RV College of Engineering®

Master of Computer Applications (MCA)

Scheme and Syllabus of I & II Semester
(2024 Scheme)

2024
Edition

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

40
Patents Granted
Last 3 Years

29
Skill Based Laboratories
Across Four Semesters

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)

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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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RV COLLEGE OF ENGINEERING®
(Autonomous Institution Affiliated to VTU, Belagavi)
MASTER OF COMPUTER APPLICATIONS

SL No	Course Code	Course Title	L	T	P	Total Credits	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
			I SEMESTER MCA									
			Credit Allocation									
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	-	-
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

RV COLLEGE OF ENGINEERING®
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MASTER OF COMPUTER APPLICATIONS

			II SEMESTER MCA										
			Credit Allocation										
SL No	Course Code	Course Title	L	T	P	Total Credits	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
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

			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 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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	*(Professional Core Course with Integrated Lab)*	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, 10th 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, 7th Edition, 2017, ISBN 13: 978-0-136-08620-8

SI.No.	COMPONENTS	MARKS
	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]**	
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 40% in TEST 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**

Q.NO.	CONTENTS	MARKS
	RUBRIC FOR CONTINUOUS INTERNAL EVALUATION (CIE-Lab)	
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)	
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**

Q.NO.	CONTENTS	MARKS
	RUBRIC FOR SEMESTER END EXAMINATION (SEE-Lab)	
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, 5th Edition, 2019, ISBN: 9780135182130
2. Gazihan Alankus, Rogério Theodoro de Brito, Basheer Ahamed Fazal, Vinicius Isola, Miles Obare, Java Fundamentals, Packt Publishing; 1st Edition (15 March 2019), ISBN-13:978-1789801736
3. Herbert Schildt, Dale Skrien, Java Fundamentals, A Comprehensive Introduction , Tata McGraw Hill, 1st Edition, 2017,ISBN-13:978-1259006593
4. Jeff Friesen, Java Threads and the Concurrency Utilities, 1st Edition, Apress,ISBN-13:978-1484216996
5. Ian F. Darwin, Java Cookbook: Problems and Solutions for Java Developers Shroff/O'Reilly ,2020, 4th Edition, ISBN-13:978-9352139774

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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 40% in TEST 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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	*(Professional Elective Course with Integrated Lab) -A*	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,1st Edition, 2021, ISBN-: 9789354640506, ISBN-13: 9789354640513 (EBook)
2. Joel Grus, Data Science from Scratch, First principles with Python, O'Reilly, 2nd 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 40% in TEST 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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	:	45L+45EL+30P	*(Professional Elective Course with Integrated Lab) -A*	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, Fooding, 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
3. Demonstration of Virtual LAN using GNS 3
4. Create a network with four routers and four hosts on different networks. Demonstrate RIP routing protocol using GNS 3
5. Create a network with four routers and four hosts on different networks. Demonstrate OSPF routing protocol using GNS 3
6. Build DHCP server using dns-masq with and without MAC binding with IPV4 and IPV6
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	:	Analyse 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, 6th Edition, 2021, ISBN-13: 9780137523214
2. Behrouz A Forouzan, Firouz Mosharraf, —Computer Networks A Top-Down Approach‖, McGraw-Hill, 1st Edition, 2023, ISBN 13: 9789355324900
3. Sumitabha Das, Unix: Concepts and Applications, McGraw-Hill, 4th Edition, 2017, ISBN 13: 978-0070635463
4. Stallings, William. Data and computer communications. Pearson Education India, 9th 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 40% in TEST 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 dministration 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, 2nd Edition, May 2018

3. Horowitz, Sahni and Anderson-Freed,"Fundamentals of Data Structures in C", University Press,2nd 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	: HSS116L	**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	:	2 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	
Test – II		
Experiential Learning		**Final assessment will be conducted for 50 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	10 Marks	
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	: MCA221IA	**MOBILE APPLICATION DEVELOPMENT**	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) -1*	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 widge

Custom gestures for your custom widgets - Decide on your gestures and behaviors, Create your custom widget, Add a Gesture Detector widget, Associate your gesture with its behavior

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 40% in TEST to clear in 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	Design and Development of the project	20
2	Presentation of the working model/simulation results/prototype	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 & Greedy Method 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. Sorting and Order Statistics: Sorting in Linear Time, Medians and Order Statistics, Heapsort.
Space and Time Trade Offs and Limitations of Algorithmic Power 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

