Go, Change the world®

RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Scheme & Syllabus of
I to IV Semester

2022 SCHEME

MASTER OF COMPUTER APPLICATIONS
2-Year Program

VISION

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

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. 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

RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

Scheme & Syllabus of
I to IV Semester

2022 SCHEME

MASTER OF COMPUTER APPLICATIONS

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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MASTER OF COMPUTER APPLICATIONS

I 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.	MMA205T	Mathematical Foundation for Computer Science	4	1	0	**5**	MAT	Theory	1.5	100	3	100
2.	MCA101T	Linux Shell Scripting	3	1	0	**4**	MCA	Theory	1.5	100	3	100
3.	MCA102I	Computer Networks	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
4.	MCA103I	Object Oriented Programming	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
5.	MCA104I	Web Application Programming	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
6.	MHS101L	Ability Enhancement Course-I*	0	0	2	**2**	HSS	Lab	1.5	50	2	50
7.	MCA001T	Basics of Programming**	2	0	0	**0**	MCA	Theory	1.5	50	-	-
						26						

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*Identified External Agency will conduct the classes and evaluate both CIE and SEE

Note: *Students are mandatorily required to get One MOOC certification courses as recommended by HSS BoS, within I-IV Semester MCA and this is considered for the evaluation in course code MHS102T. This is included in the HSS board.*

****Bridge Course:*** The Basics of Programming with course code MCA001T is a non-credit course offered to Non-Computer Science background students only.

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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.	MCA431T	Research Methodology and IPR	2	0	0	**2**	MCA	Theory	1.0	50	2	50
2.	MCA131T	Design and Analysis of Algorithms	3	1	0	**4**	MCA	Theory	1.5	100	3	100
3.	MCA132I	Data Modeling	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
4.	MCA231I	Cloud Native Fullstack Application Development-I	3	0	1	**4**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
5.	MCA232AX	Integrated Professional Elective- I	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
6.	MCA233BX	Professional Elective-II	3	1	0	**4**	MCA	Theory	1.5	100	3	100
7.	MCA432L	Design Thinking*	0	0	2	**2**	MCA	Lab	1.0	50	2	50
						26						

* Societal Project - Design thinking course will be based on Sustainable Development Goals (SDGs)

List of Electives: II Semester

SL No	Course Code	Elective- I	SL No	Course Code	Elective-II
1.	MCA232A1	Internet of Things	1.	MCA233B1	DevOps
2.	MCA232A2	Data Science-I	2.	MCA233B2	Advanced Computer Networks
3.	MCA232A3	Software Testing and Practices	3.	MCA233B3	Cryptography and Network Security
4.	MCA232A4	2D and 3D Modeling	4.	MCA233B4	Digital Marketing

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MASTER OF COMPUTER APPLICATIONS

III 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.	MCA161T	Software Engineering	3	0	0	**3**	MCA	Theory	1.5	100	3	100
2.	MCA261I	Modern Application Development	4	0	1	**5**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
3.	MCA361I	Cloud Native Fullstack Application Development-II	3	0	1	**4**	MCA	Theory + Lab	1.5 + 3	150	3 + 3	150
4.	MCA262CX	Professional Elective-III	3	1	0	**4**	MCA	Theory	1.5	100	3	100
5.	MCA263DX	Professional Elective-IV	3	0	0	**3**	MCA	Theory	1.5	100	3	100
6.	MCA461P	Minor Project	0	0	4	**4**	MCA	Lab	3	100	3	100
7.	MCA462N	Internship*	0	0	6	**6**	MCA	Lab	3	100	3	100
						29						

Six Weeks Internship to be completed during the intervening Vacation of II and III semesters

List of Electives: III Semester

SL No	Course Code	Elective- III	SL No	Course Code	Elective-IV
1.	MCA262C1	Data Science-II	1.	MCA263D1	AI and Product Management
2.	MCA262C2	Augmented Reality and Virtual Reality	2.	MCA263D2	Data Visualization
3.	MCA262C3	Principles of UI/UX Design	3.	MCA263D3	Digital Transformation
4.	MCA262C4	Cyber Security and Blockchain	4.	MCA263D4	Web of Things

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IV 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.	MCA491P	Major Project	0	0	15	**15**	MCA	Lab	1.5	100	3	100
2.	MCA492L	Technical Seminar	0	0	2	**2**	MCA	Lab	1.5	50	2	50
3.	MHS102T	Ability Enhancement Course-II	2	0	0	**2**	MCA	Theory	-	50	ONLINE	50
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MASTER OF COMPUTER APPLICATIONS

Credit Distribution for MCA 2022 Scheme

		SEM-I	SEM-II	SEM-III	SEM-IV	TOTAL CREDITS
SL No	**Course Type**	**Credits**				**Credits**
1.	Basic Science Course (BSC)	05	--	--	--	05
2.	Professional Core Course (PCC)	04	02	03	--	09
3.	Integrated Professional Core Course (IPCC)	15	14	09	--	38
4.	Professional Elective Course (PCE)	--	08	07	--	15
5.	Audit Course/ Ability Enhancement Course (AUD/AEC)	02	--	--	02	04
6.	Project / Internship	--	02	10	15	27
7.	Seminar	--	--	--	02	02
	Total	**26**	**26**	**29**	**19**	**100**

SEMESTER: I

MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE (Theory)

Course Code	**:**	**MMA205T**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**4:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**52L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	**10 Hrs**
Sets, Relations and Functions: Basics of set theory, Cartesian product of sets. Relations, Properties of relations, Zero-one matrices and directed graphs, Hasse diagram, Equivalence relations and partitions. Functions- types of functions, ceil function and the floor function, Function composition and Inverse function.	
UNIT-II	**10 Hrs**
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	**11 Hrs**
Engineering Optimization: Introduction to Operations Research, Linear Programming Problem-Formation, Classical optimization techniques-Simplex method. Transportation Model-North-west corner rule, Vogel's approximation method, Optimum solution using modified distribution method. Assignment Model-Hungarian method**.**	
UNIT-IV	**11 Hrs**
Statistics and Probability: 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	**10Hrs**
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	Understand fundamental concepts of sets, relations, functions, logic, statistics and probability. theory.
CO2	Apply fundamental concepts of functions, reasoning, statistics and probability theory for different domains in data science and machine learning
CO3	Analyze mathematical concepts like relational algebra, statistics, and probability. theory to optimize the solutions of engineering problem.
CO4	Implement overall mathematical knowledge gained to demonstrate and analyze the problems. arising in practical situations.

Reference Books	
1.	Ralph P Grimaldi, B.V. Ramana, Discrete and Combinatorial Mathematics, An applied Introduction, Pearson Education, 5th Edition, 2019, ISBN: 9789353433055, 9353433053.
2.	Kenneth H Rosen, Discrete Mathematics & its applications, McGraw-Hill, 8th Edition, 2021, ISBN: 9390727359 · 9789390727353.
3.	Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying E. Ye, "Probability and Statistics for Engineers and Scientists", Pearson, 9th Edition, 2021, ISBN-13: 9780136860969.
4.	Wayne L Winston, Operations Research: Applications and Algorithms, Thomson Learning, 4th Edition, 2004, ISBN 0-534-38058-1

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: I					
LINUX SHELL SCRIPTING (Theory)					
Course Code	**:**	**MCA101T**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	07 Hrs
The Unix/Unix Like Operating System architecture and commands: Unix Architecture, Features of UNIX, General purpose utility commands, Basic and advanced file attributes, File system. **Introduction to version control system:** git and its usage for managing code repositories. **Introduction to Shell Script:** Shell scripts, read, command line arguments, exit, variables, wildcards, escape characters logical operators and conditional operators	
UNIT–II	**08 Hrs**
Programming through Shell Script: if conditional, case conditional, expr computations and string handling, while looping, for looping, set and shift, trap interrupting a program, debugging shell scripts with set command, validation and data entry scripts, function: introduction, scope of variable, return codes. **Scripting Standards:** Scripts and naming convention, Script File Permission, Shell Script Format, Sequence of Script execution.	
UNIT–III	**08 Hrs**
Introduction to filters: pr: paginating files**,** head: Displaying the beginning of a file, tail: displaying the end of the file, cut: slitting a file vertically, paste: pasting files, sort: ordering a file, uniq, tr: translating characters. **Filters and regular expression: grep:** Searching for a pattern, Basic Regular Expression, Extended Regular Expression and egrep, types of grep. **sed**: stream editor, Line addressing, Context addressing, Text editing, Substitution. **awk**: Simple awk filtering, splitting a line into fields, printf, redirecting and expression, comparison, begin and end, built-in variables and arrays.	
UNIT–IV	**08 Hrs**
User Management: Adding a group, adding a user, user profiles, modifying and removing users. **Process Management:** Process status, system processes, mechanism of process creation, Internal and External commands, process states and Zombies, killing processes with signals. **Job scheduling:** Scheduling jobs with at and crontab. **Log Management**: Running script in background for tracking various log messages, tail with egrep and echo, Central logging (rsyslog)	
UNIT–V	**08 Hrs**
Database Administration and Backup: Backing up each database to a separate file, backing up a single database, Backup all databases to a single file, schedule a backup to automatically back up a web portal or website data. **Real Time Practice:** Shell scripting to execute different commands on different remote servers, Automatic email alert generation about hardware resources, automate installation of required git version using shell script, Shell script to backup file system. **Introduction to Docker and Curl:** Brief introduction about docker and its usage while automating infrastructure management. **Introduction to Curl:** Automating user communication to and from servers using Curl	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand how to write shell scripts from basic to advanced level
CO2	Analyze and identify high-level steps such as verifying user input to automate repetitive tasks
CO3	Apply shell scripting techniques and standards using filters for pattern matching on plain text data and variety of system log files
CO4	Develop effective and interactive scripts using functional blocks, operating system and networking utilities to manage complex and repetitive tasks in real time scenarios

Reference Books	
1.	Sumitabha Das, Unix Concepts and Applications, McGraw Hill, 4th Edition, 2012, ISBN:978-0-07-063546-3
2.	Ganesh Naik, Learning Linux Shell Scripting, Packt Publishing, 2nd Edition, May 2018, ISBN:978-1788993197
3.	Narendra Kumar Reddy, Complete Bash Shell Scripting, Polu Packt Publishing, April 2020, ISBN: 9781800209695 https://www.packtpub.com/in/cloud-networking/complete-bash-shell-scripting-video
4.	Mokhtar Ebrahim, Andrew Mallett, Mastering Linux shell scripting, Packt Publishing, 2nd Edition, 2018, ISBN 9781788990554
5.	Imran Afzal, A Complete Course on Linux bash shell scripting with real life examples, Packt Publishing, July 2019, ISBN:9781838984083

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: I					
COMPUTER NETWORKS (Theory & Practice)					
Course Code	**:**	**MCA102I**	**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	**10 Hrs**
Introduction: Introduction, Uses of Computer Networks, 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, Digital Modulation and Multiplexing	
UNIT-II	**10 Hrs**
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	**12 Hrs**
The Network Layer: Network Layer Design issues, Routing algorithms- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms, Quality of Service, Internetworking	
UNIT–IV	**10 Hrs**
The Network Layer in the Internet: 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–V	**10 Hrs**
The Transport Layer: The Transport Service: Services Provided to the Upper Layers, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols- TCP: Introduction to TCP, The Service Model, Protocol, Segment Header, UDP **The Application Layer**: The Domain Name System, Electronic Mail, The World-Wide-Web, Streaming Audio and Video	

LABORATORY	
1.	Create a LAN with three or more nodes implementing star topology and demonstrate classful addressing
2.	Create a LAN using physical networks/virtual machine and install FTP server to demonstrate file transfer
3.	Demonstrate secured file transfer and computing over wired network and wireless network with SCP and SSH key based computing
4.	Demonstrate to calculate IP addresses using ipcalc
5.	Build DHCP server using dns-masq with and without MAC binding with IPV4 and IPV6
6.	Build DNS server for resolving the names and IP addresses
7.	Build a Firewall to Restrict Network Access using Firewall
8.	Demonstrate basic trouble shooting using ping, traceroute, ifconfig, nslookup, netstat and route
9.	Demonstrate multiple client server communication on different ports using netcat
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	Understand the fundamentals of computer networking and the concept of layered approach
CO2	Identify 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	Analyze and evaluate the principles and protocols of computer networks

Reference Books	
1.	Andrew S. Tanenbaum, David J Wetherall, “Computer Networks”, Pearson Education, Pearson Publication, 5th Edition, 2012, ISBN-1978-81-317-8757-1
2.	Behrouz A Forouzan, Firouz Mosharraf, “Computer Networks A Top-Down Approach”, Tata McGraw-Hill Education Pvt. Ltd, 2011, ISBN 13: 9781259001567
3.	Peterson, Larry L., and Bruce S. Davie. Computer networks: a systems approach. Elsevier, 2012, 5th Edition, ISBN-13: 978-0-12-385059-1
4.	Stallings, William. Data and computer communications. Pearson Education India, 2007, 8th Edition, ISBN: 0-13-243310-9.

