offered by NPTEL (i.e. if the same course is not re-run) in the subsequent semester by NPTEL, the students need to write letter seeking permission from the Counsellor, HoD and Dean Academics with further approval from BoS Committee to take alternative course from the list announced by NPTEL. 7. Exam is conducted by NPTEL.					



SEMESTER: II					
Course Code	:	MCA427DL	DESIGN THINKING LAB	CIE Marks	: 50
Credits L-T-P	:	0-0-2	(Design Thinking/ Skill Lab)	SEE Marks	: 50
Hours	:	04	(Practice)	SEE Duration	: 2 Hours
Phase – I					
Empathy: The Empathy phases of the process are focused on understanding the experiences, emotions and motivations of others. Designers use specific empathy methods to learn more about the needs of the users for whom they are designing.					
Methods: Interviewing Probes and Observations					
Phase – II					
Define: The Define phase of the process is focused on developing a point of view about the need of your user. During this stage of process, designers narrow from lots of information to a statement that is inspiring and specific.					
Methods: Empathy Mapping, Point of View.					
Phase – III					
Ideate: The Ideate phase of the process is focused on generating as many solutions to a problem as possible. Once many solutions have been generated, students will select one to move forward to prototyping.					
Methods: Brainstorming and Selection					
Phase – IV					
Prototype: The Prototype phase is where designers construct representation of their solutions. These representations are intended to elicit feedback and answer specific questions about a concept.					
Methods: Improve, Rapid and Experiential Prototyping					
Phase – V					
Test: The Test phase of the process is focused on getting specific feedback about how ideas can improve. It is important to remember during this phase that prototypes are imperfect, but feedback is gift.					
Methods: Testing					
Course Outcomes:					
After going through this course the student will be able to:					
CO1	:	Learn to use different modes of thinking to understand the problem instead of finding answers/solutions for questions/problems			
CO2	:	Acquire adductive reasoning to find new problems			
CO3	:	Sow the seed of creativity to look for innovative solutions for a problem			
CO4	:	Adopt human centric approaches while developing new solutions, products or services.			
Reference Books					
1. https://onlinecourses.nptel.ac.in/noc22_mg32/preview					

Guidelines for Design Thinking Lab:

1.	The Design Thinking Lab (DTL) is to be carried out by a team of two-three students.
2.	Each student in a team must contribute equally in the tasks mentioned below
3.	Each group has to select a theme that will provide solutions to the challenges of societal concern. The topics should be in line with the Sustainable Development Goals (SDG)
4.	The above five stages specified will be evaluated in three phases
5.	For every Phase of evaluation, the committee constituted by the department along with the coordinators would evaluate for CIE. The committee shall consist of respective coordinator & two senior faculty members as examiners. The evaluation will be done for each student separately.
6.	The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee.

Scheme of Continuous Internal Examination (CIE-Lab)

The evaluation of the work will be done by the committee appointed by the director, Dept of MCA. The student should submit a report on the Case Study solved under the theme
Evaluation will be carried out in THREE Phases.

Phase	Activity	Marks
I	Phase I	10
II	Phase II	15
III	Phase III	15
	Final Report	10
Maximum Marks for CIE		50

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)

The evaluation will be done by Internal and External examiners through Exhibition Mode.
The following weightage would be given for the exhibition

Q.NO.	CONTENTS	MARKS
1	Presentation through posters	15
2	Demonstration of the Prototype	25
3	Vivavoce	10
Maximum Marks for SEE		50



SEMESTER: III					
Course Code	:	MCA261IA	FULL STACK APPLICATION DEVELOPMENT	CIE Marks	: 100 +50
Credits L-T-P	:	3-0-1	<i>(Theory & Practice)</i>	SEE Marks	: 100 + 50
Hours	:	45L + 30P	<i>(Professional Core Course with Integrated Lab)</i>	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Introduction to Full Stack Development: Understanding Full Stack Development, Technologies associated with Full Stack Introduction to the MERN stack: Introduction, The MVC architectural Pattern, MERN Components React, Node.js, Express, MongoDB, Advantages of MERN, Isomorphic; Node.js - event-driven programming, JavaScript closures Node modules, Common JS modules, Node.js core modules, Node.js third-party modules, Node.js file modules Developing Node.js web application, connecting and mounting middleware; Building Express Web Application - Introduction to Express, Installing Express, Creating your first Express application, The application, request and response objects- The application object, The request object, The response object, External middleware					
UNIT - II					9 Hours
Understanding React and Web Server: Server setup, NVM Node JS, Project, NPM, Express, Build time JSX compilation- Separate Script File, Transform, Automate, React Library, React Components-React classes, Composing components, passing data- using properties, property validation, using children's Dynamic composition; Understanding React State: React State: Setting state, Event handling, communicating from child to parent, Stateless components, Designing Components-state vs props, component hierarchy communication, Stateless components					
UNIT - III					9 Hours
Introduction to MongoDB: Introduction to NoSQL, Introducing MongoDB, MongoDB sharding, MongoDB CRUD operations- Creating a new document, Creating a document using insert(), Creating a document using update(), Creating a document using save(); Introduction to Mongoose- Introducing Mongoose, Connecting to MongoDB, Understanding Mongoose schemas, Creating the user schema and model, Registering the User model, Creating new users using save(), Finding multiple user documents using find(), Reading a single user document using find One(), Updating an existing user document Deleting an existing user document; Extending your Mongoose schema- Defining default values, Using schema modifiers, Predefined modifiers, Custom setter modifiers, Custom getter modifiers					
UNIT - IV					9 Hours
Building RESTful APIs and Mongo DB: REST, HTTP method as Actions, JSON, Express, Routing Handler function , Request Object, Response objects, Middleware, The list API , The create API, Using the LIST API, Using the Create API, Error Handling					
UNIT - V					9 Hours
Working with React Router and forms: Routing Techniques, Simple Routing, Route parameters, Route Query String, Programmatic Routing, Nested Routes, Browser history, Forms, Filter form, Get API, Edit page, UI Components, update API, Delete API.					

LABORATORY

1. Demonstrate Node. Js Application to perform CRUD operation for online Book Cart
2. Write a node.js program using Express framework to accept user name, Branch, Semester, from web page and display the information as below
 - a) Handle both get and post methods
 - b) Branch should be underlined
 - c) Name should be in bold face.
3. Design a resume of a job aspirant using React components like Classes and Functions. Style the resume by applying CSS
4. Build student registration portal using Entities like component, state and props
5. Design and implement a React Form that collects user input for name, email, and password. Validate the form using Regular Expression.
6. Deploy connectivity between React and Node Application for Inventory Management system
7. Develop a MongoDB query for comparison selectors, Logical Selectors for Company database
8. Execute aggregation pipeline and its operation to illustrate text search on catalog data collection
9. Design an employee Management system using RESTFULL APIs in React
10. Create a React application using react-router-dom with multiple pages (Home, About, Contact).

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Demonstrate the core concepts of the Model-View-Controller (MVC) architecture and its role in structuring web applications
CO2	:	Apply the MVC pattern in building applications using the MERN stack components
CO3	:	Design and develop full-stack web applications using the MERN stack
CO4	:	Analyze the structure and functionality of web applications by implementing the MVC framework using the MERN stack

Reference Books

1. Subramanian, V. "Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node" Apress. 2nd edition, 2019, ISBN: 9781484243904
2. Hoque, S. "Full-Stack React Projects: Learn MERN Stack Development by Building Modern Web Apps Using MongoDB, Express, React, and Node.js", Packt, 2nd Edition, 2022 Publishing. ISBN: 9781801070636
3. Ackermann, P. "Full Stack Web Development: The Comprehensive Guide, Packt publication, Rheinwerk Computing, 2023, ISBN: 9783969108830
4. Osmani, A. , "Learning JavaScript Design Patterns: A JavaScript and React Developer's Guide" 2nd Edition, 2023, O'Reilly Media. ISBN: 9781098139872

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST and Quiz to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	CIE THEORY TOTAL	100

RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)



Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
2	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: III					
Course Code	:	MCA262IA	DEVOPS AUTOMATION	CIE Marks	: 100+50
Credits L-T-P	:	3-0-1	(Theory & Practice)	SEE Marks	: 100+50
Hours	:	45L + 30P	(Professional Core Course with Integrated Lab)	SEE Duration	: 03 Hours
UNIT - I					09 Hours
The DevOps Culture: Getting started with DevOps					
Docker Fundamentals: Discovering Docker, What and why of Docker, Building a Docker Application. Understanding Docker - Docker’s Architecture, The Docker Daemon, The Docker Client, Docker Registries, The Docker Hub					
UNIT - II					09 Hours
Docker and Development: Using Docker as a lightweight Virtual Machine - From VM to Container, Saving and restoring your work, Environments as processes, Building Images, Running Containers					
UNIT - III					09 Hours
Docker and DevOps: Continuous Integration - Docker Hub automated builds, containerizing your CI process - Running the Jenkins master within a Docker container. Continuous delivery - Interacting with other teams in the CD pipeline, facilitating deployment of Docker images, Configuring your images for environments, Upgrading running containers					
UNIT - IV					09 Hours
First steps with Docker and Kubernetes: Creating, running, and sharing a container image, Setting up a Kubernetes cluster - Running a Local Single-Node Kubernetes Cluster with Minikube, Setting up an alias and command-line completion for kubectl, Running the first app on Kubernetes - Deploying your Node.js app, accessing your web application, The logical parts of your system, Examining what nodes your app is running on, Introducing the Kubernetes dashboard					
UNIT - V					09 Hours
Pods: Introducing Pods, Creating pods from YAML or JSON descriptors, organizing pods with labels, Listing subsets of pods through label selectors, Annotating pods, Using namespaces to group resources, Stopping and removing pods					
LABORATORY					
1. Build a Docker Container from a Custom Dockerfile					
2. Develop a Multi-Stage Dockerfile for Container Orchestration.					
3. Code a Dockerized Python Flask or Node.js Application					
4. Integrate Git with Docker for Source-Controlled Application Builds					
5. Demonstrate CI Integration by Running Jenkins in a Docker Container					
6. Deploy an Automated Build Pipeline using Docker Hub					
7. Deploy a Web Application to Kubernetes using Minikube					
8. Create Kubernetes Pods using YAML Descriptors					
9. Organize Kubernetes Pods Using Labels and Namespaces					
10.Demonstrate Kubernetes Dashboard and CLI for Cluster Monitoring					

**Course Outcomes:**

After going through this course the student will be able to:

CO1	: Understand the fundamentals of DevOps and demonstrate the use of Docker for container creation and management.
CO2	: Build and run Docker containers to simulate virtual environments and enable consistent development workflows.
CO3	: Develop automated CI/CD pipelines using Jenkins and Docker Hub to streamline integration and deployment processes.
CO4	: Deploy containerized applications on Kubernetes and manage pods, labels, and namespaces for efficient workload orchestration

Reference Books

1. Gaurav Agarwal, "Modern DevOps Practices: Implement, secure, and manage applications on the public cloud by leveraging cutting-edge tools", Packt Publishing, 2nd Edition, 2024, ISBN-9781805121824
2. Ian Miell, Aidan Hobson Sayers, "Docker in Practice", Manning Publications, 2nd Edition, 2019, ISBN-9781617294808
3. Marko Lukša, "Kubernetes in Action", Manning Publications, 2nd Edition, 2018, ISBN-9781617293726
4. Brendan Burns, Joe Beda, and Kelsey Hightower, "Kubernetes: Up and Running", 2nd Edition, 2019, ISBN-978-1-492-04653-0

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST and Quiz to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100

RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)

Q.NO.	CONTENTS	MARKS
1	Conduction of the Experiments & Lab Record	40
2	Lab Test	10
CIE LAB TOTAL		50
MAXIMUM MARKS FOR THE CIE		150



RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)		
Q.NO.	CONTENTS	MARKS
1	Design and Development of Project	20
2	Presentation of working model/simulation results/prototype building	20
3	Viva voce	10
SEE LAB TOTAL		50
MAXIMUM MARKS FOR THE SEE		150



SEMESTER: II					
Course Code	: MCA263D1	ADVANCED INTERNET OF THINGS	CIE Marks	:	50
Credits L-T-P	: 3-0-0	(Theory)	SEE Marks	:	100
Hours	: 45L	(Professional Elective Course) - D	SEE Duration	:	3 Hours
UNIT - I					9 Hours
Advanced IoT Architecture, Ecosystem and protocols beyond MQTT IoT layered architecture (perception, network, application), Smart objects and digital twins IoT platforms comparison (AWS IoT, Azure IoT, ThingsBoard, etc.), Design considerations: interoperability, scalability, latency, Case study: Industrial IoT vs Consumer IoT CoAP, XMPP, AMQP, DDS – overview and use cases, 6LoWPAN, Zigbee, BLE Mesh, Thread LoRaWAN architecture and use cases, Edge vs Fog vs Cloud communication Interfacing protocols: I2C, SPI, UART, Modbus RTU/TCP					
UNIT - II					9 Hours
IoT Security and Data Integrity IoT attack surfaces and threat models, Secure communication (TLS, DTLS, VPNs) Authentication (OAuth2, API Keys, Tokenization), Secure firmware updates and boot mechanisms Privacy, identity, and data encryption techniques, Blockchain in IoT security (introduction level)					
UNIT - III					9 Hours
Edge AI and ML in IoT Edge AI platforms (NVIDIA Jetson, Coral, ESP32-S3), Data acquisition and feature extraction at the edge, On-device model inference (TensorFlow Lite, Edge Impulse), Real-time decision making using micro-models, Use cases: predictive maintenance, anomaly detection					
UNIT - IV					9 Hours
IoT Data Management and Visualization and Time-series databases (InfluxDB, TimescaleDB), Data ingestion pipelines (Node-RED, Apache NiFi), Dashboards (Grafana, ThingsBoard etc), Event triggers and notification systems Integration with cloud storage (AWS S3, Google Firebase etc)					
UNIT - V					9 Hours
Advanced Application Development IoT DevOps – containerization (Docker), CI/CD, OTA updates, Multi-node coordination and orchestration, Interoperability with external APIs and ERP systems, Use of REST/GraphQL APIs for remote access, Design and development of end-to-end IoT projects					
Course Outcomes: After going through this course the student will be able to:					
CO1	:	Analyze the architecture and design considerations for advanced IoT systems, including industrial applications.			
CO2	:	Compare and implement various IoT communication protocols beyond MQTT for efficient and secure data transmission.			
CO3	:	Develop secure IoT applications incorporating encryption, authentication, and firmware integrity mechanisms and Deploy machine learning models on edge devices to enable local decision-making in IoT systems.			
CO4	:	Design data ingestion, storage, and visualization pipelines for real-time monitoring and analytics and Integrate cloud and edge systems to create full-stack, intelligent, and secure IoT solutions.			

**Reference Books**

1. Rolando Herrero, "Practical Internet of Things Networking: Understanding IoT Layered Architecture", January 2023, Springer DOI:10.1007/978-3-031-28443-4, ISBN: 978-3-031-28442-7, Northeastern University.
2. Daniel Situnayake, "AI at the Edge: Solving Real-World Problems with Embedded Machine Learning", Jenny Plunkett, O'Reilly Media, 1st Edition, 2023, ISBN-13. 978-1098120207;
3. Smita Jain, Vasantha Lakshmi, Dr Rohini Srivathsa, "IoT and OT Security Handbook: Assess Risks, Manage Vulnerabilities, and Deploy Secure Systems" Packt Publishing, 2023 ISBN 978-180461980.
4. ByRute C. Sofia, John Soldatos, Shaping the Future of IoT with Edge Intelligence, 1st Edition 2024, River Publishers, DOI <https://doi.org/10.1201/9781032632407>
5. Sudip Misra, Chandana Roy, Anandarup Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", CRC Press, 2021

URL resources

Node-RED Docs	https://nodered.org/docs/
Mosquitto MQTT Broker	https://mosquitto.org/
LoRaWAN Protocol Overview	https://lora-alliance.org/lorawan-specification/
CoAP Protocol (RFC 7252)	https://datatracker.ietf.org/doc/html/rfc7252
ESP32 Technical Reference Manual	
https://www.espressif.com/en/support/download/documents	
Edge Impulse (ML on Microcontrollers)	https://docs.edgeimpulse.com/docs
ThingsBoard IoT Platform	https://thingsboard.io/docs/
Grafana Visualization Platform	https://grafana.com/docs/grafana/latest/
TensorFlow Lite for Microcontrollers	https://www.tensorflow.org/lite/microcontrollers
OpenCV for Embedded Vision	https://opencv.org/platforms/embedded/
OWASP IoT Top 10 Security Risks	https://owasp.org/www-project-internet-of-things/

**RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)**

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST and Quiz to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
CIE THEORY TOTAL		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
SEE THEORY TOTAL		100