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 asymptotic performance of algorithms
CO2	:	Strategize algorithms using different design techniques for a given computing problem
CO3	:	Analyze the techniques to find optimal solutions, improving computational efficiency
CO4	:	Synthesize efficient algorithms for real world problem

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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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	:	30L+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
2. Susheela Hooda Vandana Mohindru Sood Yashwant Singh, Sandeep Dalal and Manu Sood,Agile Software Development, Trends, Challenges and Applications Wiley Publications, 2023
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

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3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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
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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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	*(Professional Elective Course with Integrated Lab) -B*	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

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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	Design and Development of the project	20
2	Presentation of the working model/simulation results/prototype	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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	*(Professional Elective Course with Integrated Lab) –B*	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:
   a. Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue.
   b. Create a line chart to show the revenue based on the month of the year.
   c. Create a bin of size 10 for the age measure to create a new dimension to show the revenue.
   d. Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field.
   e. Create a butterfly chart by reversing the bar chart to compare female & male revenue based on product category.
   f. 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:
   a. Create a Donut chart to show the percentage of movie and tv shows
   b. Create a area chart to shows by release year and type.
   c. Create a horizontal bar chart to show Top 10 genre
   d. Create a map to display total shows by country
   e. 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, 2nd 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
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)

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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	Design and Development of the project	20
2	Presentation of the working model/simulation results/prototype	20
3	Viva voce	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**

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Bengaluru - 560059, Karnataka, India

Go, change the world

SEMESTER: II						
Course Code	:	MCA224B3	**INTERNET OF THINGS APPLICATIONS**	CIE Marks	:	100 + 50
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	:	45L+45EL+30P	*(Professional Elective Course with Integrated Lab) –B*	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 behaviour 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 exp32 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 IIoT 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/

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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	Design and Development of the project	20
2	Presentation of the working model/simulation results/prototype	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	*(Theory & Practice)*	SEE Marks	:	100 + 50
Hours	: 45L+45EL+30P	*(Professional Elective Course with Integrated Lab) -B*	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 daemonized containers, Seeing what's happening inside our container, Inspecting the container's processes, Stopping a daemonized 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 ECLIPSE Integration with cloud
9. Deploy Java application by connecting to RDS Server in cloud
10. Demonstrate auto scaling group concept in cloud
11. Deploy and test docker container websites using 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

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 40% in TEST 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	Design and Development of the project	20
2	Presentation of the working model/simulation results/prototype	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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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: 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**

Overview of Large Language Models: LLMs and their architectures. 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, CycleGAN and attention mechanisms, Variable Auto Encoders

UNIT – III	**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 – IV	**9 Hours**

Advanced Techniques: Understanding BERT architecture and pre-training objectives. Fine-tuning BERT for downstream NLP tasks. Exploration of advanced Transformer architectures 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, Adversial 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 prompt engineering principles to design effective prompts for diverse generative AI applications
CO2	:	Demonstrate large language models architecture and working for various in real-world scenarios
CO3	:	Build LLM Models and Frameworks to generate text, audio, image, and video content
CO4	:	Analyze the ethical, security, and legal challenges associated with generative AI tools and models

Reference Books

1.	David Foster, Generative Deep Learning, O'Reilly Media, 2023, ISBN-978-1098134181
2.	Lewis Tunstall, Leondro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly Media, 2022, ISBN- 978-9355420329
3.	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
4.	Chris Fregly, Antje Barth, Generative AI on AWS, O'Reilly Media, 2023, ISBN-978-9355427939

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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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 40% in TEST to clear CIE**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (15) & Phase II (25) 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	*(Theory - NPTEL Online Course)*	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, 17th 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, 3rd Edition, Atomic Dog Publishing, 2006, ISBN: 978-1592602919
3. Kothari C.R., Research Methodology Methods and Techniques, 4th Edition, New Age International Publishers, 2019, ISBN: 978-93-86649-22-5.
4. Levin, R.I. and Rubin, D.S., Statistics for Management, 8th Edition, Pearson Education: New Delhi, 2017, ISBN-13- 978-8184957495.