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: I					
OBJECT ORIENTED PROGRAMMING (Theory & Practice)					
Course Code	**:**	**MCA103I**	**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	11 Hrs
Object Oriented Programming: Introductions, OOP, classes, class attributes, instances, instance attributes, Constructor and Destructor, Encapsulation **Introduction to Python Programming Language:** Introduction to python, program output, input, comments, operators, variables and assignment, numbers, if statement, while loop, for loop, and the range ( )	
UNIT–II	**11 Hrs**
Data Types: Operations and methods on strings, tuples, lists, sets and dictionaries. **Functions:** Built-in Functions: Lambda, MAP, Filters and User defined Functions **Magic Methods:** Magic method syntax, available methods	
UNIT–III	**10 Hrs**
Basics of Polymorphism and Inheritance: Operator and function overloading, Introduction to Inheritance, types of Inheritance, sub classing and scope, overriding methods **Modules and Packages:** What are modules, modules and packages, creation of packages, importing modules, importing packages. **Introduction to Numpy module:** numpy basics, numpy data types, creation of ndarray, nested sequences, numpy array iteration, concatenation	
UNIT–IV	**10 Hrs**
Reading and Writing Files: Introduction to File operation, opening a File, Techniques for Reading Files, Writing Files. **Context Managers:** Context manager syntax, when you should write context managers. **Error and Exceptions:** Introduction to exceptions in python, detecting and handling exceptions, exceptions as strings, raising exceptions, assertions, standard exceptions	
UNIT–V	**10 Hrs**
Decorators: Understanding Decorators, Decorator Syntax, Decorators Functions, Decorator classes. **Generators:** Understanding Generators, Generator syntax, Generator Examples **OOP for Database Programming:** Introduction, Architecture, Steps for Connecting Database, Basic Operations with Examples	

LABORATORY **Students should implement using Python Language. Apply Unit testing and integration testing (As per problem definition). Develop various test cases, execute them and analyze the test results**	
1.	Implement 10 operations on string and Tuple
2.	Implement 10 operations on sets and lists
3.	Demonstrate dictionary concepts for a given scenario
4.	Implement importing of user defined modules using Magic Methods
5.	Implement any two types of Inheritance
6.	Implement overloading concept
7.	Implement overriding concept
8.	Demonstrate any five-exception handling mechanism using files
9.	Write a python program to Insert, Search, and Retrieve data into Employee Database
10.	Write a program to create Fibonacci series using generators and stack the same with a decorator to find the time taken by the generator

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concepts of object-oriented programming
CO2	Identify and apply relevant object-oriented concepts in any real-world scenario.
CO3	Utilize object-oriented concepts to solve any real-world problem
CO4	Analyze solutions using OOPs concepts for real world applications

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

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:
The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**
Scheme of Semester End Examination (SEE) Laboratory for 50 marks:
SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: I					
WEB APPLICATION PROGRAMMING (Theory & Practice)					
Course Code	**:**	**MCA104I**	**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**10 Hrs**
Introduction to Web Technologies: Internet, WWW, Web Browsers, Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox. WAMP, LAMP, ZAMP, Client-Side Scripting versus Server-Side Scripting **Mark-up Language:** HTML5 tags- Formatting, Commenting, Code, Anchors, Backgrounds, Images, Hyper-links, Lists, Tables, Semantic Elements in HTML, Multimedia, Forms	
UNIT–II	**12 Hrs**
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. **Bootstrap:** Getting Started with Bootstrap- Mobile-irst design, Why Bootstrap, Including Bootstrap in your HTML file, The Bootstrap CDN, overriding with custom CSS, Using the Bootstrap customizer, 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 **Doing More with Components:** Jumbotron, Badges, Progress bar, Button groups	
UNIT–III	**08 Hrs**
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–IV	**11 Hrs**
XML: Introduction, syntax, Document structure, Document Type Definitions, Namespaces, XML schema, displaying raw XML documents **JSON:** Introduction-JSON Is a Data Interchange Format, JSON Is Programming Language Independent, JSON Syntax -JSON Is Based on JavaScript Object Literals, Name-Value Pairs, Proper JSON Syntax, Syntax Validation, JSON as a Document, The JSON Media Type, JSON Data Types -Quick Look at Data Types, The JSON Data Types, The JSON Object Data Type, JSON Schema -Contracts with Validation Magic, Introduction to JSON Schema	
UNIT–V	**11 Hrs**
Document Object Model: The JavaScript Execution Environment, The Document Object Model, Elements Access in Java Script, Events and Event Handling, The DOM2 Event Model, DOM Tree Traversal and Modification **Data Visualization**: Getting Started with D3.JS, Using SVG to Create Images Using Code, Base tag, Basic elements, positioning an element, Styling an element, Important SVG elements	

LABORATORY	
1.	Design a static web portal using HTML5 semantic elements, style using CSS
2.	Design a web page to demonstrate, customization of Bootstrap classes using CSS
3.	Develop an event countdown timer using HTML5, CSS/Bootstrap and JavaScript
4.	Design a JS program to show the stack implementation using Arrays
5.	Write a JS program to demonstrate any 4 methods of a. String object b. Date object c. Number Object
6.	Write a JS program to illustrate the following concepts considering appropriate scenario. a. Different ways of creating objects and nested objects. b. Different kinds of DOM events
7.	Design a form and validate the fields. Use regular expression to condition the fields
8.	Compose an XML file to store name, address, Email Id and phone number of three. person and access the data using JavaScript, display the result by applying styles
9.	Design JSON document to store information about faculty in MCA Department, college affiliated to VTU. Make up sample data for 5 students. Access the values through JavaScript and store them in the table format
10.	Design a page to display complex shapes using D3.JS

Course Outcomes: After going through this course, the student will be able to	
CO1	Describe the basic constructs of the web concepts
CO2	Determining and comparing the relevant components that can be applied to a given problem
CO3	Apply the concepts to design and implement the web solutions for the given scenario
CO4	Analyze the web 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, 9781491929483.
3.	Aravind Shenoy, Ulrich Sossou, Learning Bootstra, O'Reilly Media, 2020, ISBN 978-1-78216-184-4.
4.	Matthew Huntington, D3.js Quick Start Guide, Packt Publishing, 2018, ISBN-13: 978-1789342383

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding upto 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: I					
ABILITY ENHANCEMENT COURSE-I (Practice)					
Course Code	**:**	**MHS101L**	**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**	**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 hrs / Semester**	**SEE Duration**	**:**	**2.00 Hours**

UNIT-I	**05 Hrs**
Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening **Communication with Confidence & Clarity**: Interaction with people, the need, the uses and the methods, getting phonetically correct, using politically correct language, Debate & Extempore. **Assertive Communication**: Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive	
UNIT-II	**06 Hrs**
Aptitude Test Preparation: Importance of Aptitude tests, Key Components, Quantitative **Aptitude** – Problem Solving, Data Sufficiency, Data Analysis - Number Systems, Math Vocabulary, fraction decimals, digit places, profit and loss, time and work, time, speed and distance, calendar, clock, permutations and combinations, probability etc. **Mental ability:** coding-decoding, blood relations, puzzle test, logical sequence of words	
UNIT-III	**05 Hrs**
Reasoning and Logical Reasoning: logic, statement- arguments, assumptions, courses of actions, conclusions, deriving conclusions from passages, logical puzzles, Analytical Reasoning, Critical Reasoning **Presentation Skills:** Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, how to make effective presentations, body language, Rapport Building	
UNIT-IV	**05 Hrs**
Interview Skills: Questions asked and how to handle them, Behavioral, technical and HR Interviews, etiquette. **Motivation and Stress Management:** Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. Individual Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life	
UNIT –V	**05 Hrs**
Professional Practice: Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behavior at different Hierarchical Levels. Positive Attitude, Self-Analysis and Self-Management **Professional Ethics:** values to be practiced, standards and codes to be adopted as professional engineers in society for various projects**.** Balancing Personal & Professional Life	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand and solve problems covering Quantitative, verbal Ability and Logical Reasoning
CO2	Apply and enhance communication, leadership and interpersonal working skills with professional ethics
CO3	Inculcate problem solving, decision making, stress management skills for lifelong learning
CO4	Develop their potential and become confident to acquire a high degree of self

Reference Books	
1.	Arun Sharma, How to prepare for Quantitative Aptitude for CAT, McGraw Hill, 8th Edition, 2022, ISBN:978-93-53160-18-0
2.	R S Agarwal, Dr. R.S. Aggarwal, S Chand Publishing, 2022, ISBN: 978-9355012326
3.	R S Agarwal, A Modern Approach to Verbal and Non-verbal Reasoning, S Chand Publishing, 2018, ISBN:978-9352832163
4.	Kerry Patterson, Joseph Grenny, Ron McMillan, Crucial Conversation: Tools for Talking When Stakes are High, McGraw-Hill Publication, 3rd Edition, 2021, ISBN: 9780071772204
5.	Aptimithra: Best Aptitude Book, Ethnus, Tata McGraw Hill, 2014 ISBN: 9781259058738

Scheme of Continuous Internal Evaluation Laboratory (CIE): 40 + 10 = 50
Conduction of aptitude, Reasoning, communication skills, analysis and presentation (50 Marks), Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Experiential Learning (10 Marks) adding up to 50 Marks
Semester End Evaluation (SEE); Theory (50 Marks) - SEE for 50 marks are executed by means of an examination. The duration of the SEE will be for 2 hours.

Lab Only Course with 50 Marks					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	Continuous evaluation by the course co-ordinators	50	The evaluation is individual for the student		
2	Test	50	1.	Aptitude and Reasoning (Problem Solving):	20
	Marks (Sl No 1+2)	**100**	2.	Communication Skills (Verbal, Non-Verbal presentation skill analysis)	20
	Reduced to	40		Viva voce	10
3	Experiential Learning	10			
	Total Marks	**50**		**Total Marks**	**50**

SEMESTER: I					
BASICS OF PROGRAMMING (Theory)					
Course Code	**:**	**MCA001T**	**CIE**	**:**	**50 Marks**
L:T:P	**:**	**2*:0:0**	**SEE**	**:**	**---**
Total Hours	**:**	**26L**	**SEE Duration**	**:**	**---**

UNIT–I	**05 Hrs**
C Programming: Decision making, control structures and arrays: C Structure, Data Types, Input-Output Statements, Decision making with if statement, simple if statement, the if-else statement, nesting of if-else statements, the else-if ladder, the switch statement, the ?: operator, the goto statement, the break statement, programming examples The while statement, the do...while statement, for statement, nested loops, jumps in loops, the continue statement, programming examples. One dimensional and two-dimensional arrays, declaration and initialization of arrays, reading, writing and manipulation of above types of arrays	
UNIT–II	**05 Hrs**
Structures: Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, Operations on individual members, array of structures, structures within structures, structures and functions, Unions, size of structures	
UNIT–III	**06 Hrs**
Pointers: Pointers in C, Declaring and accessing pointers in C, Pointer arithmetic, Functions, Call by value, Call by reference, Pointer as function arguments, recursion, passing arrays to functions, passing strings to functions, Functions returning pointers, Pointers to functions, Programming Examples	
UNIT–IV	**05 Hrs**
Digital Logic: Binary Systems and Combinational Logic Digital Computers and Digital Systems, Binary Numbers, Number Base Conversion, Octal and Hexadecimal Numbers, subtraction using r's and r-1 complements, Binary Code, Binary Logic, Digital Logic Gates **Computer Organization:** Basic Operational Concepts, Software, Performance, Multiprocessing and Multi computers, Machine Instruction: Memory Locations and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Interrupts	
UNIT–V	**05 Hrs**
Operating System: Operating-System Structure, Operating-System Operations, Overview of - Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems **CPU Scheduling:** Basic Concepts of CPU scheduling, Scheduling Algorithms-FCFS, SJF, Round Robin, Priority Scheduling	

*The Basics of Programming (MCA001T) is a mandatory audit course **(non-credit course)** offered to Non-Computer Science background students only.

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concepts of programming, digital logic, organization, and operating system
CO2	Demonstrate the principles of logical programming and operating system management
CO3	Apply and analyse the programming and logical skills to real world problems
CO4	Evaluate and compare the methods, solutions and algorithms of basics of programming

Reference Books	
1.	Herbert Schild, C: The Complete Reference, McGraw Hill Education, 4th Edition, July 2017, ISBN-13: 978-0070411838
2.	Yashwant Kanetkar, Let us C, BPB Publications ,18th Edition, 2021, ISBN-13: 978-9391392994
3.	M.Morris Mano, Digital Logic and Computer Design" Pearson, 2016, ISBN-13: 978-9332542525
4.	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, Wiley India Pvt. Limited , 9th Edition, ISBN-BRV: !978-1-118-12938-8

Scheme of Continuous Internal Evaluation (CIE) Theory: 10 + 30 + 10 = 50

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks adding up to 20 marks. Final Quiz mark will be reduced to 10 marks.

TESTS: Students will be evaluated in test, 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 30 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (10), Video based seminar/presentation/demonstration (10) adding upto 20 marks. Final EL marks will be reduced to 10 Marks

Rubric for CIE & SEE Theory courses of 50 Marks			
RUBRIC for CIE			***RUBRIC for SEE***
SL.NO	**Contents**	**Marks**	**No SEE Examination for this bridge course**
1	QUIZZES – Q1 & Q2	10	
2	TESTS – T1 & T2	30	
3	Experiential Learning – EL1 & EL2	10	
	Total Marks	**50**	

SEMESTER: II					
RESEARCH METHODOLOGY AND IPR (Theory)					
Course Code	**:**	**MCA431T**	**CIE**	**:**	**50 Marks**
L:T:P	**:**	**2:0:0**	**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26L**	**SEE Duration**	**:**	**2.00 Hours**

UNIT–I	**06 Hrs**
Research Methodology: Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing how Research is Done, Research Process, Criteria of Good Research, Research Problem, Selecting the Problem, Technique Involved in Defining a Problem, Reviewing the literature, bringing clarity and focus to the research problem, improving research methodology, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed	
UNIT–II	**05 Hrs**
Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs. Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs	
UNIT–III	**05 Hrs**
Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports	
UNIT–IV	**05 Hrs**
Intellectual Property: IP law basics, types of Intellectual Property, Agencies responsible for Intellectual property Registrations, foundations of trademark law, international trademark law, subject matter of copyright, international copy right Law, foundations of Patent law- patentability, design patents. International Patent law	
UNIT–V	**05 Hrs**
Protecting Software and Computer: Related Innovations: An overview, Case studies, Software Patent vs Copyright, Guideline for computer – related invention in Europe and Japan, Case studies	

Course Outcomes: After going through this course, the student will be able to	
CO1	Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem
CO2	Conduct literature survey, define the problem statement, and suggest suitable solution for the given problem and present in the format of the research paper like IEEE/ACM/Elsevier or a proof of concept
CO3	Analyze the problem and formulate the problem to develop methodology to conduct research
CO4	Apply Copy Right Act /Patent Act /Cyber Law/ Trademark / Plagiarism check to the given case and prepare the technical paper

Reference Books	
1.	C.R. Kothari, Gaurav Garg, "Research Methodology: Methods and Techniques", New Age International 4th Edition, 2018. ISBN-13: 978-9386649225
2.	Ranjit Kumar, "Research Methodology- A step-by- step guide for beginners". SAGE Pub 3rd Edition, 2011, ISBN: 9781849203005, 9781849203012
3.	Debirag E. Bouchoux, "Intellectual Property", Cengage learning, 4th Edition, ISBN-13: 978-1-111- 64857-2
4.	Prabuddha Ganguli, "Intellectual Property Rights", Tata McGraw-Hill Publishing Company Limited, ISBN-13:978-0-07-007717-1

Scheme of Continuous Internal Evaluation (CIE) Theory: 10+ 20 + 20 = 50

QUIZ: Quiz will be conducted in online/offline mode. Two quizzes will be conducted. Each quiz will be evaluated for 10 Marks, adding up to 20 Marks. Final quiz marks will be reduced to 10 Marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 20 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and plan to carry out research study after literature review. Video based seminar / presentation / (20) adding up to 40 marks. Final EL marks will be reduced to 20 Marks.