SEMESTER: III					
Course Code	:	MCA263D2	DEEP LEARNING	CIE Marks	: 100
Credits L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -D	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Neural Networks: Introduction to NN, models of neuron and network architectures. Learning Processes: Different types of learning processes, Learning with and without teacher, Memory, statistical learning theory. Single layer perceptron: Adaptive filter problem, least mean square algorithm, learning rate, Learning rate, annealing techniques, perceptron and perceptron convergence theorem. Multilayer Perceptron: Back propagation algorithm, Sequential and batch modes of training, stopping criteria, XOR problem, and some numerical problems					
UNIT - II					9 Hours
Convolutional Neural Networks: Introduction, Historical Perspective and Biological Inspiration. Basic Structure of a Convolutional Network: Padding, Strides, Typical Settings, The ReLU Layer, Pooling, Fully Connected Layers, The Interleaving Between Layers, Local Response Normalization, Multiplications, Data Augmentation. Training a Convolutional Network: Back propagating Through Convolutions, Back propagation as Convolution with Inverted/Transposed Filter, Convolution/Back propagation as Matrix					
UNIT - III					9 Hours
Convolutional Architectures: AlexNet, ZFnet VGG, GoogLeNet, ResNet Effect of Depth, Pretrained Models. Applications of CNN: Content based image retrieval, Object Localization, Object Detection, Natural Language and sequence learning, and Video classification					
UNIT - IV					9 Hours
Recurrent Neural Networks: Introduction and expressiveness of RNN. Basic Structure of a RNN: Language Modeling Example of RNN, Generating a Language Sample, Back propagation Through Time, Bidirectional Recurrent Networks, Multilayer Recurrent Networks. Echo-State Networks, Long Short-Term Memory (LSTM), Gated Recurrent Units (GRUs) Applications of Recurrent Neural Networks: Automatic Image Captioning, Temporal Recommender Systems, Secondary Protein Structure Prediction, End-to-End Speech Recognition, Handwriting Recognition					
UNIT - V					9 Hours
Deep Reinforcement Learning: Introduction Stateless Algorithms: Multi-Armed Bandits: Naïve Algorithm, Greedy Algorithm, Upper Bounding Methods The Basic Framework of Reinforcement Learning: Challenges of Reinforcement Learning, Simple Reinforcement Learning for Tic-Tac-Toe, Role of Deep Learning and a Straw-Man Algorithm					
Course Outcomes: After going through this course the student will be able to:					
CO1	:	Apply basic concepts of neural network, its applications and various learning models			
CO2	:	Analyse different Network Architectures, learning tasks, convolutional networks, and deep learning models			
CO3	:	Assess neural networks model and learning techniques to solve problems related to society and industry			
CO4	:	Demonstrate a prototype application developed using any NN tools and APIs			

Reference Books

1. Simon Haykin, "Neural Networks – A Comprehensive Foundation", 2nd Edition, PHI, 2005.
2. Charu C Aggarwal, "Neural Networks and Deep learning: A Textbook", Springer International Publishing AG, ISBN 978-3-319-94462-3 ISBN 978-3-319-94463-0 (eBook), <https://doi.org/10.1007/978-3-319-94463-0>, 2018
3. Gunjan Goswami, S.K. Kataria & Sons, "Introduction to Artificial Neural Networks", 3rd edition, 2012, ISBN-13:978-9350142967.
4. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms", O'Reilly Publications, 1st Edition, 2017, ISBN-13: 978-1491925614.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component
[20 (Q) + 40 (T) + 40 (EL) = 100 marks]

Sl.No	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in a test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: III					
Course Code	:	MCA263D3	ADVANCED COMPUTER NETWORKS	CIE Marks	: 100
Credits L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -D	SEE Duration	: 3 Hours
Faculty Coordinator:					
UNIT - I					9 Hours
Internet Protocol- Introduction, Error and Control Messages (ICMP): The Internet Control Message Protocol, Error Reporting vs Error Correction, Testing Destination Reachability and status, Echo Request and Reply Message Format. Classless and Subnet Address Extension (CIDR): Review of Relevant Facts, Proxy ARP, Subnet Addressing, Subnet Mask Representation, Broadcasting the Subnets, A Classless Addressing example					
UNIT - II					9 Hours
Wireless LANS and PANS – Fundamentals of WLAN's, 802.11 Standards, HIPERLAN Standard, Blue tooth specifications, Transport Protocol group, ZigBee Specification Wireless WANS and MANS – The Cellular Concept and Cellular Architecture- Capacity enhancement, Channel Allocation Algorithms					
UNIT - III					9 Hours
Mobile IP - Introduction, Mobility, Routing and Addressing, Mobile IP Characteristics, Overview of Mobile IP Operations, Mobile Addressing Details, Foreign Agent Discovery, Agent Registration, registration message format, communication with a foreign agent, datagram transmission and reception, two- crossing problem, communication with computers on the home network Private					
UNIT - IV					9 Hours
Advanced Internetwork Router Implementation: The Global Internet-Routing Areas, Inter domain Routing (BGP), IP Version 6(IPv6), Multiprotocol Label Switching (MPLS)-Destination Based forwarding, Explicit Routing, Network Interconnection- NAT, VPN- Introduction					
UNIT - V					9 Hours
SDN - Introduction, Centralized and Distributed Control and Data Planes- Introduction, Control plane, Data plane, Moving Information Between Planes, Distributed Control Planes, IP and MPLS, Convergence Time, Load Balancing, High Availability.					
Course Outcomes:					
After going through this course the student will be able to:					
CO1	:	Apply the advanced networking concepts			
CO2	:	Identify various networking classifications in day to day computing			
CO3	:	Analyze the importance of routing and congestion control principles			
CO4	:	Access the different routing protocol methods in the networking support layers			
Reference Books					
1. James F. Kurose and Keith W. Ross," Computer Networking: A Top-Down Approach", Pearson Education, 8 th edition, 2023, ISBN: 978-0136685208					
2. William Stallings, "Wireless Communications & Networks", Pearson Education, 7 th Edition, 2020, ISBN: 978-0134799085.					
3. Patricia Marechal and Giovanni Chiola, "Software Defined Networking: Design and Deployment", Springer International Publishing, First Edition, 2023.ISBN: 978-3031234567.					



RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in a test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	MAXIMUM MARKS FOR THE CIE	100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	MAXIMUM MARKS FOR THE SEE	100



SEMESTER: III					
Course Code	:	MCA263D4	PRINCIPLES OF UI/UX DESIGN	CIE Marks	: 100
Credits L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -D	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Elements of UX Design-I- Introduction, from product design to user experience design, designing for experience, User experience and the web, Building from bottom to top. Strategy Plane: Product Objectives, Business goals, Brand Identity, Success Metrics and User Needs, User Segmentation, Usability and User Research, Creating Personas Scope Plane: Defining the Scope, Functional specifications, Content requirements.					
UNIT - II					9 Hours
Elements of UX Design -II Structure Plane: Interaction Design, Conceptual Models, Error Handling, Information Architecture Skeleton Plane: Interface Design, Navigation Design, Information Design, Wireframes Surface Plane: Sensory Design, Making Sense of the Senses, Contrast and Uniformity, Internal and External Consistency, Color Palettes and Typography, Design Comps and Style Guides.					
UNIT - III					9 Hours
UI Design Process Usability of Interactive Systems: Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Guideline, principles, and theories Managing Design Processes: Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies, Ethnographic Observation, Participatory Design, Scenario Development					
UNIT - IV					9 Hours
User Interface Evaluation and Interacting Styles Evaluating Interface Design: Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments. Menu Selection, Form Filling and Dialog Boxes: Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through, Menus, Data Entry with Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays					
UNIT - V					9 Hours
Patterns For Effective Interaction Design Using social media: The Patterns-Editorial Mix, Personal Voices, Repost and Comment, Inverted Nano-pyramid, Sharing Widget, Content Leaderboard. Going Mobile: Patterns-Vertical Stack, Touch Tools, Bottom Navigation, Thumbnail-and-Text List, Loading Indicators, Richly Connected Apps. Visual Style and Aesthetics: Visual Design for Desktop applications, The Patterns Deep Background, Few Hues Many Values, Contrasting Font Weights Skins and Themes Case Study: To explore the UI/UX using Digital tools, dark Patterns					
Course Outcomes:					
After going through this course the student will be able to:					
CO1	:	Apply the theoretical foundations and awareness of User Interface and User Experience Design			
CO2	:	Design based on the knowledge of features, approach, and patterns for designing UI and UX for cross platform applications			
CO3	:	Identify and Apply various Design Skills in UI and UX for real world Applications			
CO4	:	Evaluate UI/UX design Process/ artifacts for building products			

Reference Books	
1. Jesse James Garrett, "The Elements of User Experience: User-Centered Design for the Web and Beyond", New Riders Publishers ,2 nd Edition, 2011, ISBN-13: 978-0321683687	
2. Ben Shneiderman, Plaisant, Cohen, Jacobs, "Designing the User Interface", Pearson Education, 5 th Edition, 2014, ISBN-10: 9332518734 ISBN-13: 978-9332518735	
3. Bill Buxton, "Sketching User Experiences: Getting the Design Right and the Right Design", Morgan Kaufmann, 1st Edition,2007, ISBN-10: 0123740371 ISBN-13: 978-0123740373	
4. Jenifer Tidwell, Charles Brewer, and Aynne Valencia, "Designing Interfaces- Patterns for Effective Interaction Design", O'Reilly®, 3 rd Edition, ISBN 978-1492051916	
5. Jeff Gothelf and Josh Seiden, "Lean UX: Applying Lean Principles to Improve User Experience", O'Reilly Media , 3 rd Edition , ISBN 978-1492080359,2021	
E-Resources https://maze.co/collections/ux-ui-design/tools/#list https://careerfoundry.com/en/blog/ux-design/dark-patterns-ux/	

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in a test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	MAXIMUM MARKS FOR THE CIE	100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	MAXIMUM MARKS FOR THE SEE	100

SEMESTER: III					
Course Code	:	MCA461P	MINOR PROJECT	CIE Marks	: 50
Credits: L-T-P	:	0-0-3	(Practice)	SEE Marks	: 50
Hours	:	06		SEE Duration	: 3 Hours

GUIDELINES	
1. Student can form group of two to execute the Minor Project. 2. The student shall undertake a minor project aligned with their chosen electives, and it may be research-based or industry-oriented. 3. Allocation of the guides preferably in accordance with the expertise of the faculty. 4. Minor project topics could be aligned to any of the Centre of Excellence (CoE)/ Center of Competence (CoC) domain. The details of these could be obtained by visiting the website https://rvce.edu.in/rvce-center-excellence. 5. Minor project has to be implemented/executed in-house, using the resources available in the department/college/CoE/CoC. 6. Students have to note the periodic progress in the Minor Project Diary and report the work carried to their respective guides. 7. Students have to present the Minor project work to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final Minor project report. The reports shall be printed on A4-size paper, with 1.5 line spacing, in Times New Roman font, size 12 and the report shall be softbound.	