GENERAL GUIDELINES

5. 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.
6. NPTEL is offering online certification courses through its portal - https://swayam.gov.in/nc_details/NPTEL
7. Enrollment to courses and exam registration can be done in ONLINE mode only. The link is available on NPTEL website http://nptel.ac.in/
8. Students need to enroll for the NPTEL course and clear the exam.
9. 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.
10. 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.
11. 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/week	:	04	*(Practice)*	SEE Duration	:	2 Hours

UNIT – I	9 Hours

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

UNIT – II	9 Hours

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.

UNIT – III	9 Hours

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

UNIT – IV	9 Hours

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

UNIT – V	9 Hours

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

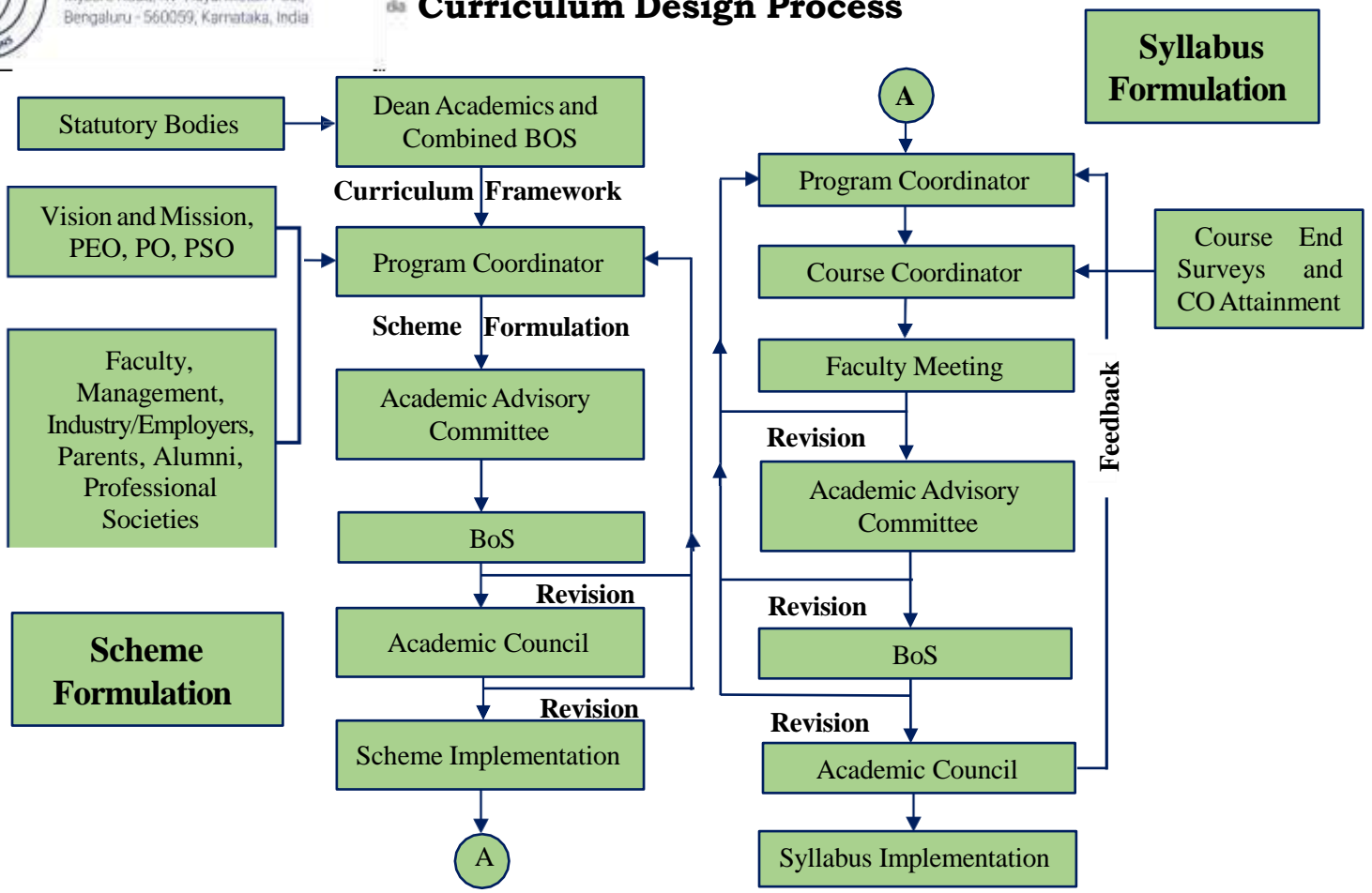| Q.NO.	CONTENTS	MARKS
1	Presentation through posters	15
2	Demonstration of the Prototype	25
3	Vivavoce	10
Maximum Marks for SEE		**50**