Scheme of Semester End Examination (SEE) Theory for 50 marks: The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 10 marks. Student will have to answer one full question from each unit**.**

Rubric for CIE & SEE for Integrated Theory Course with Theory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES– Q1 & Q2	10	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	20	1 & 2	Unit 1: Question 1 or 2	10
3	Experiential Learning – EL1 & EL2	20	3 & 4	Unit 2: Question 3 or 4	10
			5 & 6	Unit 3: Question 5 or 6	10
			7 & 8	Unit 4: Question 7 or 8	10
	Total Marks	**50**	9 & 10	Unit 5: Question 9 or 10	10
				Total Marks	**50**

SEMESTER: II					
DESIGN AND ANALYSIS OF ALGORITHMS (Theory)					
Course Code	**:**	**MCA131T**	**CIE**	**:**	**100 Marks**
L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
Fundamentals of Algorithms and Divide and Conquer technique: Notion of Algorithm, Review of Asymptotic Notations, Recursive functions using stack, Mathematical Analysis of Non-Recursive and Recursive Algorithms **Divide and Conquer**: Binary Search, Merge Sort, Quick Sort and its performance.	
UNIT–II	**08 Hrs**
Decrease-and-Conquer & Greedy Method **Decrease and Conquer**: Insertion Sort, Topological Sorting, Depth First Search using stack, Breadth First Search using Queue. **Greedy Method:** Representation of Graphs, Knapsack Problem, Minimum-Cost Spanning Trees: Prim's Algorithm, Kruskal's Algorithm; Single Source Shortest Paths	
UNIT–III	**08 Hrs**
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, P, NP, and NP-Complete Problems, Challenges of Numerical Algorithms.	
UNIT–IV	**07 Hrs**
Dynamic Programming: Warshall's Algorithm, Floyd's Algorithm for the All-Pairs Shortest Paths Problem, 0/1 Knapsack, The Traveling Salesperson problem.	
UNIT–V	**08 Hrs**
Backtracking and Branch - Bound Technique Introduction to trees, tree traversal techniques **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	Identify the data structures, paradigms and approaches used in algorithms and its impact in practice
CO2	Classify different computational models (e.g., divide-and-conquer), order notation and various complexity measures (e.g., running time, disk space) for real world applications
CO3	Apply relevant data structures and algorithm techniques to design efficient solutions for different applications
CO4	Analyze and evaluate the algorithms based on the data structures used, order of notation and performance metrics

Reference Books	
1.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Person Education, 3rd Edition, 2016, ISBN-13: 9780321358288
2.	Ellis Horowitz, Sanguthevar Rajasekaran,Sartaj Sahni, "Fundamentals Of Computer Algorithms", Galgotia Publications, 2nd Edition, 2004, ISBN 13: 9788175152571
3.	Rod Stephens, "Essential Algorithms A Practical Approach to Computer Algorithms", Wiley, 2013, ISBN: 978-1-118-61210-1
4.	Rajesh K. Shukla, "Analysis and Design of Algorithms A Beginner's Approach", Wiley Edition: 2015, ISBN 13: 9788126554775

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: II					
DATA MODELING (Theory & Practice)					
Course Code	**:**	**MCA132I**	**CIE**	**:**	**100+50 Marks**
L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**10 Hrs**
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–II	**11 Hrs**
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 **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 **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	
UNIT–III	**10 Hrs**
Transaction Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions **Semantic Data Modeling: Introduction –** Mind the Semantic Gap **Semantic Modeling Elements-** General Elements, Common and Standardized Elements **Semantic Model Development:** Development Activities, vocabularies, Patterns, and Exemplary Models	

UNIT–IV	11 Hrs
MongoDB: SQL and NoSQL evolution, MongoDB key characteristics and use cases, MongoDB configuration and best practices, Reference documentation. **Scheme Design and Data Modeling: Data modeling,** MongoDB scheme design, Modeling data for atomic operations Modeling relationships, connecting to MongoDB using Python. **MongoDB CRUD operations: CRUD using the shell-** Administration, MapReduce in the mongo shell, Aggregation framework, Securing the Shell	
UNIT–V	**10 Hrs**
Advanced Querying: MongoDB CRUD operations: CRUD in Mongoid, CRUD using the Python driver, Comparison operators, Update operators, Smart querying. **Aggregation:** Why Aggregation**,** Aggregation operators, Expression operators, Limitations **Indexing:** Index types- single field indexes, compound indexes	

LABORATORY	
Exercise 1	Design, Create and Implement the relational databases for any one of the Domains like Tourism, Human Resource Management, Debris Management and Others **Note:** Minimum Six (6) Queries to be executed including nested queries
Exercise 2	Design, Create and Implement the relational databases for any one of the Domains like Health Care, Energy, Agriculture, Telecom and others **Note:** Minimum Six (6) Queries to be executed including joins
Exercise 3	Create and implement CRUD operations using MongoDB for any one of the domains. Telecom, Tourism, Human Resource Management and Others **Note**: Minimum Six (6) Queries to be executed
Exercise 4	Create and implement CRUD operations using MongoDB for any one of the domains. Health Care, Energy, Agriculture **Note**: Minimum Six (6) Queries to be executed
Exercise 5	Implement an interface to perform CRUD operations in MongoDB using Python Driver for any one of the Domain listed in the exercises

Reference Books	
1.	RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Pearson Addison Wesley, 6th Edition, 2011, ISBN 13: 978-0-136-08620-8
2.	Raghu Ramakrishnan, Johannes Gehrke, Database Management System, Mc Graw-Hill, 3rd Edition, 2014, ISBN-13:978-8131769591
3.	Alex Giamas, Mastering MongoDB 3.x, Packt Publishing,Kindle Edition, 2017 ISBN 978-1-78398-260-8
4.	Panos Alexopoulos, Semantic Modeling for Data, O'Reilly Media, Inc.First Edition, 2020, ISBN 9781492054276

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the fundamental concepts of structured, unstructured and semantic data models
CO2	Apply suitable data model concept to solve the given problem
CO3	Analyse relational and non-relational data model to check the performance of the data models with respect to design and manipulations
CO4	Design and implement suitable data model for any given real time scenarios

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks :

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up : 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
CLOUD NATIVE FULLSTACK APPLICATION DEVELOPMENT-I (Theory & Practice)					
Course Code	**:**	**MCA231I**	**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**39L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
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, Design Patterns, The SOLID Principles of Object-Oriented Design	
UNIT–II	**08 Hrs**
Java Fundamental: Applications of Java Programming, Conditional and Control Statements, Arrays, String Handling, Classes, Objects and Methods, Inheritance, super keyword. Interface, Exception Handling **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–III	**08 Hrs**
Java Advanced Programming: Java Concurrency package, Java Generics: Generics Fundamentals Bounded Types, Generic Methods, Generic Constructors, Some Generic, Restrictions. Collections: Collections Overview, The Collection Interfaces, The collection Classes. The Arrays Class. Lambda Expressions, Java Memory Management **Java Design Patterns**: Creational, Behavioral and Structural patterns	
UNIT–IV	**07 Hrs**
RESTful API: Java APIs For JSON Processing, Introduction to the Basics of RESTful Architecture Design Strategy, Guidelines, Best Practices, Essential RESTful API Patterns	
UNIT–V	**08 Hrs**
Advanced RESTful API: Patterns, Microservice API Gateways, RESTful Services API Testing and Security, RESTful Service Composition for Smart Applications RESTful API Design Tips	

LABORATORY	
1.	Write a Java program to demonstrate the concepts. Encapsulation, Inheritance & Multiple Inheritance
2.	Complete the following: 1. Create a package named shape. 2. Create some classes in the package representing some common shapes like Square, Triangle, and Circle. 3. Import and compile these classes in another program.
3.	Write a Java program to demonstrate the concepts. i)Abstraction, Run Time Polymorphism
4.	Write a Java programs to demonstrate the concepts of design patterns.
5.	Write a Java program that demonstrated the Thread Life Cycle
6.	Write a Java code to demonstrate producer & consumer problems using thread wait & notify methods.
7.	Write a Singleton class which is thread safe and immutable.
8.	Using Java Generics demonstrates below concepts using Java program. i) Type wildcards with Java Generics
9.	Build portal RESTful web API to demonstrate to create a web resource which can be accessed using REST URI's and demonstrate the concept of GET, POST, PUT & DELETE
10.	Build portal RESTful web API to demonstrate below concepts. i) Write a Web API to demonstrate the concepts of security using basic Oauth2

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand Object Oriented Design concepts
CO2	Identify the Objects, patterns and services in/ for real-time applications
CO3	Apply the concept of Objects, patterns and services for real-time applications
CO4	Analyze solutions using OOPs concepts for real world applications

Reference Books	
1.	Matt Weisfeld, Object-Oriented Thought Process, Addison-Wesley Professional, 5th Edition, 2019, ISBN: 9780135182130
2.	Jeff Friesen, Java Threads and the Concurrency Utilities, Apress, ISBN: 9781484217009
3.	Ian F. Darwin, Java Cookbook, O'Reilly Media, Inc., 4th Edition, ISBN: 9781492072584
4.	Bogu, Mohanram Balachandar, RESTful Java Web Services, Packt Publishing, 3rd Edition, 2017, ISBN: 9781788294041

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding upto 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
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3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
INTERNET OF THINGS (Theory & Practice)					
Course Code	**:**	**MCA232A1**	**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**10 Hrs**
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	**10 Hrs**
Programming with Arduino: Understanding the eco system of Arduino, Pinout 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	**10 Hrs**
Programming with Raspberry Pi: Understanding the eco system of Raspberry Pi3/Pi4, Pinout configuration, python modules like Rpi.GPIO and gpiozero. Digital input and output, working with sensors and actuators. Raspberry Pi serial communication. Communication interfaces (SPI and I2C). wired and wireless communication with raspberry Pi. Serial communication from raspberry Pi3 to Arduino and vice versa. Monitoring and controlling between raspberry pi.	
UNIT–IV	**10 Hrs**
Programming with esp32: Understanding the eco system of esp8266/esp32, pinout configuration, Digital, Analog input and output, working with sensors and actuators. communication from raspberry Pi to nodeMCU/esp32, Network and web stack configuration with esp32, wireless communication using esp32 about the sensor status and controlling actuators remotely.	
UNIT–V	**12 Hrs**
IoT Application Development: Integrating sensors with IoT Dashboards and micro services. IoT Platforms design methodology: Introduction to ten steps design methodology Introduction to Flow based IoT Dashboard: Fundamentals of NodeRED, creating basic dashboard. Introduction to MQTT based IoT Dashboard: setup and configuration of dashboard like Things board. Introduction to hosted IoT dashboard services like Adafruit io or thing board hosted service. IoT alert integration: alert integration in the form of email, tweets or any social media post.	

LABORATORY	
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 study	
1.	Write a program with Arduino UNO board to calculate the distance of a obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain value turns on a buzzer with an LED in ON state and display the distance in serial monitor
2.	Write a program with Arduino UNO to indicate the level of temperature using the LEDs indicating the low, medium and high values of temperature (Red, Blue and Green) OR Write a program with Arduino UNO to implement the interactive traffic signal.
3.	Write a program with Arduino UNO board to control servo motor based on potentiometer inputs **OR** to control a mini water pump based on water levels in a container **OR** Demonstrate HC-05 module for controlling Arduino with Bluetooth using Serial Communication integrating any mobile app.
4.	Write an interactive python script on Raspberry Pi3 to implement the serial communication from Raspberry Pi to Arduino or vice versa with any one sensor and actuator from the following components a) LED b) Buzzer c) Temperature and humidity sensor d) LDR sensor
5.	Write a python script on Raspberry pi to control servo motor or DC Motor based on the Potentiometer inputs or button switch inputs. OR change the color of RGB LED / Bulb based on the potentiometer inputs
6.	Develop python script to read water temperature, and water calculate water level in a container using Ultrasonic sensor and control the mini water pump. OR develop a python script to calculate water consumption bill based on the water flow sensor inputs
7.	Write a micropython or arduino program with esp32 based NodeMCU board to calculate the distance of an obstacle based on the Ultrasonic sensor inputs. If the distance calculated is less than a certain value turn on LED
8.	Write an arduino script with esp32 based nodemcu board to operate a 4-channel relay and control evices connected to relay, demonstrating minimal home automation
9.	Develop a digital scale based on esp32 with Load Cell and HX711 Amplifier
10.	IoT dashboard setup and configuration Integrate Things Board / node-red IoT dashboard with any two sensor / actuator on PC or Rpi4 **OR** Integrate Adafruit or similar hosted IoT Dashboard with arduino, RaspberryPi and any sensor / actuator. **OR** Demonstrate publish subscribe communication model using esp32 or RaspberryPi and sensors/actuators **OR** Demonstrate alert service integration to any IoT application based on esp32 or RaspberryPi

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the fundamentals of electronics and hardware devices required for IoT including deployment levels, Network protocols and standards
CO2	Comprehend various development boards, sensors, actuators, architecture of Arduino, Raspberry Pi, esp32 with Arduino IDE or other IDE
CO3	Interact with Arduino, Raspberry Pi, esp32 using python, JavaScript and c/c++ to program the devices (sensors and actuators) to develop an integrated system
CO4	Design, Setup, Configure and Develop IoT Applications (Dashboards) and integrate several essential micro services like social media notification, email, push notifications including visualization of IoT Data

Reference Books	
1.	ArshdeepBahga, Vijay Madisetti, Internet of Things: A Hands-on Approach, Orient Blackswan Private Ltd, July 1st, 2015, ISBN: 8173719543
2.	Wizardry, Exploring Arduino: Tools and Techniques for Engineering, WILEY, 1st Edition, ISBN-10: 1118549368, ISBN-13: 978-1118549360
3.	Elector, The Official ESP32 Book, ISBN: 978-1-907920-63-9
4.	The Official Raspberry Pi Handbook by The Magpi Magazine, 2023
5.	Maneesh Rao, Internet of Things with Raspberry Pi 3, Pack Publihing, April 2018 ISBN: 9781788627405
6.	Simon Monk, Programming the Raspberry Pi, McGraw Hill TAB, 3rd Edition, July 2021, ISBN-13: 978-1264257355