Course Outcomes: After going through this course, the students will be able to	
CO1	Analyze the research gaps, formulate the problem definition, conceptualize the objectives and design solution to cater to specific problems.
CO2	Apply higher order thinking skills and develop skill competencies specific to program specialization to implement real world problems with professional ethical standards.
CO3	Demonstrate the skill and knowledge by applying appropriate tools and techniques specific to their domain.
CO4	Communicate, work in teams and demonstrate the learning through oral presentations and report writing.
The evaluation criteria shall be as per the rubrics given below:	

Phase	Activity	Weightage
I	Approval of the selected topic, formulation of Problem Statement and Objectives along with Synopsis submission	10%
II	Demonstrate the skill and knowledge by applying appropriate tools/techniques to design solution specific to the problem.	30%
III	Demonstrates the work carried out through experimental results, analysis and testing. Exhibits writing and communication skills through presentations, report writing and paper publication.	60%

Scheme for Semester End Evaluation (SEE):

The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

Sl. No	Contents	Marks
1	Write Up	20%
2	Demonstration of Project Work	60%
3	Viva Voce	20%



SEMESTER: III					
Course Code	:	MCA462N	INTERNSHIP	CIE Marks	: 100
Credits: L-T-P	:	0-0-6	<i>(Practice)</i>	SEE Marks	: 100
Hours	:	12		SEE Duration	: 3 Hours

GUIDELINES

1. Students can opt for undergoing internship at the industry or research organizations like BEL, DRDO, ISRO, NAL, etc.
2. Students must submit letter from the industry/research organizations, clearly specifying the candidate's name and the duration of the internship on the company letter head with authorized signature.
3. The duration of the internship shall be for a period of 6 weeks on full time basis after II semester final exams and before the commencement of III semester.
4. Students can approach the Centre of Excellence (CoE) in various domains and Center of Competence (CoC) hosted by RVCE for registering and working on relevant domain for training/internship. The details of these could be obtained by visiting the website <https://rvce.edu.in/rvce-center-excellence>.
5. Internship must be related to the field of specialization of the respective PG program in which the student has enrolled.
6. Students undergoing internship training are advised to report their progress and submit periodic progress reports/diary to their respective guides.
7. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report.

The reports shall be printed on A4-size paper, with 1.5 line spacing, in Times New Roman font, size 12 and the report shall be softbound.

Course Outcomes:

After going through this course, the student will be able to

CO1	Explore the workplace, operating procedures of the department/company and its products, and other organizational concepts
CO2	Learn and improve writing and communication skills, research and technology, work in a team, and develop leadership skills
CO3	Apply higher order thinking skills - critical thinking, analysis, synthesis and evaluate complex problems to solve real world problems with professional ethical standards.
CO4	Develop and demonstrate skill competencies and knowledge specific to program specialization by applying appropriate tools and techniques.

**Scheme of Continuous Internal Evaluation (CIE):**

The evaluation committee shall consist of a Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

Reviews	Activity	Weightage
Review I	Ability to comprehend the functioning/operating procedures of the Organization/Departments. Application of Engineering knowledge, Critical thinking and analysis to solve problems.	40%
Review II	Demonstrates skill competencies, Resource Management and Sustainability. Exhibits writing and communication skills through presentations and report writing.	60%

Scheme for Semester End Evaluation (SEE): The SEE examination shall be conducted by an external examiner and an internal examiner. Evaluation shall be done in batches, not exceeding 6 students per batch.

Sl. No	Contents	Marks
1	Write Up	20%
2	Demonstration of Internship Work	60%
3	Viva Voce	20%



SEMESTER: IV					
Course Code	:	MCA491P	MAJOR PROJECT	CIE Marks	: 100
Credits: L-T-P	:	0-0-14	(Practice)	SEE Marks	: 100
Hours	:	28		SEE Duration	: 3 Hours

GUIDELINES	
1. Major Project is to be carried out for a duration of 18 weeks. 2. Student have to implement the Major Project individually. 3. Allocation of the guides preferably in accordance with the expertise of the faculty. 4. Major Project could be implemented in Industry/Research organizations after providing the letter of approval. Students can also implement Major Project, in-house using the resources available in the department/college/ Centre of Excellence (CoE)/ Center of Competence (CoC). The details of these could be obtained by visiting the website https://rvce.edu.in/rvce-center-excellence. 5. Students have to adhere to the Project Presentation Schedule and note the periodic progress in the Major Project Diary and report the work carried to their respective guides. 6. It is mandatory for the students to present/publish their project work in National/International Conferences/ reputed Journals. 7. Students have to present the Major Project work to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final Major Project report. Major Project report has to be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be Hardbound in Ivory color.	

Course Outcomes:	
After going through this course, the students will be able to	
CO1	Analyze the research gaps, formulate the problem definition, conceptualize the objectives and design solution to cater to specific problems.
CO2	Apply higher order thinking skills and develop skill competencies specific to program specialization to implement real world problems with professional ethical standards.
CO3	Demonstrate the skill and knowledge by applying appropriate tools and techniques specific to their domain.
CO4	Communicate, work in teams and demonstrate the learning through oral presentations and report writing.

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of guide and members appointed by Director, MCA

The evaluation criteria shall be as per the rubrics given below:

Phase	Activity	Weightage
I	Approval of the selected topic, formulation of Problem Statement and Objectives along with Synopsis submission	10%
II	Demonstrate the skill and knowledge by applying appropriate tools/techniques to design solution specific to the problem.	30%
III	Experimental result & analysis, testing, Conclusions and Future Scope of Work, Dissertation Report. Exhibits writing and communication skills through presentations, report writing and paper publication.	60%

Note -

- (a) 50% CIE is the prerequisite to appear for SEE
- (b) Two hard bound dissertation reports are to be submitted.
- (c) Certificate sheet having the signatures of Guide, Director and Principal must be included.
- (d) Plagiarism report must be $\leq 10\%$ and to be included in the report.

Scheme for Semester End Examination (SEE):

Major Project SEE evaluation shall be conducted in two stages. This is initiated after fulfilment of submission of Project Report and CIE marks.

Stage-1 Report Evaluation: Evaluation of Project Report shall be done by the Guide and an External examiner.

Stage-2 Project Viva-voce: Major Project Viva-voce examination is conducted after receipt of evaluation reports from Guide and External examiner.

The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. Evaluation will be done in batches not exceeding SIX students per batch.

SEE procedure is as follows:

	Internal Examiner	External Examiner	Total	
Report Evaluation	100 marks (A)	100 marks(B)	$(A) + (B) = 200/2 = 100$ (C)	
			(C)	100 marks
Viva Voce	Jointly Evaluated by Internal and External Examiner		(D)	100 marks
		Total Marks	$[(C)+(D)]/2 = 100$	

Final Marks / Grades = $(CIE+SEE)/2$



SEMESTER: IV					
Course Code	:	MCA492L	TECHNICAL SEMINAR	CIE Marks	: 50
Credits: L-T-P	:	0-0-1	(Practice)	SEE Marks	: 50
Hours	:	2		SEE Duration	: 2 Hours

GUIDELINES	
1. The seminar presentation shall be done by individual students. 2. The topic for seminar should be in one of the thrust areas relevant to industry or on-going research with in-depth technical review and analysis. 3. The topic can also be an extension of the Major project. 4. The student must be able to highlight or relate the technological developments with societal relevance and sustainability. 5. The students must mandatorily address professional computing practices relevant to the topic of study. 6. The student shall try to perform financial / cost analysis or apply project management tools as related to his/her topic of study. 7. Each student must submit both hard and soft copy of the presentation and report.	