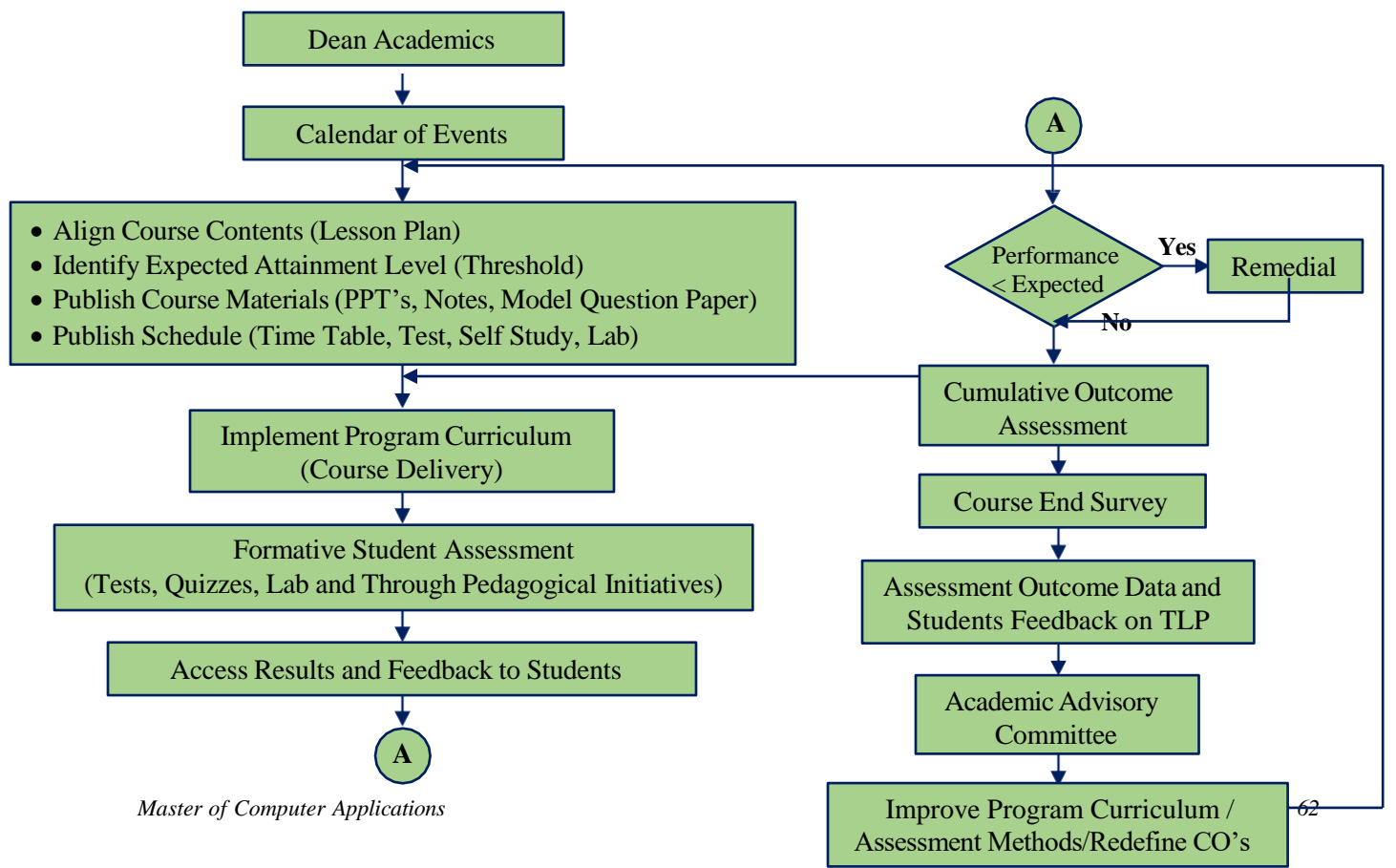# PROGRAMME OUTCOMES (PO)