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:
The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**
Scheme of Semester End Examination (SEE) Laboratory for 50 marks:
SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
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	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
DATA SCIENCE – I (Theory & Practice)					
Course Code	**:**	**MCA232A2**	**CIE**	**:**	**100+50**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100+50**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	10 Hrs
Introduction to Data Science and Exploratory Data Analysis: 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 **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 Variables	
UNIT-II	**11 Hrs**
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. **Supervised Learning Algorithms**: K-Nearest Neighbors, Similarity Based on Distance Function, KNN Model Building, Model performance measures. Linear Regression, Building linear regression, Interpretation of Linear Regression coefficients, Validation of Linear regression, Decision Tree, Tree Structure, Criteria for splitting decision node	
UNIT-III	**11 Hrs**
Ensemble Methods and Unsupervised Learning: Ensemble methods, Bias Variance Trade off, Random Forest as ensemble technique, Control Parameters, out of bag error rate, Tuning the Random Forest, Variable Importance Plot, Model Performance Measures **Unsupervised Learning:** Introduction, Association Rule Mining, Clustering, K Means clustering	
UNIT-IV	**10 Hrs**
Text Analytics and Artificial Intelligence **Text Analytics:** Introduction, Unstructured data, word cloud, sentiment analysis, web and social media analytics **Artificial Intelligence and Deep Learning:** Introduction, Application of Artificial Intelligence, Classification of Artificial Intelligence, Difference between AI and Deep Learning	
UNIT –V	**10 Hrs**
Deep Learning: Neural Networks- Perceptron, Feed Forward Neural networks, Back Propagation, Tensor, Layer Abstraction, Linear Layer, NN as sequence of layers, Loss and optimization, Other activation functions, SoftMax and Cross entropy, Dropout, Working of Deep Learning, Convolutional Neural Networks **Artificial Neural Networks**: Application of ANN, ANN model building, Steps in ANN model building, Model Performance Measures, Types of ANN	

LABORATORY	
1.	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 analyse the data. d. Draw a violin plot do describe the distribution of a numerical variable to analyse 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)
2.	For the data set in Q1, a. Show the distribution of continuous variables using histogram. 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. e. #Question 1b has to be performed before 2a
3.	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
4.	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.
5.	For the dataset in Q4, 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
6.	For the market basket dataset, apply apriori algorithm and identify the best rules based on support and confidence values.
7.	For the Mall-Customers dataset Implement k-means clustering algorithm and visualize the clusters.
8.	Consider the given text dataset. Implement different text processing techniques and identify the most important keywords from the text. Display a word cloud from the same.
9.	Consider the iris dataset and apply the Multilayer perceptron to classify the type of the flower. Analyze the performance of the perceptron and display the output.
10.	Consider the MNIST data set and implement CNN architecture to identify the handwritten images. Optimize the model and display the output.

Note : Students will be given with different case studies and scenario's during examination.

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the need and fundamental concepts of data science in real world applications
CO2	Identify and apply the relevant data science concept for given scenario
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, ISBN-: 9789354640506, ISBN-13: 9789354640513 (EBook)
2.	Joel Grus, Data Science from Scratch, First principles with Python, O'Reilly, 2nd Edition, ISBN: 9789352138326
3.	Laura Igual, Santi Seguí, Springer Publications, Introduction to Data Science- A Python Approach to Concepts, Techniques and Applications, ISSN: 1863-7310 ISSN 2197-1781 (electronic)
4.	Sayan Mukhopadhyay, Advanced Data Analytics Using Python, Apress, ISBN-13 (pbk): 978-1-4842-3449-5 ISBN-13 (electronic): 978-1-4842-3450-1

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding upto 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
SOFTWARE TESTING AND PRACTICES (Theory and Practice)					
Course Code	**:**	**MCA232A3**	**CIE**	**:**	**100 + 50 Marks**
L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**10 Hrs**
Introduction to software testing -Definitions, Test Cases, Test case design techniques, Preparing a Test Plan, Levels of Testing, Software testing life cycle, Software testing methodologies: Waterfall testing, Agile Testing, Iterative testing, QA, QC & Testing Case study- Develop test cases for any real-world application using test case description template	
UNIT–II	**10 Hrs**
Test Automation- Need of Automation Testing, Refactoring, Continuous Improvement, Difference between Manual and Automation testing, Choosing right tools, Test Automation Architecture (SUT), Automation Frameworks	
UNIT –III	**12 Hrs**
Introduction to JMeter- Why JMeter, Configuring JMeter Components of JMeter - Test Plan, Thread Groups, Controllers, Samplers (FTP, HTTP/HTTPS, JDBC), Listeners, Timers, Assertions, Configuration Elements, Pre-Processors and Post-Processors, Collectors	
UNIT –IV	**10Hrs**
Submitting Forms and Managing Sessions- Capturing simple forms (Check boxes, Radio buttons, File uploads/File Downloads, Posting and Reading JSON data, Managing sessions with cookies and URL rewriting	
UNIT –V	**10Hrs**
Types of Testing using JMeter- Performance Testing (Load/Stress testing), Distributed Testing, Database Testing, API Testing, Security Testing, Test Execution and Reporting	

LABORATORY	
Note: Students are required to create a Test plan, configure test scenarios, Run the test, Analyze the results and Generate reports for the following Lab programs. Based on the result analysis Iterate and optimize the testing process.	
1.	Demonstrate the concept of Single and Multiple threads simulating concurrent user actions such as logging in, browsing pages and submitting forms. Analyze response times, throughput and error rates under different load levels
2.	Demonstrate Assertions by sending parameter values to the database and assert the response code for both successful and failure cases
3.	Demonstrate pre-processor and post processor concept in the following Scenario. a. Add data to Sampler using Pre-processor for an HTTP request. b. Validate all the status codes generated from Sampler page using RegEx (Regular Expression Extractor) of Post-processor
4.	Demonstrate the use of Simple and Modular Controllers and Listeners for the following scenario. a. A sampler to store the sampler request whose data can be extended outside to other samplers. b. A container that provides values to all the sampler within the thread group
5.	Perform database load testing to measure the performance under database load. Configure JMeter to send SQL queries to the database server and monitor the response times. Analyze the query execution times, throughput, and resource utilization to identify any performance issues in the database layer.
6.	Consider a web application and perform load testing under the following conditions - Normal and peak load conditions.
7.	Set up a distributed testing environment using JMeter to distribute the load across multiple machines. Configure a master-slave setup where the master controls and coordinates the load testing activities across multiple slave instances.
8.	Demonstrate response codes validations (Eg:200, 300, 400, 500) for different API calls
9.	Demonstrate the concept of collection by implementing the CRUD operations on a website in which all the API calls are the input to the other call. (Eg: GET method's response value should be input for the POST method).
10.	Demonstrate multipart request with file upload feature for various file type extensions (.pdf,.xlsx,. csv,.json)

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concepts of Automation testing
CO2	Identify and apply relevant automation testing techniques suitable for a real-world scenario
CO3	Demonstrate various types of testing using JMeter
CO4	Analyze the test result and automation process for real world applications

Reference Books	
1	Paul C. Jorgensen, "Software Testing, A Craftsman's Approach", Auerbach Publications, 4th Edition, First Indian Reprint, 2014, ISBN-13:9781466560680
2	Bayo Erinle, Performance Test with JMeter, PACKT Publishing, Copyright © 2013, ISBN 978-1-78216-584-2
3	Arnon Axelrod, Complete Guide to Test Automation, Apress, Copyright © 2018, ISBN-13 (pbk): 978-1-4842-3831-8, ISBN-13 (electronic): 978-1-4842-3832-5
4	Antonio Gomes Rodrigues, Bruno Demion (Milamber), Master Apache JMeter - From Load Testing to DevOps: Master performance testing with JMeter ,PACKT publishing, 1st Edition,2019, ISBN-13:978-1839217647

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding upto 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
2D & 3D MODELING (Theory and Practice)					
Course Code	**:**	**MCA232A4**	**CIE**	**:**	**100 + 50 Marks**
L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**10 Hrs**
Conventions and Standards: Standard sizes of drawing sheets, Lines, Dimensioning terms and notations, general rule for dimensioning, Scales, conventions for materials, simple geometrical constructions (Regular Polygons), perspective projection, orthographic projection, bill of materials	
Unit–II	**10 Hrs**
Orthographic reading and conversion of views: Conversion of pictorial views into orthographic view, screws and threads, riveted joints and welding joints. **Computer aided modeling and drafting (Solidworks):** Terminology, User Interface, Design Process, Design Method, Sketches, Part modeling, Assembly: Assembly Design Methods, Mates, Drawings: Drawing documents	
UNIT –III	**12 Hrs**
Understanding the interface: Interacting with interface, Editors - Workspaces – Themes, Objects in 3D view editor, editing objects, Editing tools **Modifiers:** Editing with generate modifiers, editing with deform modifiers **Editing Techniques**: Examples, The Outliners and collections,3D text, Viewport shading, Scene lighting and cameras Examples, The Outliners and collections,3D text, Viewport shading, Scene lighting and cameras	
UNIT –IV	**10 Hrs**
Materials textures nodes, Textures, Rendering, Animation, Constraints	
UNIT –V	**10 Hrs**
Physics and simulation, Particle system, Armature and character rigging, Installing Add-Ons, Making a movie, Cycles and workbench render	

LABORATORY	
1.	Practice lab- General Interface introduction and playing with shapes
2.	Custom 3D object Creation
3.	Color shading/Texturing the object
4.	Custom logo
5.	Develop Animating logo
6.	Explosive product animation
7.	Record explosive product animation from different angles using "Render Animation"
8.	Terrain for natural forest with camp
9.	Baking rain animation and fire camp animation
10.	Rigging an armature to human character with dancing animation

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concept of 2D and 3D modeling
CO2	Outline the components of models using basic geometric principle
CO3	Apply the constructs to easily modify models and implement design changes
CO4	Analyze the design constraints and the design intent of the model

Reference Books	
1.	N D Bhatt, Engineering drawing, fiftieth edition, Charotar Publishing House, 2011, ISBN 978-80358-17-8
2.	Dassault Systèmes, Introducing Solidworks, Dassault Systèmes S.A. company, 175 Wyman Street, Waltham, Mass. 02451 USA. All Rights Reserved.1995-2014
3.	John M. Blain, The Complete Guide to Blender Graphics Computer Modeling & Animation,7th Edition, 2022, ISBN 9781003226420, A K Peters/CRC Press
4.	Romain Caudron, Pierre-Armand Nicq, Enrico Valenza, Blender 3D: Designing Objects,2016, Packt Publishing Ltd, ISBN 978-1-78712-719-7

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding upto 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding upto 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The break up for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: II					
DEVOPS (Theory)					
Course Code	**:**	**MCA233B1**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+ 26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
Docker Fundamentals: Discovering Docker, What and why of Docker, Building a Docker application. Understanding Docker - Docker's architecture, The Docker daemon, The Docker client, Docker registries, The Docker Hub	
UNIT–II	**08 Hrs**
Docker and Development: Using Docker as a lightweight virtual machine - From VM to container, Saving and restoring your work, Environments as processes, building images, Running containers	
UNIT–III	**08 Hrs**
Docker and DevOps: Continuous integration - Docker Hub automated builds, Containerizing your CI process. Continuous delivery - Interacting with other teams in the CD pipeline	
UNIT–IV	**07 Hrs**
First steps with Docker and Kubernetes: Creating, running, and sharing a container image, setting up a Kubernetes cluster, Running the first app on Kubernetes	
UNIT–V	**08 Hrs**
Pods: Introducing Pods, creating pods from YAML or JSON descriptors, organizing pods with labels, Listing subsets of pods through label selectors, Annotating pods, Using namespaces to group resources, Stopping and removing pods	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand of Docker basics, installation and learn to work with containers
CO2	Use containers and move applications across environments with continuous integration and delivery
CO3	Leverage Docker to perform automated builds and make Kubernetes to work on container. images
CO4	Explore the Kubernetes architecture to set up and use entire lifecycle-based clusters and pods

Reference Books	
1.	Ian Miell, Aidan Hobson Sayers, "Docker in Practice", Manning Publications, 2nd Edition, 2019, ISBN–9781617294808
2.	Marko Lukša, "Kubernetes in Action", Manning Publications, 2nd Edition, 2018, ISBN–9781617293726
3.	James Turnbull, "The Docker Book", Turnbull Press, 2nd Edition, 2017, ISBN–9780988820203
4.	Brendan Burns, Joe Beda, and Kelsey Hightower, "Kubernetes: Up and Running", 2nd Edition, 2019, ISBN–978-1-492-04653-0

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: II					
ADVANCED COMPUTER NETWORKS (Theory)					
Course Code	**:**	**MCA233B2**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+ 26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
Introduction to Internet Protocol and Classless and Subnet Address Extension (CIDR) **Wireless LANS and PANS**: Fundamentals of WLAN's, 802.11 Standards, HIPERLAN Standard, Bluetooth specifications, Transport Protocol group, ZigBee Specification Wireless WANS and MANS – The Cellular Concept and Cellular Architecture- Capacity enhancement. Channel Allocation Algorithms	
UNIT–II	**08 Hrs**
Mobile IP : Introduction, Mobility, Routing and Addressing, Mobile IP Characteristics, Overview of Mobile IP Operations, Mobile Addressing Details, Foreign Agent Discovery, Agent Registration, registration message format, communication with a foreign agent, datagram transmission and reception, two- crossing problem, communication with computers on the home network Private	
UNIT–III	**07 Hrs**
Parallel and Distributed Systems: Level of Parallel Computing, challenges in handling concurrency, Distributed Systems, characteristics, properties, design goals, Types of distributed systems. **Virtualization:** Introduction, Hardware virtualization, Hypervisors, Network function virtualization, **Implementation:** Installing the virtualization packages, Creating virtual machines, Network configuration	
UNIT–IV	**08 Hrs**
SDN: Introduction, Centralized and Distributed Control and Data Planes- Introduction, Control plane, Data plane, Moving Information Between Planes, Distributed Control Planes, IP and MPLS, Convergence Time, Load Balancing, High Availability	
UNIT–V	**08 Hrs**
Cloud computing: Introduction, Characteristics of Cloud Computing, Cloud Models, Cloud Service Examples, Load Balancing, Scalability & Elasticity, Deployment, Replication, Monitoring, **Cloud Application Design:** Design characteristics for cloud application, Reference architecture for cloud application, Cloud application design methodologies	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the advanced networking concepts
CO2	Identify the various advances in networking
CO3	Analyse the various approaches in networking domain
CO4	Apply the advanced networking concepts