Course Outcomes: After going through this course, the students will be able to	
CO1	Identify topics in recent trends in computing technology
CO2	Perform literature / market / product survey and analyse information in the field of study
CO3	Enhance communication skills and report writing skills
CO4	Exhibit creative thinking abilities

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of guide and senior faculty members. The evaluation criteria shall be as per the rubrics given below:

The evaluation criteria shall be as per the rubrics given below:

Reviews	Activity	Weightage
Phase 1	Selection of topic – Technical Relevance, review of literature, Presentation skills, Sustainability and Societal Concerns	50%
Phase 2	Technological developments, key competitors, Presentation skills, Report writing	50%

Scheme for Semester End Evaluation (SEE):

The evaluation will be done by ONE Senior faculty / Internal Guide from the department and ONE External member from Academia / Industry / Research Organization. Evaluation will be done in batches, 6 students per batch.

Rubrics for SEE evaluation.

• Topic	10%
• Literature Review	20%
• Technical relevance, Sustainability and Societal Concerns	30%
• Presentation Skills	20%
• Viva- Voce	20%



SEMESTER: IV					
Course Code	:	MCA293E1	DIGITAL MARKETING	CIE Marks	: 100
Credits: L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -E	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Digital Marketing in Digital World: What Is Digital Marketing? , Evolution and Environment of Digital Marketing, Types of Digital Marketing, Digital Marketing Value, The Digital Marketing Mix, Digital Marketing Objectives, Digital Marketing Analytics Creating Value through Digital Marketing Strategy: Introduction to Digital Marketing Strategy, The Strategic Digital Marketing Planning Process, Basic Digital Marketing Strategies and Tactics, The Strategic Digital Marketing Plan,					
UNIT - II					9 Hours
Digital Consumer Behavior and Customer Relationship and Experience Management : Digital Consumer Behavior and Influences, Digital Customer Relationship Management, Digital Customer Experience (DCX) Management, Website Marketing Strategy: Website Evolution and Value, Website Marketing Objectives, Website Marketing Considerations, Strategies, and Tactics, Website Content Strategies, Website Marketing Analytics; Search Engine Optimization (SEO) Strategy: Evolution and Value of Search Engine Optimization, SEO Objectives, SEO Considerations, Strategies, and Tactics, SEO Analytics,					
UNIT - III					9 Hours
Search Engine Marketing (SEM) Strategy : SEM Objectives, SEM Considerations, Strategies, and Tactics, SEM Content Strategies and Tactics, Email Marketing Strategy: Evolution and Value of Email Marketing, Email Marketing Considerations, Strategies, and Tactics, Email Marketing Content and Design Strategies and Tactics, Email Marketing Analytics, Mobile Marketing Strategy: Evolution and Value of Mobile Marketing, Mobile Marketing Considerations, Strategies, and Tactics, Mobile Marketing Content Strategies and Tactics, Mobile Marketing Analytics					
UNIT - IV					9 Hours
Digital Brand, Trust, and Reputation Management Strategy: Brand Switching Online, Social media and Community Marketing Strategy: Evolution and Value of Social Media and Community Marketing, social media and Community Marketing Considerations, Strategies, and tactics, social media and Community Marketing Content Strategies and Tactics, Social Media and Community Marketing Analytics,					
UNIT - V					9 Hours
Digital Marketing Legal, Ethical, Privacy, and Security: Digital Marketing Legal and Ethical Framework, Digital Marketing Legal and Ethical Considerations, Strategies, and tactics, Trends and the Future of Digital Marketing, Digital Marketing Trends and Future Considerations, Strategies, and Tactics					
Course Outcomes:					
After going through this course the student will be able to:					
CO1	:	Understand the core concepts, evolution and environment of digital marketing and strategies			
CO2	:	Apply various digital marketing tools and techniques such as SEO, SEM, email, and mobile marketing to design strategic campaigns			
CO3	:	Analyse digital consumer behaviour, website metrics and digital marketing analytics to evaluate campaign effectiveness			
CO4	:	Design and formulate an integrated digital marketing strategy considering legal, ethical and branding actors.			

Reference Books

1. Raj Sachdev, "Digital Marketing", Tata McGraw Hill , Copyright 2024, ISBN-13 : 978-1266214431
2. Seema Gupta, "Digital Marketing", Tata McGraw Hill, India, 3rd Edition, 2022, ISBN-9789355320483
3. Dave Chaffey, Fiona Ellis-Chadwick, "Digital Marketing- Strategy, Implementation and Practice", Pearson, 6th Edition, 2016, ISBN: 978-1-292-07761-1

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)

CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component **[20 (Q) + 40 (T) + 40 (EL) = 100 marks]**

Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)

Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: IV					
Course Code	:	MCA293E2	AI IN PRACTICE	CIE Marks	: 100
Credits L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course)-E	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Fundamentals of AI- Core of AI, Fields of Application, Ethics and Fairness of AI Drivers of Artificial Intelligence- Moores’ law and effects of Exponentiality, Digitalization and Dematerialization of products, services and processes, New Technologies Data, Law and Responsibility- AI and law, Tsunami of the information Society, AI Regulation, Protection of Personal Data, Red flags in handling AI Tools					
UNIT - II					9 Hours
Unveiling Generative AI: A new frontier- What Is Generative AI? How Does Generative AI Work? What Can Generative AI Do? The Impact of Generative AI. Revolutionizing societies and business ecosystems- Transforming Sectors and Society, Reshaping Business Models, Innovating Products and Services, Refining Business Processes, Generative AI in Daily Life.					
UNIT - III					9 Hours
Generative AI in Practice- a new dawn in media and entertainment- Generative AI and Journalism, Enhancing Sports Broadcasting and Fan Engagement with Generative AI, Storytelling: Generative AI in Books, Audiobooks, and Podcasts, Generative AI in Film, Generating Music with AI, AI in Art Personalized Learning: the future of education- Rethinking how learners learn, and how teachers teach, transforming <i>what</i> we teach.					
UNIT - IV					9 Hours
Implementing Generative AI: Key for Success- Fostering right culture and mindset, Right skills and Talent, Data as another key building block, Getting right Technology at Place. Glimpses of the Future: Predicting the trajectory of Generative AI- Are we moving closer to general AI?, combining generative AI with robots, Brain–Computer Interfaces will allow for more intuitive Interactions, using generative AI for a better world.					
UNIT - V					9 Hours
Case Studies: Advertising and Marketing, Healthcare Transformation, Banking and Financial services, AI in Design and Development: Video Game Design, Drug Discovery. Note: Case studies will be discussed in alignment with the concepts introduced in unit1-4. Students are expected to apply knowledge from previous units to analyse and solve case study based problems.					
Course Outcomes: After going through this course the student will be able to:					
CO1	:	Apply AI foundational concepts to understand real-world systems and their strategic value.			
CO2	:	Analyze industrial challenges and domain-specific problems to identify suitable AI technologies and frameworks for optimal solutions.			
CO3	:	Design AI-based solutions using case studies and frameworks for business processes			
CO4	:	Assess the impact of different AI applications in various sectors, identifying benefits and possible pitfalls.			
Reference Books					
1. Ralf T. Kreutzer, Marie Sirrenberg, “Understanding Artificial Intelligence: Fundamentals, Use Cases and Methods for a Corporate AI Journey (Management for Professionals)”, Springer, 1 st edition , 2020, ISBN13: 978-3030252700					
2. Bernard Marr, “Generative AI in Practice: 100+ Amazing Ways Generative Artificial Intelligence is Changing Business and Society”, Wiley, March 2024, ISBN:978-1-394-24556-7					
3. Amit Bahree, “Generative AI in Action”, Manning, September 2024, ISBN 9781633436947					
4. David Foster, “Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play”, June 2023, O’Reilley, ISBN-13978-1098134181					

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
MAXIMUM MARKS FOR THE CIE		100

RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
MAXIMUM MARKS FOR THE SEE		100



SEMESTER: IV					
Course Code	:	MCA293E3	IT SECURITY	CIE Marks	: 100
Credits: L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -E	SEE Duration	: 03 Hours
UNIT - I					09 Hours
Introduction to Information Security - Data and Information, Information Classification, Information Security, Other Applicable Attributes of Information Security, Logical Security, Advantages & Disadvantages of organization's information security programme, Goals of Information security, Types of information security, The services of information security					
Security Threats Overview - Threats, Cyber Espionage, Cyber Terrorism					
UNIT - II					09 Hours
Corporate IT Security Policies - Meaning of Corporate IT Security, Need for a Corporate IT Security Policy, Legal Requirements, Essential Features of Corporate IT Security Policy, Physical Security Policy, Methodology of Framing an IT Security Policy, Awareness Initiatives, Aspects of security measurement.					
Organisational Security - Organisational Security, Public Sector Organisation, Right to Information Act, 2005, Risk Metrics, Downstream, Liability					
UNIT - III					09 Hours
Security Governance - Concepts, Policies, Framework, Key Responsibility Areas, Security Governance in Public Sector Undertakings, Security Governance in Banks, Compliance to Policies is a Must in Any Organization, Monitoring.					
Software and Operational Security - Concepts, Cloud Computing, Operational Security, User Level Controls, Software Security Techniques.					
UNIT - IV					09 Hours
Security Standards and Best Practices - ISO 27000 Standards, ISO – ISMS, Benefits of ISO 27001, Cobit-Control Objectives in IT, CIA triad - Confidentiality, Integrity, Availability, Importance of Confidentiality, Components of Confidentiality, Different types of Confidentialities					
UNIT - V					09 Hours
Fault Tolerant Systems - High Availability (HA), Services Oriented Architecture (SOA), The primary aspects of Service-Oriented Architecture.					
Business Continuity and Disaster Recovery Management - Downtime, Phase I, Backups, Who Should Call 'Disaster'? Phase II, Phase III.					
Course Outcomes:					
After going through this course the student will be able to:					
CO1	:	Explore the foundational concepts of information security			
CO2	:	Demonstrate the ability to frame and interpret corporate IT security policies, legal frameworks, and physical security measures			
CO3	:	Analyse the role of security governance, frameworks, and confidentiality principles in assessing an organization's security posture.			
CO4	:	Evaluate modern security threats and formulate effective strategies for business continuity and disaster recovery using fault-tolerant systems.			