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.
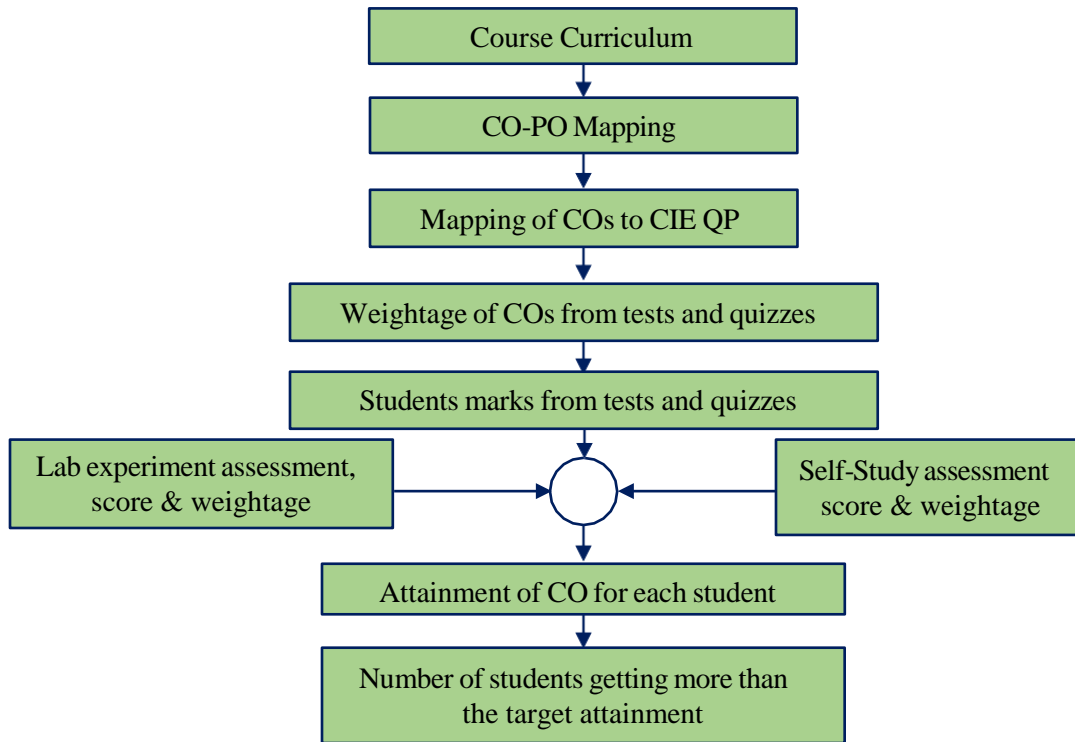
Curriculum Design Process

Go, change the world

Syllabus Formulation

Scheme Formulation

Statutory Bodies → Dean Academics and Combined BOS

Curriculum Framework

Vision and Mission, PEO, PO, PSO → Program Coordinator

Scheme Formulation

Faculty, Management, Industry/Employers, Parents, Alumni, Professional Societies

- Academic Advisory Committee
- BoS
- **Revision**
- Academic Council
- **Revision**
- Scheme Implementation
- A

A → Program Coordinator → Course Coordinator → Faculty Meeting

Course End Surveys and CO Attainment

Revision → Academic Advisory Committee

Revision → BoS

Revision → Academic Council

Syllabus Implementation

Feedback

Academic Planning and Implementation

Dean Academics → Calendar of Events

- Align Course Contents (Lesson Plan)
- Identify Expected Attainment Level (Threshold)
- Publish Course Materials (PPT's, Notes, Model Question Paper)
- Publish Schedule (Time Table, Test, Self Study, Lab)

Implement Program Curriculum (Course Delivery)

Formative Student Assessment (Tests, Quizzes, Lab and Through Pedagogical Initiatives)

Access Results and Feedback to Students

A

A → Performance < Expected — **Yes** → Remedial / **No**

Cumulative Outcome Assessment

Course End Survey

Assessment Outcome Data and Students Feedback on TLP

Academic Advisory Committee

Improve Program Curriculum / Assessment Methods/Redefine CO's

Master of Computer Applications

Process For Course Outcome Attainment

Course Curriculum

CO-PO Mapping

Mapping of COs to CIE QP

Weightage of COs from tests and quizzes

Students marks from tests and quizzes

Lab experiment assessment, score & weightage

Self-Study assessment score & weightage

Attainment of CO for each student

Number of students getting more than the target attainment

Final CO Attainment Process

Course (Syllabus)