Reference Books	
1.	C. Siva Ram Murthy, B. S. Manoj, Ad Hoc Wireless Networks Architecture and Protocols, Pearson Publication, 2011, ISBN 978–81-317-5905-9
2.	Douglas E Comer, Internetworking with TCP/IP, Pearson Education India, 6th Edition, 2015, ISBN: 978-9332550100
3.	Maarten van Steen and Andrew S. Tanenbaum, Distributed systems, Pearson Education, 3rd Edition, 2017, ISBN: 978-90-815406-2-9
4.	Arshadeep Bahga, Vijay Madisetti, Cloud Computing A Hands-On Approach, University Press, 2014, ISBN: 9788173719233

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & El2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: II					
CRYPTOGRAPHY AND NETWORK SECURITY (Theory)					
Course Code	**:**	**MCA233B3**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+ 26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
Introduction: Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security. Case study **Classic Encryption Technique-** Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography.	
UNIT–II	**07 Hrs**
Block Ciphers and the Data Encryption Standard: Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The Strength of DES, Block Cipher Design Principles **Tools:** NMAP, Wire shark	
UNIT–III	**08 Hrs**
Advanced Encryption Standard: Finite Field Arithmetic, AES Structure, AES Transformation Functions. **Public-Key Cryptography and RSA:** Principles of Public-Key Cryptosystems, The RSA Algorithm, Diffie-Hellman Key Exchange, Message Authentication **Tools:** OWASP	
UNIT–IV	**08 Hrs**
Cryptographic Hash Functions: Applications, Two Simple hash Functions, Requirements and Security. Digital Signatures, Elliptic Curve Digital Signatures Algorithm. **Network Security:** Email, PGP, S/MIME, SSL architecture, handshake protocol, change cipher spec protocol.	
UNIT–V	**08 Hrs**
Network Security: Transport layer security. IPSecurity, security policy, Internet key exchange Wireless Security, Mobile Device security **Contemporary Issues and Trends**: Case Study	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basics of Cryptography and Network Security standards.
CO2	Understand public-key cryptography, RSA and other public-key cryptosystems
CO3	Analyse and design algorithms and digital signatures
CO4	Build for the key management, distribution schemes and design

Reference Books	
1.	William Stallings, "Cryptography and Network Security-Principles and Practice" Pearson, 7th Global Edition, 2017, ISBN 13: 978-1-292-15858-7.
2.	Behrouz A. Forouzan "Introduction to Cryptography and Network Security", McGraw-Hill Forouzan Networking Series, 2008, ISBN 978–0–07–287022–0
3.	Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003, ISBN 0-470-85285-2 2.
4.	Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, 2nd Edition, Private Communication in Public World", PHI, 2002, ISBN-13: 978-0130460196

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

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EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: II					
DIGITAL MARKETING (Theory)					
Course Code	**:**	**MCA233B4**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+ 26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	07 Hrs
Introduction to Digital Marketing: Evolution of Digital Marketing from traditional to modern era, Role of Internet; Current trends, Info graphics, implications for business & society; Emergence of digital marketing as a tool; Drivers of the new marketing environment; Digital marketing strategy; Paid, Owned, Earned Media framework, Digital landscape, Digital marketing plan, Digital marketing models. Careers in Digital Marketing, Case studies	
UNIT–II	**07 Hrs**
Internet Marketing and Digital Marketing Mix: Internet Marketing, opportunities, and challenges; Digital marketing framework; Digital Marketing mix, Impact of digital channels on IMC; **Search Engine Advertising**- Pay for Search Advertisements, Ad Placement, Ad Ranks, Creating Ad Campaigns, Campaign Report Generation Display marketing- Types of Display Ads - Buying Models - Programmable Digital Marketing - Analytical Tools - YouTube marketing. Case studies	
UNIT–III	**10 Hrs**
Social Media Marketing: Role of Influencer Marketing, Tools & Plan– Introduction to social media platforms, penetration & characteristics; Building a successful social media marketing strategy Facebook Marketing: - Business through Facebook Marketing: Creating Advertising Campaigns, Adverts, Facebook Marketing Tools LinkedIn Marketing: Introduction and Importance of LinkedIn Marketing, Framing LinkedIn Strategy, Lead Generation through LinkedIn, Content Strategy, Analytics and Targeting and Mobile Marketing: Mobile Advertising, Forms of Mobile Marketing, Features, Mobile Campaign Development, Mobile Advertising Analytics Introduction to social media metrics. Case studies	
UNIT–IV	**08 Hrs**
Search Engine Optimization (SEO): Web Analytics, Mobile Marketing, Trends in Digital Advertising–Introduction and need for SEO, how to use Internet & search engines; search engine and its working pattern, On-page and off-page optimization, SEO Tactics - SEM Web Analytics - Google Analytics and Google Ad Words; data collection for web analytics, multichannel attribution, Universal analytics, Tracking code Trends in digital advertising. Case studies	
UNIT–V	**07 Hrs**
Social Media Strategy: Introduction, Key terms, and concepts. Using social media to solve business challenges. Step-by-step guide to creating a social media strategy. Documents and processes. Dealing with opportunities and threats. Step-by-step guide for recovering from an online brand attack. Social media risks and challenges. Case studies	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand Digital marketing theories and practices
CO2	Foster Analytical and critical thinking abilities for decision making
CO3	Build global and economical communication strategies for E-marketing
CO4	Analyse, communicate global, economic aspects of E-marketing

Reference Books	
1.	Seema Gupta "Digital Marketing" Mc-Graw Hill ISBN:978-9355320407 1st Edition, 2022
2.	Nitin C. Kamat, Chinmay Nitin Kamat," Digital Social Media Marketing", Himalaya Publishing House Pvt. Ltd. Latest Edition
3.	Ian Dodson, "The Art of Digital Marketing" Wiley Latest Edition
4.	Damian Rayan, "Marketing Strategies for Engaging the Digital Generation", Brilliance Audio 4th Edition,2016978-0749453893.

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 upto 100 Marks. Final test marks will be reduced to 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: II					
DESIGN THINKING (Practice)					
Course Code	**:**	**MCA432L**	**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**	**SEE**	**:**	**50 Marks**
Total Hours	**:**	**52P (26 contact hrs+ 26 non-contact hrs)**	**SEE Duration**	**:**	**3.00 Hours**

STAGE–I

Empathy: The Empathy phases of the process are focused on understanding the experiences, emotions and motivations of others. Designers use specific empathy methods to learn more about the needs of the users for whom they are designing.
Methods: Interviewing Probes and Observations.

STAGE–II

Define: The Define phase of the process is focused on developing a point of view about the need of your user. During this stage of process, designers narrow from lots of information to a statement that is inspiring and specific.
Methods: Empathy Mapping, Point of View.

STAGE–III

Ideate: The Ideate phase of the process is focused on generating as many solutions to a problem as possible. Once many solutions have been generated, students will select one to move forward to prototyping.
Methods: Brainstorming and Selection

STAGE–IV

Prototype: The Prototype phase is where designers construct representation of their solutions. These representations are intended to elicit feedback and answer specific questions about a concept.
Methods: Improve, Rapid and Experiential Prototyping

STAGE–V

Test: The Test phase of the process is focused on getting specific feedback about how ideas can improve. It is important to remember during this phase that prototypes are imperfect, but feedback is gift.
Methods: Testing

Course Outcomes: After going through this course, the student will be able to	
CO1	Learn to use different modes of thinking to understand the problem instead of finding answers/solutions for questions/problems
CO2	Acquire adductive reasoning to find new problems
CO3	Sow the seed of creativity to look for innovative solutions for a problem
CO4	Adopt human centric approaches while developing new solutions, products or services.

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)

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.

Evaluation will be carried out in THREE Phases.

Phase	**Activity**	**Marks**
I	Phase I	10
II	Phase II	15
III	Phase III	25

Scheme for Semester End Examination (SEE)

The evaluation will be done by Internal and External examiners. The following weightage would be given for the examination.

1	Written presentation of synopsis: Write up	05 Marks.
2	Presentation / Demonstration of the project Idea / Solution	15 Marks
3	Demonstration of the Prototype	20 Marks
4	Viva- Voce	05 Marks
5	Report	05 Marks

SEMESTER: III					
SOFTWARE ENGINEERING (Theory)					
Course Code	**:**	**MCA161T**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	**07 Hrs**
Software Process & Software Development Methods Professional Software Development, IEEE/ ACM code of software engineering ethics, Process activities, Requirements Specification, Structure of SRS (IEEE format); Software Development Methods -Plan-driven and Agile Development, Extreme Programming, Scrum; DevOps, DevOps Vs Agile Development	
UNIT-II	**08 Hrs**
System Design and Modeling Architectural Design: Architectural design decisions, Architectural patterns. Interaction Modeling: Use case models, Sequence diagrams, Activity diagrams. Structural modeling: Class diagrams. Behavioral Modeling: State diagrams; Functional modeling: Data flow diagrams	
UNIT-III	**08 Hrs**
Scrum Framework Foundation of Scrum, pillars of empiricism, Scrum Values, Identifying a Scrum Team; Scrum events: Spring planning, Implementation and review, Scrum artifacts, Creating, Managing and refining product bask logs	
UNIT-IV	**09 Hrs**
Scrum in Action Planning and Estimating with Scrum: Estimation Scale, Bucket method, Envisioning the product journey with a product roadmap; Sprint Journey: Refining the Product Backlog, Tracking progress with a Scrum Board, Defects in Sprint; 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	
UNIT-V	**07 Hrs**
Project Management Project Management: Project planning, Risk management, Plan-driven development, Agile planning, Project Budgeting, Scheduling and Resource Allocation	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concepts associated with software Engineering
CO2	Describe various system design and models to apply them in real world applications
CO3	Apply Software Engineering Principles and practices to build Software Products
CO4	Analyze software development practices for real world problems

Reference Books	
1.	Ian Summerville, Software Engineering, Pearson Education Ltd, 10th Edition, 2015, ISBN: 9780133943030
2.	Michael Blaha and James Rumbaugh, Object Oriented Modeling and Design with UML ,2nd Edition, Pearson India, ISBN-13: 978-0130159205
3.	Fred Heath, The Professional Scrum Master (PSM I) Guide, 1st Edition, Packt Publishing, Copyright © 2021, ISBN: 9781800200494
4.	Ken Schwaber: Agile Project Management with Scrum, Microsoft Press @ 2004, ISBN:073561993x

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
MODERN APPLICATION DEVELOPMENT (Theory & Practice)					
Course Code	**:**	**MCA261I**	**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**4:0:1**	**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**52L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	**10 Hrs**
Hybrid Mobile Apps: Comparing Mobile Solutions. **Android: Android Overview, Android Studio & Project Basics**: History, Operating System, Setup, Configuring Android Studio, Project Basics, Create an AVD, The IDE, Main Editor, Editing Layout Files, TODO Items, Project Tool Window **Android Application Overview & Activities and Layouts:** What Makes Up an Android Project, Application Entry Point, Activities, Intents, Activity, Layout File, View and ViewGroup Objects, Containers, Activity Class	
UNIT-II	**11 Hrs**
Mobile Design: Mobile-Only Interactions, Interactions that are not possible on Mobile. **Event Handling & Intents:** Intro to Event Handling, Handling Long Clicks, What Intents are for, Implicit Intents **Fragments:** Introduction to Fragments Running in the Background: Basic Concepts, The UI Thread, Threads and Runnables	
UNIT–III	**10 Hrs**
Debugging & Testing: Types of Errors, Debugger, Types of Testing, Unit Testing, Instrumented Testing, **Data Storage:** Storing simple data, Read and write a text file to internal storage and external storage, Creating and using an SQLite database **Location and Using Geofencing:** How to get the device location, Creating and monitoring a Geofence	
UNIT–IV	**10 Hrs**
Intro to PWAs and Tooling: Intro. to Progressive Web Apps, Tools to Measure Progressive Web Apps. **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–V	**11 Hrs**
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. **Push Notifications:** Subscribing a User to Push Notifications, Saving the PushSubscription Object, Triggering the Push Notification, Catching Push Events in the Service Worker	

LABORATORY	
1.	Devise a Mobile App to showcase graphics on button states and add a widget at run time
2.	Develop an app to display a Progress Bar and show a message with Alert Dialog
3.	Create an app to navigate from one activity to another using an intent object and passing data
4.	Demonstrate adding and removing fragments at run time.
5.	Implement an application that will create a database with a table of user credentials and create a Login portal system
6.	Develop an application to send SMS to a particular contact from the Phonebook
7.	Build a simple web page using PWA by adding a Service Worker
8.	Create a login page to authenticate a user using PWA with Manifest file
9.	Demonstrate online and offline web page load using PWA, Service Worker and Caching
10.	Build an application to do a stock display using PWA using a raw JSON file

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand Android applications work, Life cycle, Manifest, Intents, and using external resources
CO2	Demonstrate Activities, Layouts, Views, Widgets, Menus and Notifications
CO3	Identify communication abilities including SMS, network management with Data Storage
CO4	Design and develop innovative applications with enhanced features

Reference Books	
1.	Ted Hagos, Learn Android Studio 4: Efficient Java-Based Android Apps Development, Apress Publishing, 2nd Edition, 2020, ISBN: 9781484259368
2.	Rick Boyer, Android 9 Development Cookbook, Packt Publishing, 3rd Edition, 2018, ISBN – 13: 9781788622967
3.	Cameron Banga and Josh Weinhold, Essential Mobile Interaction Design: Perfecting Interface Design in Mobile Apps (Usability), Addison-Wesley Professional, 1st Edition, 2014, ISBN-13: 978-0321961570
4.	Dennis Sheppard, Beginning Progressive Web App Development: Creating a Native App Experience on the Web, Apress Publishing, 2017, ISBN: 9781484230909