Reference Books

1. Indian Institute of Banking & Finance (IIBF), "IT Security", Taxmann, 2024 Edition, 2024, ISBN: 9789357788571
2. Tyler Wrightson, "Advanced Persistent Threat Hacking", Mc Graw Hill Education, 2014 Edition, 2014, ISBN: 9780071828376
3. Ian Neil, "CompTIA Security+ Certification Guide", Packt Publication, 2018 Edition, ISBN: 9781789348019
4. Dafydd Stuttard and Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Wiley, 2nd Edition, 2011, ISBN: 9781118026472



RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (CIE-Theory)		
CIE will consist of TWO Quizzes (Q), TWO Tests (T), and ONE Experiential Learning (EL) component [20 (Q) + 40 (T) + 40 (EL) = 100 marks]		
Sl.No.	COMPONENTS	MARKS
1.	QUIZZES: Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & each Quiz will be evaluated for 10 marks, and Final Quiz marks adding up to 20 marks. THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS FINAL QUIZ MARKS.	20
2.	TESTS: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO TESTS will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS. Students should score minimum 50% in TEST & QUIZ to clear CIE	40
3.	EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS.	40
	MAXIMUM MARKS FOR THE CIE	100
RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
	MAXIMUM MARKS FOR THE SEE	100



SEMESTER: IV					
Course Code	:	MCA293E4	PROJECT MANAGEMENT	CIE Marks	: 100
Credits: L-T-P	:	3-0-0	(Theory)	SEE Marks	: 100
Hours	:	45L	(Professional Elective Course) -E	SEE Duration	: 3 Hours
UNIT - I					9 Hours
Strategic Project Management and Selection: Introduction , The Definition of the Project, Why Project Management?, The Project Life Cycle, Project Strategic and Selection, Organizational Project Management and Governance, Project Portfolio Management (PPM),Case Studies					
UNIT - II					9 Hours
Project Organization Structure and Activity Planning: Projects in a functional organization, Projects in a Projectized Organization, Projects in a Matrix Organization, Projects in Composite Organization Structures, Selecting a Project Form, Project Team , Human Factors and the Project Team, Traditional Project Activity Planning, Coordination through Integration Management, Case Studies					
UNIT - III					9 Hours
Project Budgeting, Scheduling and Resource Allocation: Estimating Project Budgets, Better Cost Estimation and Bidding, Project Risk Management, Network techniques (PERT),Critical Path Method (CPM), Resource Allocation Problem, Resource Loading, Resource Leveling, Constrained Resource Scheduling, Case Studies					
UNIT - IV					9 Hours
Project monitoring, Control and Auditing: The Planning-Monitoring-Controlling Cycle, Information Needs and Reporting, Earned Value Analysis, Fundamental Purposes of Control, Three Types of Control Processes, Design of Control Systems, Purposes of Evaluation, The Project Audit, Project Audit Life Cycle, Some Essentials of an Audit, Measurement, Case Studies					
UNIT - V					9 Hours
Project Management in Software Environment and Project Closures Software Projects versus other types of Project, Activities covered by software project management, Plans, methods & Methodologies, Project Success and Failure, Managing People – Understanding Organizational Behavior, Motivation, Stress, Health & Safety, Ethical and Professional Concerns The Varieties of the Project Closures , When to close a Project, The Closure Process					
Course Outcomes: After going through this course the student will be able to:					
CO1	:	Demonstrate the principles involved from project initiation to Project Closure in Project Management			
CO2	:	Apply Project Management Approaches and techniques to solve Real World Problems			
CO3	:	Analyze various organizational structures, risk factors, and control mechanisms in managing projects across different environments			
CO4	:	Evaluate effective project planning, Scheduling, monitoring, auditing, and closure strategies in both traditional and software project contexts			
Reference Books					
1. Jack R. Meredith, Scott M. Shafer, Samuel J. Mantel Jr. Project Management: A Managerial Approach, 11th Edition ISBN: 978-1-119-80381-2 ,2021					
2. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management , Tata McGraw-Hill Education, 6th Edition, 2017, ,ISBN 13:9789387067189,ISBN 109387067181.					
3. A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute, 6th Edition, 2017, Inc, ISBN: 978-1-62825-184-5					
4. Harold Kerzner, Project Management , Wiley, 13th Edition, 2022, ISBN 9781119805397					



RUBRIC FOR SEMESTER END EXAMINATION (SEE-Theory)		
Q.NO.	CONTENTS	MARKS
1 & 2	Unit 1: Question 1 or 2	20
3 & 4	Unit 2: Question 3 or 4	20
5 & 6	Unit 3: Question 5 or 6	20
7 & 8	Unit 4: Question 7 or 8	20
9 & 10	Unit 5: Question 9 or 10	20
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MAXIMUM MARKS FOR THE CIE		100

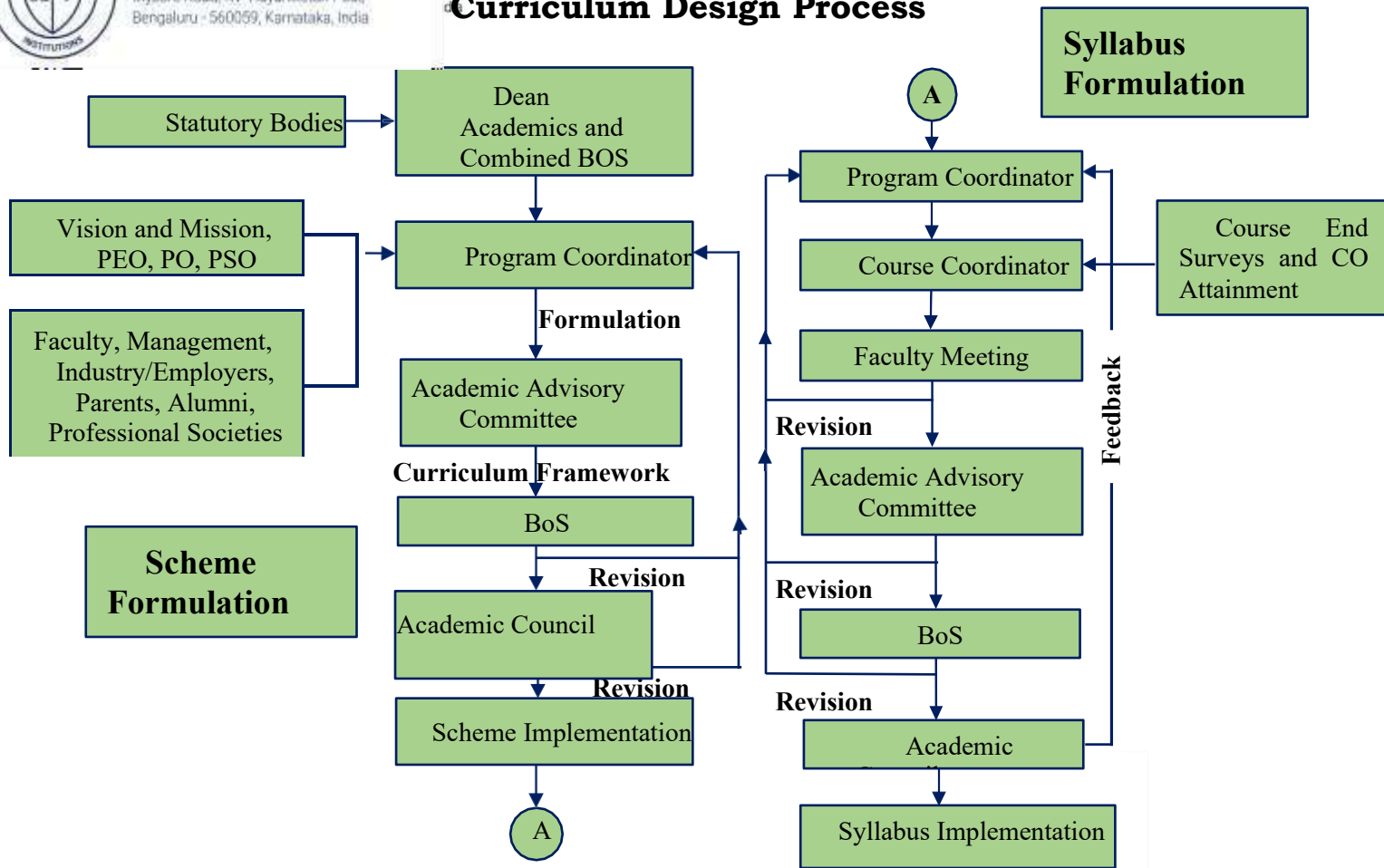


PROGRAMME OUTCOMES (PO)