Course Achievable Matrix

Mapping of COs to CIE Question Paper

Weightage of COs from Test and Quizzes

Student Marks from Test and Quizzes

Lab experiments mapped to COs

Self-Study assessment Rubrics Mapped to COs

90% DIRECT

60% CIE

CO Attainment

40% SEE

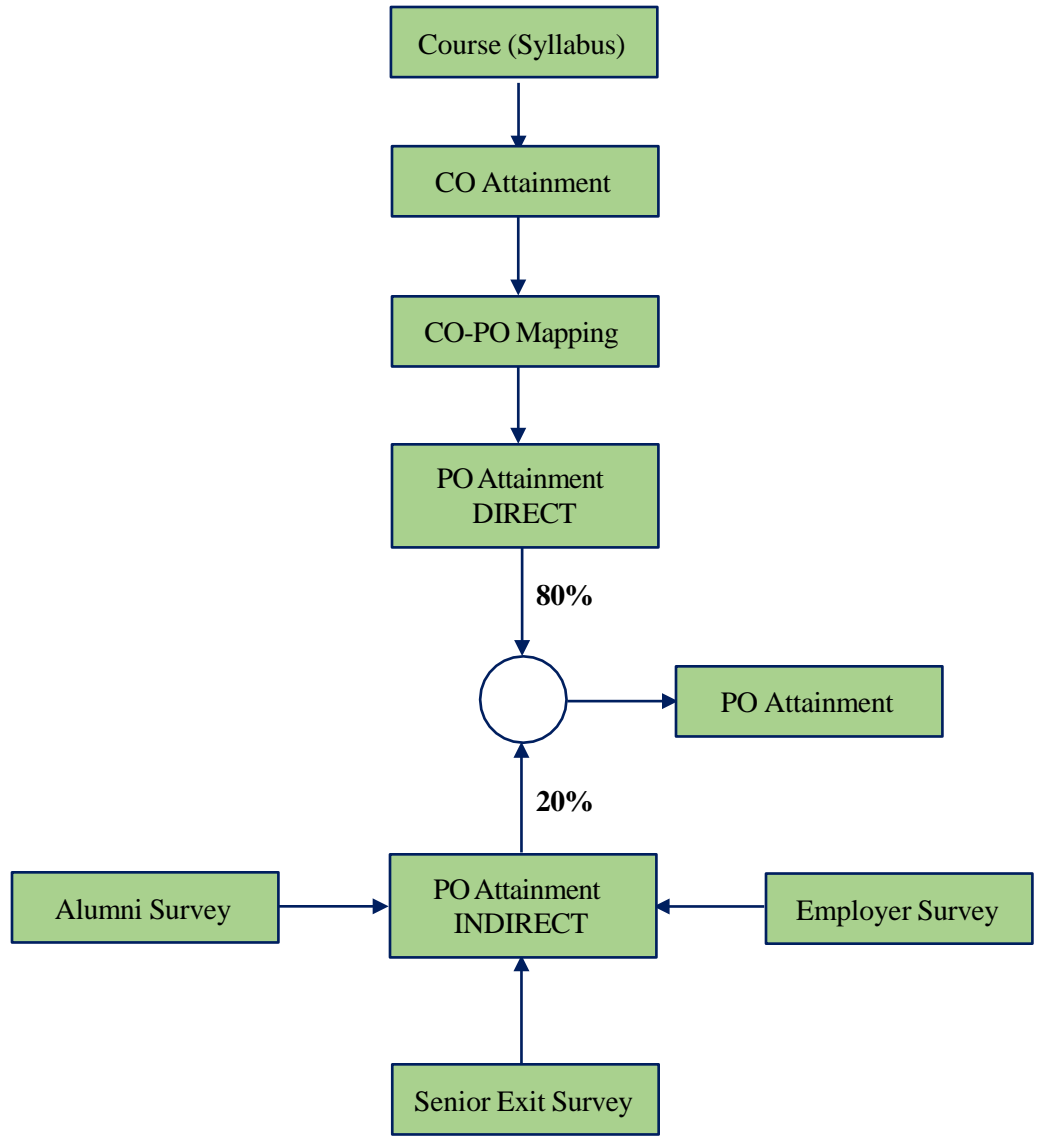CO Attainment from SEE