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: III					
CLOUD NATIVE FULL STACK APPLICATION DEVELOPMENT-II (Theory & Practice)					
Course Code	**:**	**MCA361I**	**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**3:0:1**	**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**39L+26P**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**08 Hrs**
Spring Boot: What is Spring Boot - Creating a Project with Spring Boot Initializer, Wire beans together in the Spring container using Inversion of Control, Configure the Spring container for Dependency Injection, Define Spring Beans using the Component annotation, perform auto-scanning of Spring beans to minimize configuration, Automatically wire beans together using Auto wired annotation, Apply all Java configuration to Spring Beans (no xml)	
UNIT–II	**08 Hrs**
Spring Boot RestAPI: Writing RESTful controllers, Consuming REST services; Spring Boot REST API Validation: Validation with Spring Boot – Overview, Validate Create Post and Update Post REST API Request, Customizing Validation Response, Validate Create Comment and Update Comment **REST API Request:** Spring Boot Security: Secure your REST APIs and web applications with Spring Boot Security, Set up your Maven pom.xml file with Spring Boot Security starter, Define users and roles for authentication, Restrict access to URLs based on user role JWT	
UNIT–III	**08 Hrs**
Spring Boot Hibernate/JPA: Understanding Object/Relational Persistence, what is persistence? Relational database, Using SQL in Java, persistence in object-oriented applications; Persistence layers and alternatives, layered architecture; object/relational mapping-what is ORM? Generic ORM problems, Why ORM? Introduction and integrating hibernate; mapping persistent classes- the caveat emptor application, implementing the domain model; Working with persistence object. **Persisting data with Spring Data JPA:** Adding Spring Data JPA to the project, Annotating the domain as entities, Declaring JPA repositories, Customizing JPA repositories	
UNIT–IV	**08 Hrs**
Containerization with Docker: Virtualization Concepts, Docker Overview, Manipulating Containers with Docker, Docker Compose an Overview. **Dockering Spring Boot Application:** Create Spring Boot Project and Build Simple REST API, Create Dockerfile to Build Docker Image, Build Docker Image from Dockerfile, Run Docker Image in a Docker Container. **Kubernetes: Getting Started with Kubernetes** Using Kubectl with Multiple Clusters, - Setting Up a Multi-Node Cluster, Learning to Use the Kubernetes Client, Creating and Modifying Fundamental Workloads, Handling Traffic with Ingress Controllers, Managing Specialized Workloads, Volumes And Configuration Data, Deploy & Orchestrate Spring Boot Application on Kubernetes	
UNIT–V	**07 Hrs**
Microservices with Spring Boot: What's a microservice? What is Spring and why is it relevant to microservices? Building a microservice with Spring Boot, Why change the way we build applications?, What exactly is the cloud?, Why the cloud and microservices?. **Microservices are more than writing the code:** Core microservice development pattern, Microservice routing patterns, Microservice client resiliency patterns, Microservice security patterns, Microservice logging and tracing patterns, Microservice build/deployment patterns, Using Spring Cloud in building your microservices, microservices with Spring Boot	

LABORATORY	
1.	Demonstrate Dependency Injection using annotation based using Spring boot-
2.	Demonstrate Dependency Injection using constructor based using Spring boot
3.	Create a Spring Boot Application using Maven Plugin - Write a sample REST Controller API using Spring Annotations - Using Postman invoke the REST Controller to demonstrate end to end working
4.	Write a sample REST App to demonstrate below Concepts with a use-case of your choice. - GET, PUT, POST, DELETE
5.	Write a sample REST App to Validate the REST API POST & PUT request. -Design a custom response with appropriate validation errors to the caller
6.	Write a Java application using Hibernate to insert data into Student DATABASE and retrieve info based on particular queries (For example update, delete, search etc...)
7.	Demonstrate Spring Data JPA integration in a Spring Boot application using Hibernate
8.	Demonstrate using Spring Boot: Complete the docker setup on your Sandbox. - Download a docker image from Docker Hub and deploy the same on your docker server - Build a sample custom image for any of the App of your choice and run the app image as a container
9.	Using a docker compose file, deploy multiple apps/containers (eg: MySql,SpringBoot) onto the docker server
10.	Demonstrate with Spring Boot: Setup a Kubernetes development Env on your Sandbox (use Docker Desktop or Minicube)

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the core principles and concepts of cloud-native application development
CO2	Identify effective strategies for designing and architecting cloud-native applications
CO3	Design scalable and resilient cloud-native applications using Spring Boot, RESTful APIs, Hibernate, Docker, Kubernetes and microservices
CO4	Build and deploy a cloud-native application using Spring Boot, Hibernate, REST API, Docker, Kubernetes, and microservices

Reference Books	
1.	K. Siva Prasad Reddy, Sai Upadhyayula, Beginning Spring Boot 3: Build Dynamic Cloud-Native Java Applications and Microservices, Apress Publications, November 2022, ISBN: 9781484287927
2.	Bauer, Christian, and Gavin King, Hibernate in action, Manning, Vol. 1, 2018. ISBN: 9781932394153
3.	Carnell, John, and Illary Huaylupo Sánchez, Spring micro services in action, Manning, 2021, ISBN: 9781617296956
4.	Jeffrey Nickoloff, Stephen Kuenzli, Docker in Action, Manning Publications, 2nd Edition, November 2019, ISBN: 9781617294761
5.	Marko Luksa, Kubernetes in Action, Manning Publications, January 2018, ISBN: 9781617293726
6.	Craig, and Ryan Breidenbach, Spring in action, Dreamtech Press, 6th Edition, 2020, ISBN – 9781617297571

Scheme of Continuous Internal Evaluation (CIE) Theory: 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Laboratory (CIE): 40 + 10 = 50

Conduction of laboratory exercises, Lab report & observation & analysis (50 Marks), Lab Test (50 Marks), adding up to 100 marks. Final marks will be reduced to 40 & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks.

Scheme of Semester End Examination (SEE) Theory for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit**.**

Scheme of Semester End Examination (SEE) Laboratory for 50 marks:

SEE for practical will be jointly conducted and evaluated by two examiners. The duration of practical examination is 3 hours and is evaluated for 50 marks. The breakup for conduction of practical examination is (i) Procedure and Write up: 20% of max marks, (ii) Conducting the practical: 60% of max marks, (iii) Viva Voce: 20% of max marks

Rubric for CIE & SEE for Integrated Theory Courses with Laboratory					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
4	Laboratory	50	5 & 6	Unit 3: Question 5 or 6	20
	Total Marks	**150**	7 & 8	Unit 4: Question 7 or 8	20
			9 & 10	Unit 5: Question 9 or 10	20
				Theory Exam Marks	**100**
				Laboratory Exam Marks	**50**
				Total Marks	**150**

SEMESTER: III					
DATA SCIENCE – II (Theory)					
Course Code	**:**	**MCA262C1**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	08 Hrs
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	
UNIT–II	**08 Hrs**
Big Data: Types of Digital Data, Big Data Analytics: Digital Data, characteristics of data, evolution of data, definition and challenges with big data, why big data, traditional BI Vs Big Data What is Big Data Analytics, Classification of Analytics, Why is Big data analytics important, Data Science, Terminologies used in Big Data	
UNIT–III	**08 Hrs**
Hadoop Architecture: Hadoop, Distributed computing challenges, Hadoop Overview, use case of Hadoop, HDFS, Processing data with Hadoop, Managing Resources and applications with Hadoop YARN, interacting with Hadoop Eco System, Map Reduce Programming	
UNIT–IV	**08 Hrs**
PIG Architecture: Anatomy of PIG, use case of PIG ETL processing, Pig Latin overview, Data types in PIG, Running and Execution modes of PIG, Execution Modes of Pig, Relational Operators, Eval Functions, Complex Data Types, Parameterized substitution, word count example using PIG.	
UNIT–V	**07 Hrs**
Spark and Big Data Analytics: Introduction to Data Analysis with Spark-Spark SQL, Python for Spark, Data Analysis Operations, Data ETL, Analytics, Reporting and Visualization	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the need and fundamental concepts of Business Intelligence, Big data and visualization in real world applications
CO2	Identify and apply big data analytics frameworks and visualization techniques for decision making
CO3	Apply data science concepts to real world applications
CO4	Analyze the use of big data analytics and visualization for business applications

Reference Books	
1.	Cindi Howson, Successful Business Intelligence, McGraw-Hill Publications, E-ISSN: 0-07-149851-6
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, ISBN:978-93-5316-496-6
4.	Matthew Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundation, Techniques and Applications, CRC Press, Taylor and Francis Group, ISBN: 978-1-4398-6554-5

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
AUGMENTED REALITY AND VIRTUAL REALITY (Theory)					
Course Code	**:**	**MCA262C2**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT-I	**08 Hrs**
Introduction to Virtual Reality: Defining Virtual Reality, Four Key Elements of Virtual Reality Experience, A History of VR. **VR The Medium:** Communicating Through a Medium, Common Issues of Human Communication Media, Narrative, Immobile Versus Interactive. The Difference between Virtual reality and Augmented Reality, Applications versus Game, Type of VR Experiences.	
UNIT-II	**08 Hrs**
Content, Objects, Scale: Getting started with Unity, Creating Simple Diorama, Measurement Tools. Build and Run- Meta Oculus, Android, PC, Menu and UI, Material and Textures, Prefabs, First Person Controller and Third Person Controller, Asset Store, Animation and Animator, Object Tracking- Ray Tracing, Effects.	
UNIT-III	**08 Hrs**
Augmented Reality: Terminology, Simple Augmented Reality, Marker-based tracking-Marker detection, Marker pose. **Marker types and identification:** Template markers, Template matching, Imperceptible markers, Build and Run-Vuforia.	
UNIT-IV	**08 Hrs**
Marker less Tracking with AR Foundation: Project Setup, architecture, Features, XR Simulation, AR Foundation Debug menu, implement a provider, Build and Run	
UNIT –V	**07 Hrs**
Mixed Reality: Introduction to mixed reality, MRTK, Project Setup, Configure Unity for Windows Mixed Reality. Interaction Model- Hands and Motion Controllers model, Hands-free model, Gaze and Commit. **WebXR using Unity:** Introduction to WebXR, set up the environment, Plugin	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the concepts of eXtended Reality (XR- VR/AR/MR) and its applications
CO2	Apply the XR concepts to story board the application requirements
CO3	Design the application with the appropriate setups to experience the XR Content
CO4	Analyze and interpret the appropriate XR technology for Application under consideration

Reference Books	
1.	Jesse Glover and Jonathan Linowes, Complete Virtual Reality and Augmented Reality Development with Unity, Packt Publishing, 17 April 2019, ISBN:9781838644864, 1838644865.
2.	Sanni Siltanen, Theory and applications of marker-based augmented reality, Julkaisija – Utgivare – publisher, ISBN 978-951-38-7449-0 (soft back ed.), ISSN 2242-119X (soft backed).
3.	Zeynep Tacgin, Virtual and Augmented Reality:An Educational HandBook,Cambridge Scholars 2020, ISBN(13): 98-1-5275-4813-8,
4.	Erin Pangilinan, Steve Lukes and Vasanth Mohan, Creating Augmented and Virtual Realities, O'Relly Media Inc., 2019, ISBN: 978-1-492-04419-2

Other material resource

https://docs.unity3d.com/Manual/index.html
https://learn.microsoft.com/en-us/training/modules/learn-mrtk-tutorials/1-3-exercise-configure-unity-for-windows-mixed-reality

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
PRINCIPLES OF UI / UX DESIGN (Theory)					
Course Code	**:**	**MCA262C3**	**CIE**	**:**	**100 Marks**
L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	07 Hrs
Elements of UX Design-I Introduction, from product design to user experience design, designing for experience, User experience and the web, Building from bottom to top. **Strategy Plane:** Product Objectives, Business goals, Brand Identity, Success Metrics and User Needs, User Segmentation, Usability and User Research, Creating Personas **Scope Plane:** Defining the Scope, Functional specifications, Content requirements.	
UNIT–II	**08 Hrs**
Elements of UX Design -II **Structure Plane**: Interaction Design, Conceptual Models, Error Handling, Information Architecture **Skeleton Plane**: Interface Design, Navigation Design, Information Design, Wireframes **Surface Plane:** Sensory Design, Making Sense of the Senses, Contrast and Uniformity, Internal and External Consistency, Color Palettes and Typography, Design Comps and Style Guides.	
UNIT–III	**08 Hrs**
UI Design Process **Usability of Interactive Systems:** Introduction, Usability Goals and Measures, Usability Motivation, Universal Usability, Guideline, principles, and theories **Managing Design Processes:** Introduction, Organizational Design to support Usability, The Four Pillars of Design, Development methodologies, Ethnographic Observation, Participatory Design, Scenario Development	
UNIT–IV	**08 Hrs**
User Interface Evaluation and Interacting Styles **Evaluating Interface Design:** Introduction, Expert Reviews, Usability Testing and Laboratories, Survey Instruments, Acceptance tests, Evaluation during Active Use, Controlled Psychologically Oriented Experiments. **Menu Selection, Form Filling and Dialog Boxes:** Introduction, Task-Related Menu Organization, Single Menus, Combination of Multiple Menus, Content Organization, Fast Movement Through Menus, Data Entry with Menus, Form Filling, Dialog Boxes and Alternatives, Audio Menus and Menus for Small Displays	
UNIT–V	**08 Hrs**
Patterns For Effective Interaction Design **Using social media:** The Patterns-Editorial Mix, Personal Voices, Repost and Comment, Inverted Nano-pyramid, Sharing Widget, Content Leaderboard. **Going Mobile:** Patterns-Vertical Stack, Touch Tools, Bottom Navigation, Thumbnail-and-Text List, Loading Indicators, Richly Connected Apps. **Visual Style and Aesthetics:** Visual Design for Desktop applications, The Patterns Deep Background, Few Hues Many Values, Contrasting Font Weights Skins and Themes **Case Study:** To explore the UI/UX using Wire framing /Prototyping tools	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the theoretical foundations and awareness of User Interface and User Experience design
CO2	Explore the knowledge of features, approach, and patterns for designing UI and UX for cross platform applications
CO3	Identify and Apply various Design Skills in UI and UX for real world Applications
CO4	Evaluate UI/UX design Process/ artifacts for building products