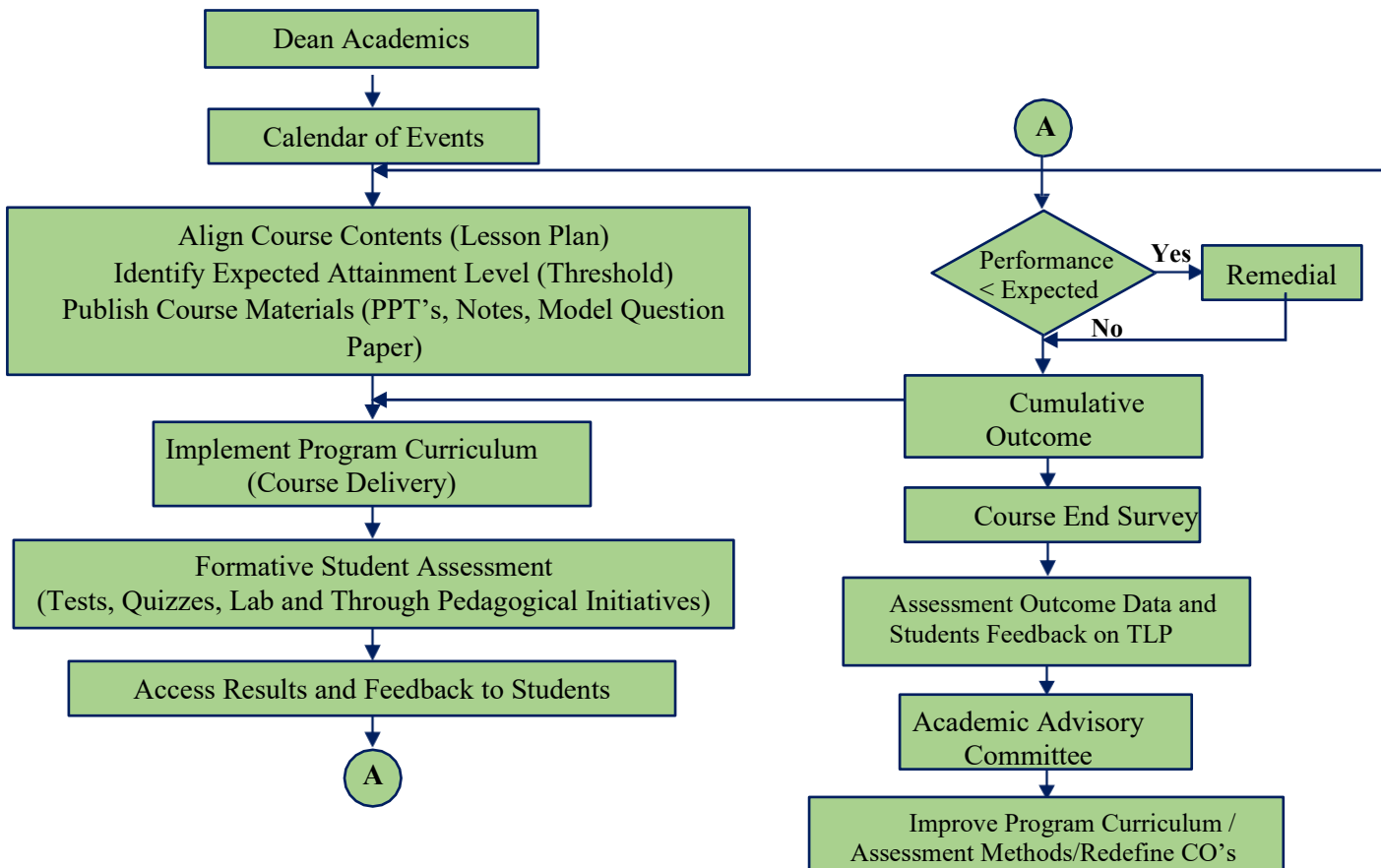
MCA Graduates will be able to:

- 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 as an innovative approach for solutions incorporating ESG/SDG goals.
- PO4 Modern Tool Usage:** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- PO5 Individual and Teamwork:** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- PO6 Project Management and Finance:** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management
- PO7 Ethics:** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- PO8 Life-long learning:** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.