10% INDIRECT

Course End Survey Mapped to COs

At the end of the Course
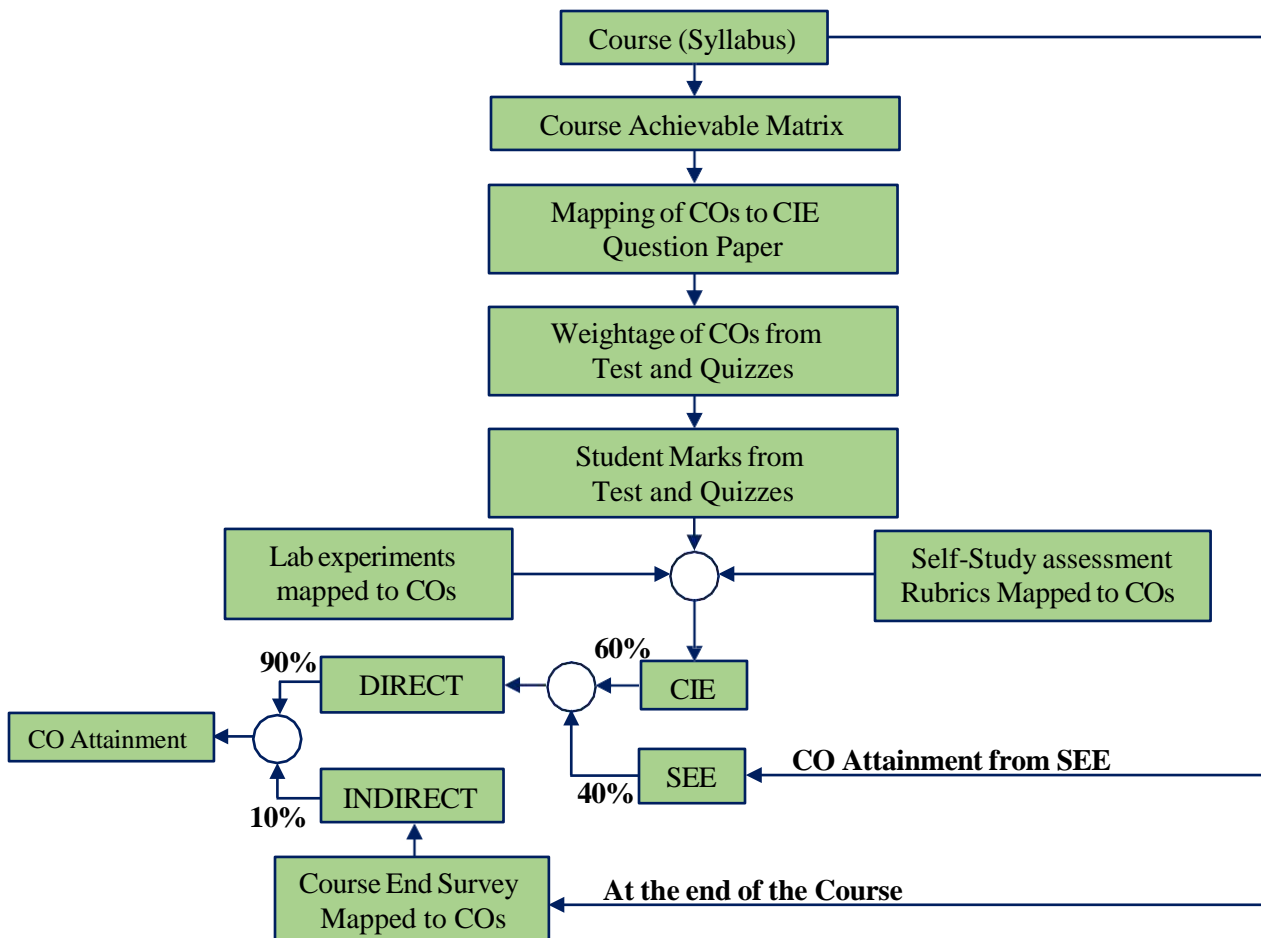
Program Outcome Attainment Process

KNOWLEDGE & ATTITUDE PROFILE

- **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 ICTS and IIA.

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