Reference Books	
1.	Jesse James, The Elements of User Experience: User-Centred Design for the Web, New Riders Publishers ,2nd Edition, 2011, ISBN-10: 0321683684 ISBN-13: 978-0321683687
2.	Ben Shneiderman, Plaisant, Cohen, Jacobs, Designing the User Interface, Pearson Education, 5th Edition, 2014, ISBN-10: 9332518734 ISBN-13: 978-9332518735
3.	Bill Buxton, Sketching User Experiences: Getting the Design Right and the Right Design, Morgan Kaufmann,2007, ISBN-10: 0123740371 ISBN-13: 978-0123740373
4.	Jenifer Tidwell, Designing Interfaces- Patterns for Effective Interaction Design, O'Reilly®, 2nd Edition, ISBN 978-1-449-37970-4

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
CYBER SECURITY AND BLOCKCHAIN (Theory)					
Course Code	**:**	**MCA262C4**	**CIE**	**:**	**100 Marks**
L:T:P	**:**	**3:1:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L+26T**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	08 Hrs
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	**07 Hrs**
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	**08 Hrs**
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	**08 Hrs**
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	
UNIT–V	**08 Hrs**
Bitcoin: Digital keys and address; private and public keys, transactions; life cycle, types of transactions, blockchain; structure, header, mining; tasks, algorithm	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the basic concepts and need of Cyber security and Blockchain Technology
CO2	Identify methods in Cybersecurity and Blockchain Technology
CO3	Apply Cyber security methods and Blockchain Technology for real time needs
CO4	Analyze Cybersecurity and Blockchain techniques for various scenarios

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., 2nd Edition, 2018, ISBN:978-1-78883-904-4
4.	Mike Shema, Anti-Hacker Tool Kit (Indian Edition), McGraw Hill, 4th Edition, ISBN: 9789339212155

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30 marks), Video based seminar/presentation/demonstration (30 marks) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
AI AND PRODUCT MANAGEMENT (Theory)					
Course Code	**:**	**MCA263D1**	**CIE**	**:**	**100 Marks**
L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	07 Hrs
Introduction to Product Management, Product Management Lifecycle, Concept validation to Go to Market cycle. **Understanding the Infrastructure and Tools for Building AI Products:** Understanding the difference AI, ML, DL, Learning Types in ML, Order of Optimal Process Flow, Deployment Strategies, Model Development and Maintenance for AI Products	
UNIT–II	**08 Hrs**
Building an AI-Native Product: Stages of AI product development, AI/ML product dream team, Productizing AI-powered outputs, how AI product management is different, AI customization; Customization for Verticals, Customers, and Peer Groups, Benchmarking Performance, Growth Hacking, and Cost	
UNIT–III	**08 Hrs**
Integrating AI into Existing Non-AI Products: The Rising Tide of AI, Trends in AI adoption-Embedded AI, Ethical AI, Creative AI, Autonomous AI, Evolving Products into AI Products	
UNIT–IV	**08 Hrs**
AI Product Strategy: Product Vision, Strategy, Roadmap, understanding customer needs, Product prioritization, Collaborators and Tools for Need Discovery, Translating Needs to Requirements, Requirement categorization, Case study	
UNIT–V	**08 Hrs**
Human Centered AI Developer Experience Design: AI Products for Developers, AI as a Service, AI as an Engine, AI Platform as a Service, Principles of AI DX Design **Case Studies** - Deep dives into Successful and Unsuccessful AI Product Launches, Lessons Learned and Best Practices	

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

CO1	Understand the basic concepts of AI and Product Management
CO2	Identify relevant Product Management concepts, AI infrastructure and tools for building AI products
CO3	Apply relevant AI and Product Management concepts in any real-world scenario
CO4	Analyze solutions using AI Product Strategies for real world applications

Reference Books	
1.	Irene Bratsis, The AI Product Manager's Handbook, Packt Publisher, 1st Edition, February 2023, ISBN 9781804612934.
2.	Adhiguna Mahendra, AI Startup Strategy: A Blueprint to Building Successful Artificial Intelligence Products from Inception to Exit, Apress, 2023, ISBN-13 (pbk): 978-1-4842-9501-4 ISBN-13 (electronic): 978-1-4842-9502-1, https://doi.org/10.1007/978-1-4842-9502-1
3.	Justin Norman, Peter Skomoroch, Mike Loukides, Product Management for AI, O'Reilly Media, Inc, February 2021, ISBN: 9781098104191.
4.	Thomas Winkle, Product Development within Artificial Intelligence, Ethics and Legal Risk Exemplary for Safe Autonomous Vehicles, Open Access, Springer Vieweg, ISBN 978-3-658-34292-0 ISBN 978-3-658-34293-7 (eBook), https://doi.org/10.1007/978-3-658-34293-7
5.	Marty Cagan, Inspired: How to Create Tech Products Customers Love, (Silicon Valley Product Group), John Wiley & Sons, 2nd Edition, 2018, ISBN-13: 978-1119387503

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
DATA VISUALIZATION (Theory)					
Course Code	**:**	**MCA263D2**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	**07 Hrs**
Defining Data Visualization: - The Components of Understanding - The Importance of Conviction **Visualization workflow:** The importance of process – Process in practice - Different tools for Data Visualization	
UNIT–II	**08 Hrs**
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	**08 Hrs**
Data Representation: Introducing visual encoding – Chart Types - Influencing Factors and Considerations - Visualization using Graphs, Plots, Charts and Geospatial Maps using Power BI	
UNIT–IV	**08 Hrs**
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	**08 Hrs**
Visualization Literacy - Viewing: Learning to See - Creating: The Capabilities of the Visualizer Creating Reports and Publishing Reports – Design Dashboards and Publishing using Gateways	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the process and principles of data visualization and apply the techniques for different data types
CO2	Identify the relevant visual encoding techniques like chart, graph, plot etc for real time example and demonstrate it 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.	Andy Kirk, Data Visualization, A Handbook for Data Driven Design, SAGE Publications India Pvt Ltd, ISBN 978-1-4739-1213-7, ISBN 978-1-4739-1214-4 (pbk)
2.	Suren Machiraju, Suraj Gaurav, Power BI Data Analysis and Visualization, De|G PRESS, ISBN 978-1-5474-1678-3 , e-ISBN (PDF) 978-1-5474-0072-0 , e-ISBN (EPUB) 978-1-5474-0074-4
3.	Jonathon Schwabish, Better data visualizations: a guide for scholars, researchers, and wonks, Columbia University Press: LCCN 2020017814 (print) | LCCN 2020017815 (ebook) | ISBN 9780231193108 (hardback) | ISBN 9780231193115 (trade paperback) | ISBN 9780231550154 (eBook)
4.	Alberto Ferrari and Marco Russo, Introducing Microsoft Power BI , Microsoft Press, ISBN: 978-1-5093-0228-4

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses

RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
DIGITAL TRANSFORMATION (Theory)					
Course Code	**:**	**MCA263D3**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	07 Hrs
Digitalize or Drown: Digitization: Drivers, Objects, and Impacts, Digitalization: Digital Innovation and Transformation **The Business Consequences of a Digitally Transformed Economy:** Modern Drivers of Change, Hyper Connectivity	
UNIT–II	**08 Hrs**
Supercomputing as Foundation for a 'Digitized Core': Leveraging Capabilities of a Digitized Core: The Business Impact **Cloud Computing & Smarter World:** Cloud Delivery Models: Cloud Computing and the Subscription Economy, Key Innovations for Smarter World **Cyber Security:** Four Cyber Security Elements, Impact of Cyber Security	
UNIT–III	**08 Hrs**
Challenges of Introducing Artificial Intelligence (AI) in Industrial Settings: Strategy and Organization, Technology – Data, Testing and Validation, Technology Risks, People and Process – People, Process, Decision-Making, Type of Problem, Make/Buy, Advice for Implementation Case studies: Digital Transformation on Higher education, other sectors	
UNIT–IV	**08 Hrs**
Blockchain-based Circular-Secure Encryption: Password Vulnerability, Password-Cracking Attacks, Common Causes of Knowledge Cracks, Preventive Steps for Violations of Data, Blockchain Structure, Hash Functions in Blockchain, Hashing in Password Security, Blockchain-Based Circular Fused Encryption, Wedges Algorithm for Adding Salt	
UNIT–V	**08 Hrs**
Digital Supply Chain Management Agenda for the Automotive Supplier Industry: Supply Chain Challenges and Trends, Digital Supply Chain Management, Dimensions of a Digital Supply Chain Management, Technological Innovations Relevant for Supply Chain Management **Digital Supply Chain Management Use Cases:** Digital Customers, Digital Logistics and Inventory, Digital Production Systems, Digital Supplier, Digital IT and Technology, Digital Performance Measurement, Digital Supply Chain Management Agenda, Learnings	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the elements and examples of digital economy.
CO2	Explore the transformative potential of disruptive technologies like Cloud Computing, Big Data, and many more.
CO3	Apply and analyse the impact of digital transformations in various sectors.
CO4	Develop an innovative customer-centric product or service that can be at the centre of a business model

Reference Books	
1.	Gerhard Oswald & Michael Kleinemeier, Shaping the Digital Enterprise, Trends and Use Cases in Digital Innovation and Transformation, Springer, ISBN 978-3-319-40966-5 ISBN 978-3-319-40967-2 (eBook), DOI 10.1007/978-3-319-40967-2.
2.	Peter Augustine, Pethuru Raj, and Sathyan Munirathinam, Enterprise Digital Transformation Technology, Tools, and Use Cases, CRC Press, 1st Edition 2022, ISBN: 978-1-003-11978-4 (ebk), DOI: 10.1201/9781003119784.
3.	Bruno Daniotti, Marco Gianinetto, Stefano Della Torre, Milan Italy, Digital Transformation of the Design, Construction and Management Processes of the Built Environment, Springer
4.	Venkatesh Upadrista, Formula 4.0 for Digital Transformation, A Framework using Digital Enablers from Industry 4.0, Routledge publishers, 1st Edition, 2021, ISBN: 978-0-367-74686-5 (hbk), ISBN: 978-0-367-74684-1 (pbk), ISBN: 978-1-003-15907-0 (ebk).

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
WEB OF THINGS (Theory)					
Course Code	**:**	**MCA263D4**	**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**	**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**	**SEE Duration**	**:**	**3.00 Hours**

UNIT–I	08 Hrs
Basics Of the Iot and The WoT: From the Internet of Things to the Web of Things, Hello World Wide Web of Things, Node.js for the Web of Things. Getting started with embedded systems and Building networks of Things	
UNIT–II	**08 Hrs**
Building The WoT: Access: web APIs for things: devices, resources, and web things. **Beyond Rest:** The Real-Time Web of Things, The WoT needs events! Publish/subscribe, Webhooks - HTTP callbacks, **Comet**: hacking HTTP for a real-time web WebSocket's The future from HTTP/1.1 to HTTP/2 Implementing web of things Connecting devices to the web Direct integration pattern—REST on devices **Creating a WoT server**: Resource design - Representation design - Interface design, - Pub/sub interface via WebSocket's. **Gateway integration pattern:** CoAP example, running a CoAP server- Proxying CoAP via a gateway. **Cloud integration pattern**: MQTT over EVRYTHNG, set up your EVRYTHNG account, Create your MQTT client application. Use actions to control the power plug, Create a simple web control application	
UNIT–III	**08 Hrs**
Find: Describe And Discover Web Things: The find-ability problem, Discovering Things, Network discovery, Resource discovery on the web **Describing web Things**: Introducing the Web Thing Model, - Metadata - Properties - Actions – Things, Implementing the Web Thing Model on the Pi The Semantic Web of Things, Linked data and RDF - Agreed-upon semantics: Schema.org - JSON-LD	
UNIT–IV	**08 Hrs**
Share: Securing And Sharing Web Things: Securing Things, - Encryption - Web security with TLS: the S of HTTPS! – Enabling HTTPS and WSS with TLS on your Pi **Authentication and access control:** Access control with REST and API tokens - OAuth: a web authorization framework **The Social Web of Things:** A Social Web of Things authentication proxy - Implementing a Social WoT authentication proxy	
UNIT–V	**07 Hrs**
Compose: Physical Mashups, Building a simple app automated UI generation, - A universal user interface for web Things, Physical mashups **Boxes and wires mashups for the Physical Web:** Node-RED, using wizards for physical mashups: IFTTT, pushing intruder alert tweets to a Google spreadsheet, sending requests to a Thing with the Maker Channel, Pushing intruder alert tweets to a Google spreadsheet	

Course Outcomes: After going through this course, the student will be able to	
CO1	Understand the fundamentals concepts of Web of Things and related stadards
CO2	Differentiate the challenges in IoT and WoT solutions
CO3	Integrate network of devices and secure with api through access, find and share stages of WoT
CO4	Develop Physical mashup for implementing Web of Things

Reference Books	
1.	Dominique D Guinard, Vlad M Trifa, Building the Web of Things With Examples in Node.js and Raspberry Pi, MANNING, 2017, ISBN: 9781617292682
2.	Taiji Hagino, Practical Node Red Programming, Packt publishing, 2021, ISBN-13: 978-1800201590
3.	Bogu, Mohanram Balachandar, RESTful Java Web Services, Packt Publishing, 3rd Edition, 2017, ISBN: 9781788294041

Scheme of Continuous Internal Evaluation (CIE): 20 + 50 + 30 = 100

QUIZZES: Quizzes will be conducted in online/offline mode. Two quizzes will be conducted & Each Quiz will be evaluated for 10 Marks. The sum of two quizzes will be the Final Quiz marks.

TESTS: Students will be evaluated in test, 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 50 Marks.

EXPERIENTIAL LEARNING: Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning and Program specific requirements (30), Video based seminar/presentation/demonstration (30) adding up to 60 marks. Final EL marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks:

The question paper will have FIVE full questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit...