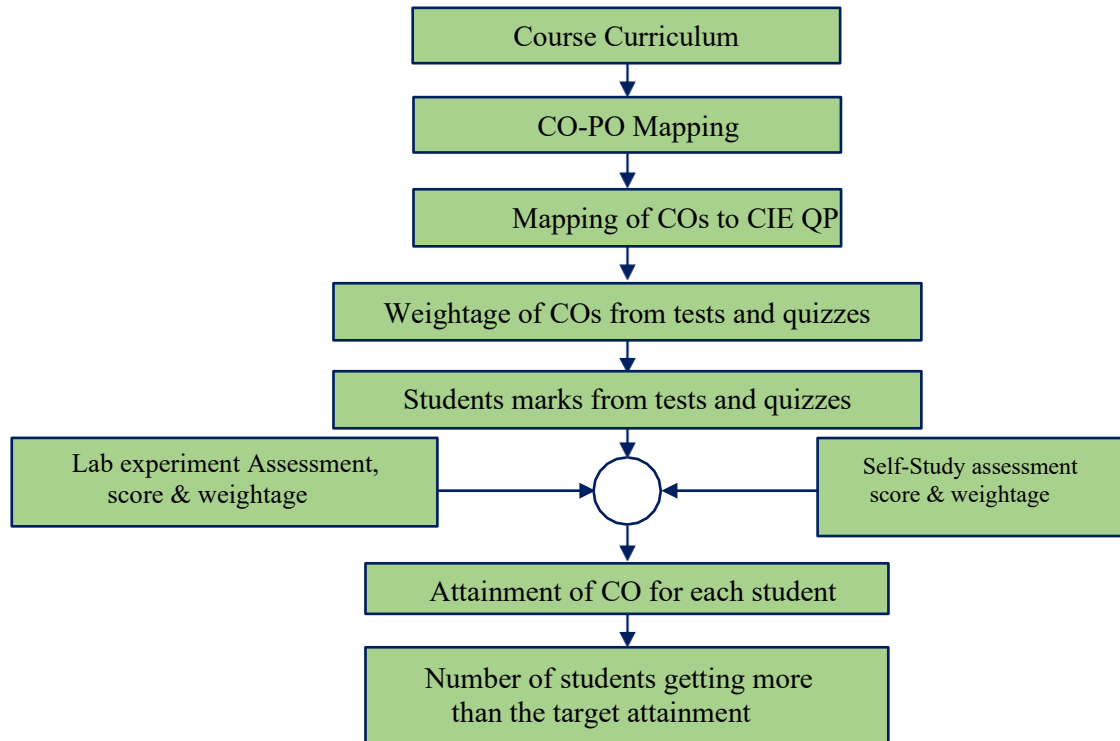
Curriculum Design Process



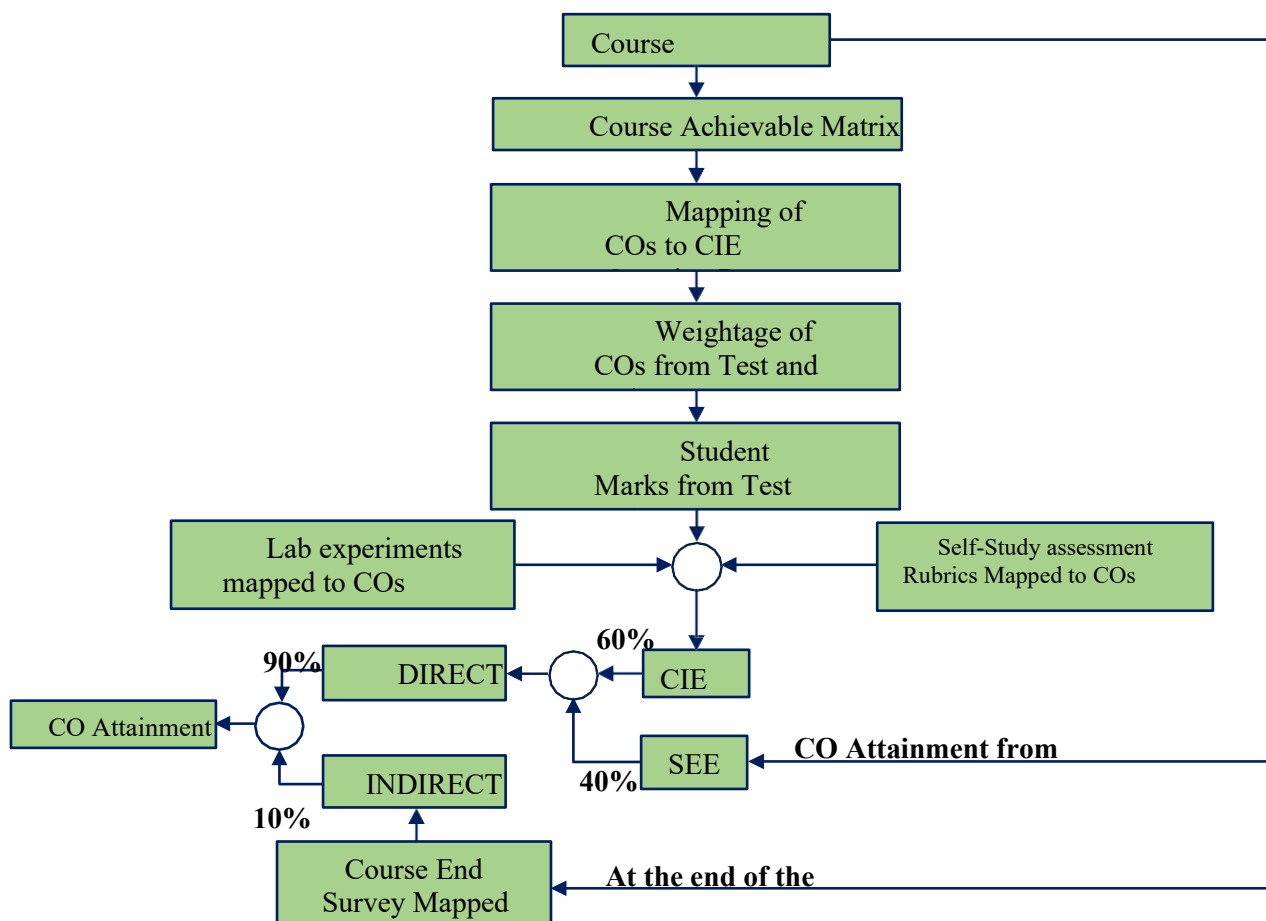
Academic Planning and Implementation



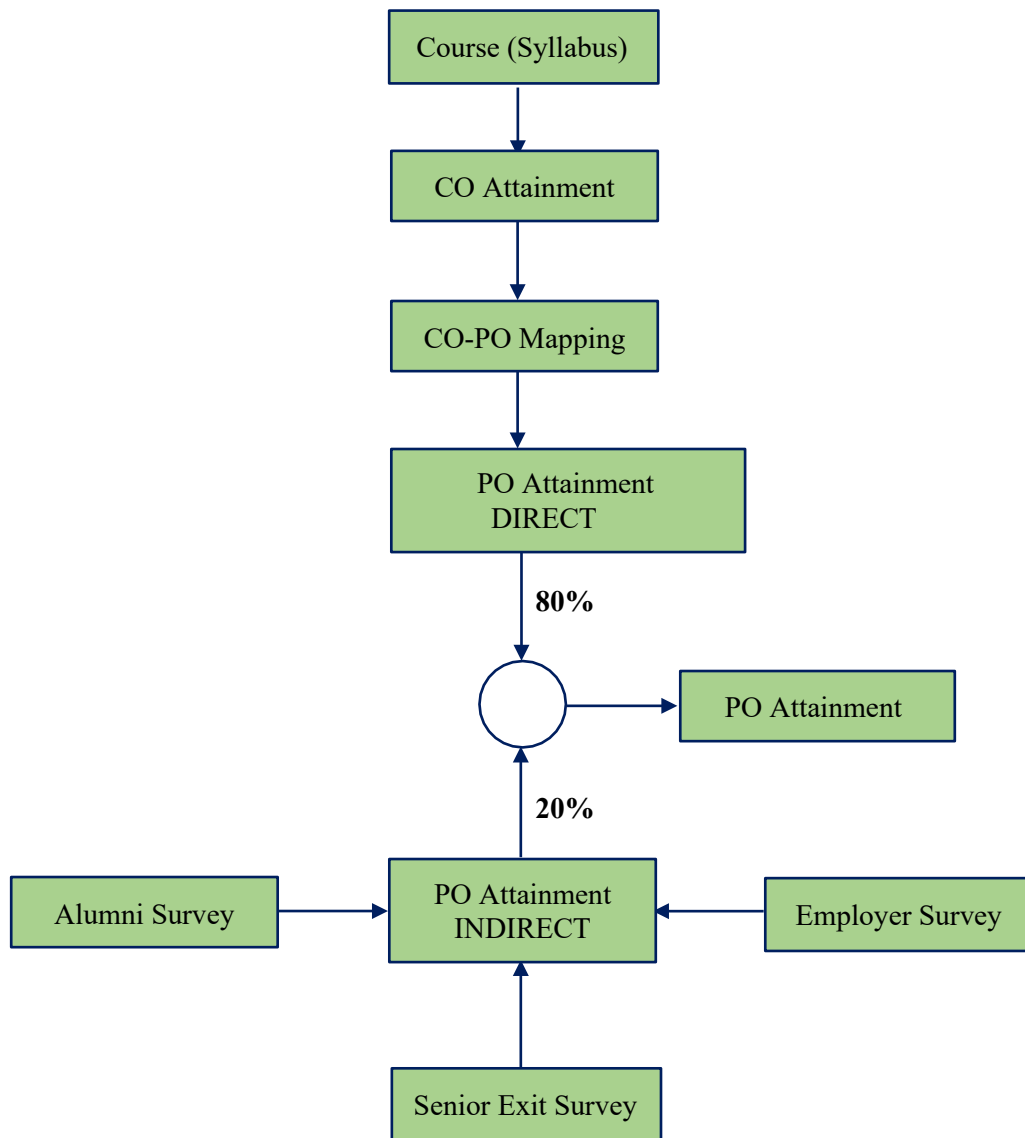
Process for Course Outcome Attainment



Final CO Attainment Process



Program Outcome Attainment Process





KNOWLEDGE & ATTITUDE

- **WK1:** A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- **WK2:** Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- **WK3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- **WK4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
- **WK5:** Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
- **WK6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
- **WK7:** Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
- **WK8:** Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
- **WK9:** Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

INNOVATIVE TEAMS OF RVCE

Ashwa Mobility Foundation (AMF): Designs and fabricates Formula-themed race cars and mobility solutions to address urban transportation issues.

Astra Robotics Team: Focuses on designing and building application-specific robots.

Coding Club: Helps students gain coding skills and succeed in competitions like GSoC and ACM-ICPC.

Entrepreneurship Development Cell (E-Cell): Promotes entrepreneurship through workshops, speaker sessions, and mentoring for startups.

Frequency Club Team: Works on software and hardware, emphasizing AI and Machine Learning.

Team Garuda: Develops a supermileage urban concept electric car and E-mobility products.

Team Jatayu: Builds low-cost UAVs with autonomous capabilities for various tasks.

Solar Car Team: Aims to create a solar electric vehicle for sustainable transportation.

Team Antariksh: Focuses on space technology and the development of operational rockets.

Team Chimera: Builds a Formula Electric Car through R&D in E-Mobility.

Helios Racing Team: Designs and tests All-Terrain Vehicles, participating in SAE's BAJA competitions.

Team Hydra: Develops autonomous underwater vehicles for tasks like water purification.

Team Krushi: Creates low-cost farming equipment to assist farmers in cultivation and harvesting.

Team Vyoma: Designs and tests radio-controlled aircraft and UAVs.

Team Dhruva: Engages in astronomy-related activities and collaborates on projects with organizations like

Ham Club: Promotes Amateur Radio and explores technical innovations in communications, especially for disaster response.

Cultural Activity Teams

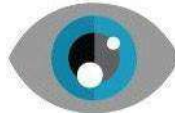
1. AALAP (Music club)
2. DEBSOC (Debating society)
3. CARV (Dramatics club)
4. FOOTPRINTS (Dance club)
5. QUIZCORP (Quizzing society)
6. ROTARACT (Social welfare club)
7. RAAG (Youth club)
8. EVOKE (Fashion team)
9. f/6.3 (Photography club)
10. CARV ACCESS (Film-making)



NSS of RVCE



NCC of RVCE



VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology



MISSION

- To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
- To create a conducive environment for interdisciplinary research and innovation.
- To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
- To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
- To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Technical Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.



CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation



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