Rubric for CIE & SEE Theory courses					
RUBRIC for CIE			***RUBRIC for SEE***		
SL.NO	**Contents**	**Marks**	**Q.NO**	**Contents**	**Marks**
1	QUIZZES – Q1 & Q2	20	Every unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit [unit 1 to 5]		
2	TESTS – T1 & T2	50	1 & 2	Unit 1: Question 1 or 2	20
3	Experiential Learning – EL1 & EL2	30	3 & 4	Unit 2: Question 3 or 4	20
	Total Marks	**100**	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
				Total Marks	**100**

SEMESTER: III					
MINOR PROJECT (Practice)					
Course Code	**:**	**MCA461P**	**CIE**	**:**	**100 marks**
Credits: L:T:P	**:**	**0:0:4**	**SEE**	**:**	**100 marks**
Total Hours	**:**	**52P**	**SEE Duration**	**:**	**3.00 Hours**

GUIDELINES

1. Each project group will consist of a maximum of two students. The student shall undertake minor project depending on the electives / Research based / Industry Oriented Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey.
2. Allocation of the guides preferably in accordance with the expertise of the faculty
3. The number of projects that a faculty can guide would be limited to six to eight.
4. The minor project would be performed in-house.
5. The implementation of the project must preferably be carried out using the resources available in the department/college.
6. Students are required to publish project findings in reputed journals/ conferences

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

CO1	Conceptualize, design and implement solutions for specific problems
CO2	Communicate the solutions through presentations and technical reports
CO3	Apply project and resource management skills, professional ethics and societal concerns
CO4	Synthesize self-learning, teamwork and ethics

Scheme of Continuous Internal Evaluation (CIE)
Evaluation of the project work will be done by the committee appointed by the Director, Dept of MCA. Evaluation will be carried out in THREE Phases.

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic and Objectives formulation	**20%**
II	Mid-term seminar to review the progress of the work and documentation. • Design and Simulation/Algorithm development Experimental Setup • Conducting experiments / Implementation / Testing	 **20%** **20%**
III	Oral presentation Demonstration Project report& Paper publication	**10%** **10%** **20%**

Scheme for Semester End Examination (SEE)
The evaluation will be done by Internal and External examiners. The following weightage would be given for the examination. Evaluation will be done in batches of 10 students.

1. Project work 40%
2. Presentation 30%
3. Viva-voce 30%

SEMESTER: III					
INTERNSHIP (Practice)					
Course Code	**:**	**MCA462N**	**CIE**	**:**	**100 marks**
Credits: L:T:P	**:**	**0:0:6**	**SEE**	**:**	**100 marks**
Total Hours	**:**	**78P**	**SEE Duration**	**:**	**3.00 Hours**

GUIDELINES

1) The duration of the internship shall be for a period of 6 weeks on full time basis after II semesterfinal exams and before the commencement of III semester.
2) The student can take up internship individually or as a team of TWO.
   A. **At Industry or Research Organizations** Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc.. However, the institute/industry should provide the letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.
   B. **At RVCE Center of Excellence/Competence** RVCE hosts around 16 CENTER OF EXCELLENCE in various domains and around 05 CENTER OF COMPETENCE.
   The details of these could be obtained by visiting the website.
   https://rvce.edu.in/rvce-center-excellence
   C. **Within the respective department at RVCE (In house)** Departments may offer internship opportunities to the students based on societal concern/ research/consultancy works.
3) The student must submit letters from the industry/ CoE/CoC clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.
4) Students undergoing internship training are required to submit periodic progress reports to their respective guides and a final report at the end of the internship.

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

CO1	Understand appropriate operational principles and practices in the real-world scenarios.
CO2	Analyze real-time problems and suggest solutions.
CO3	Communicate effectively and work in teams
CO4	Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):
The evaluation committee shall consist of a Guide, Professor/Associate Professor and Assistant Professor. The committee shall assess the presentation and the progress reports in two reviews.

Reviews	Activity	Weightage
Review I	Presentation of the operational principles and practices of internship carried out.	45%
Review II	Presentation of internship experience with suitable methodology, structure and report writing.	55%

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

SEMESTER: IV					
MAJOR PROJECT (Practice)					
Course Code	**:**	**MCA491P**	**CIE**	**:**	**100 Marks**
Credits L:T:P	**:**	**0:0:15**	**SEE**	**:**	**100 Marks**
Hrs/Week	**:**	**30**	**SEE Duration**	**:**	**3.00 Hours**

GUIDELINES

1. A major project will have to be done by only one student in his / her area of interest.
2. Each student must select a contemporary topic in the area of application or research that will use the technical knowledge and skill set.
3. The project can be carried out on-campus or in an industry or an organization with prior approval from the Director, Department of MCA
4. Students carrying out the Project In house are required to be present in the college every day and report to the Internal Guide
5. The candidate must maintain and submit a weekly project work dairy duly signed by the internal and external guide to verify the regularity of the student.
6. Internal Evaluation of the project work will be done by the evaluation committee appointed by the Director, Department of MCA.
7. The standard duration of the project is for 5-month duration, however if the evaluation committee of the department, after the assessment feel that the work is insufficient and it must be extended, then the student will have to continue as per the directions of the committee.
8. Students are mandatorily required to publish in reputed journals/ conferences.

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

CO1	Conceptualize, design and implement solutions for specific problem defined
CO2	Communicate the solutions through presentations and dissertation report
CO3	Apply project and resource management skills, professional ethics, and societal concerns
CO4	Exhibit self-learning, lifelong learning skills towards sustainable solutions

Scheme of Continuous Internal Examination (CIE)
Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of guide and members appointed by Director, MCA

Phase	Activity	Weightage
I	Synopsis submission, Preliminary seminar for the approval of selected topic, review and refinement of objectives, Literature survey	20%
II	Mid-term seminars to review the progress of the work and documentation – SRS and algorithm development, Design and simulation/ experimental set up	40%
III	Experimental result & analysis, testing, Conclusions and Future Scope of Work, Dissertation Report	40%

Note -

(a) 50% CIE is the prerequisite to appear for SEE.
(b) Two hard bound dissertation reports are to be submitted. The report must be in light yellow color.
(c) Certificate sheet having the signatures of Guide, Director and Principal must be included.
(d) Plagiarism report must be <20% and to be included in the report.

Scheme for Semester End Examination (SEE):

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

SEE procedure is as follows.

	Internal Examiner	**External Examiner**	**Total**	
SEE Dissertation	100 marks	100 marks		200 marks
			(A)	(200/2) =100 marks
Viva Voce	Jointly Evaluated by Internal and External Examiner		(B)	100 marks
		Total Marks		**[(A)+(B)]/2 = 100**

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

SEMESTER: IV					
TECHNICAL SEMINAR (Practice)					
Course Code	**:**	MCA492L	**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**	**SEE**	**:**	**50 Marks**
Hrs/Week	**:**	**4**	**SEE Duration**	**:**	**2.00 Hours**

GUIDELINES

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

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

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

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

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

Scheme for Semester End Evaluation (SEE):

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

Rubrics for SEE evaluation.

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

SEMESTER: IV					
ABILITY ENHANCEMENT COURSE-II (NPTEL)					
Course Code	**:**	**MHS102T**	**CIE**	**:**	**--**
Credits: L: T:P	**:**	**2:0:0**	**SEE**	**:**	**--**
Total Hours	**:**		**SEE Duration**	**:**	**--**

GUIDELINES

1) Students are mandatorily required to take One MOOC certification courses as recommended by HSS BoS, within I-IV Semester MCA and this is considered for the evaluation in course code MHS102T. This is included in the HSS board.
2) Students are required to take and complete the NPTEL courses recommended by HSS BoS.
3) The course completed certificates along with scores to be submitted to the department.
4) The grading is calculated as per the scores obtained.

Curriculum Design Process

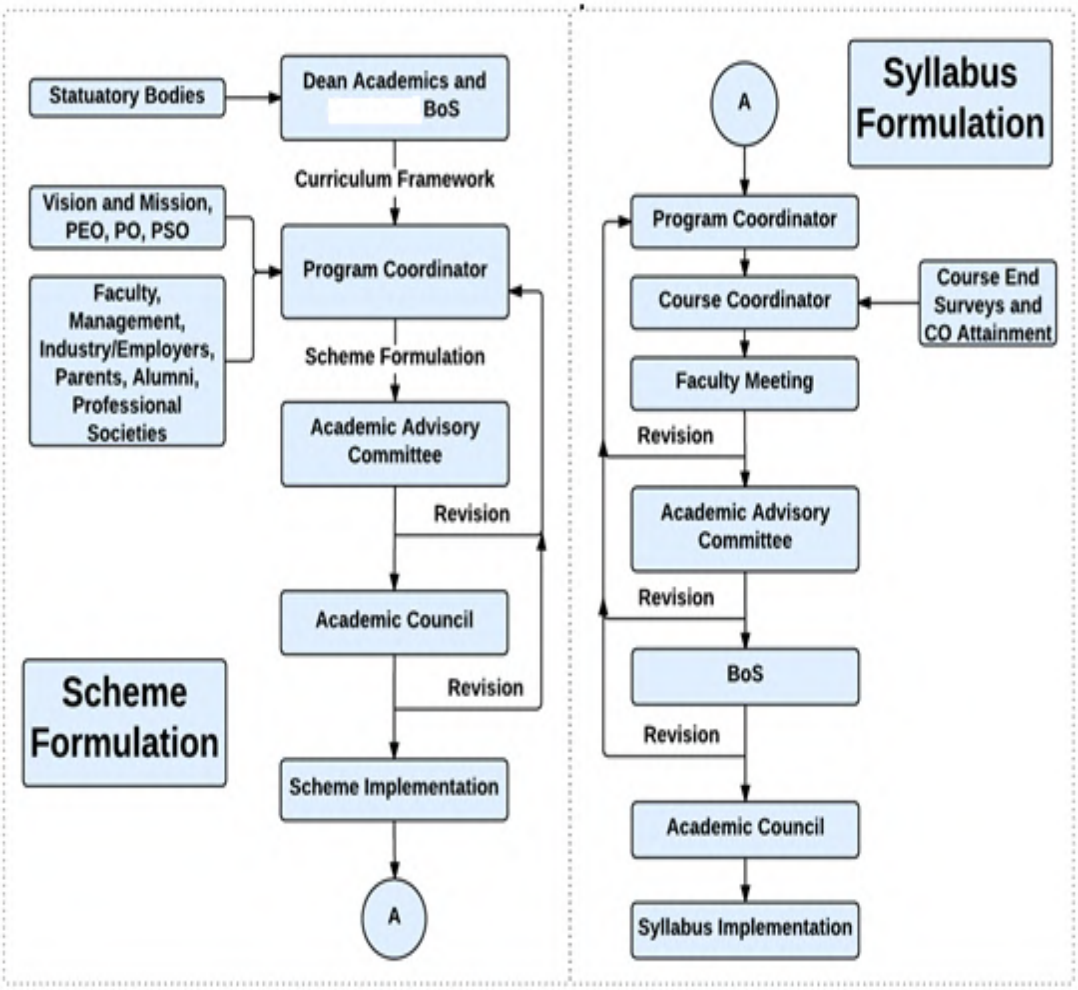

Figure 1: Curriculum Design Process

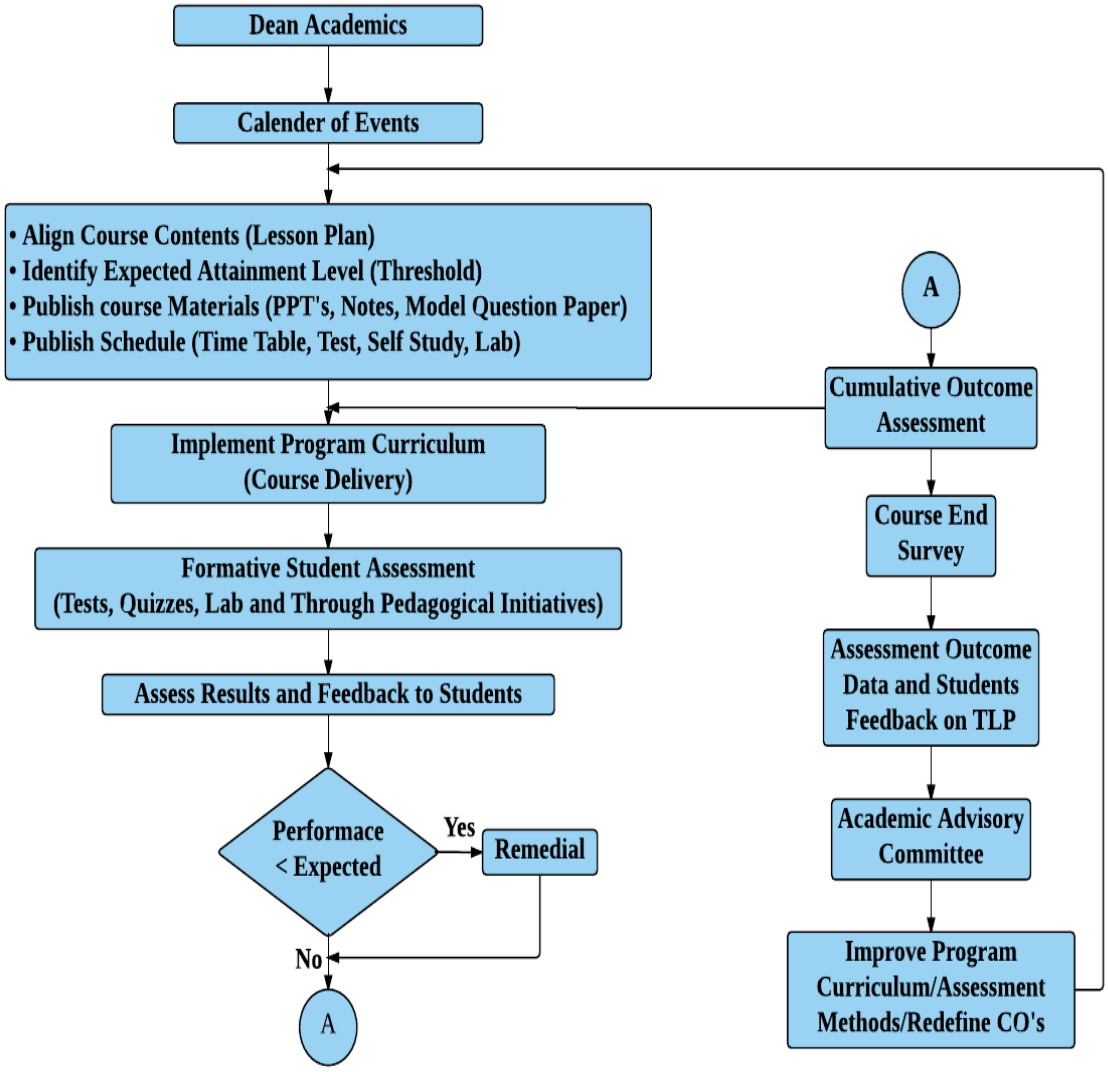

Figure 2: Academic Planning and Implementation

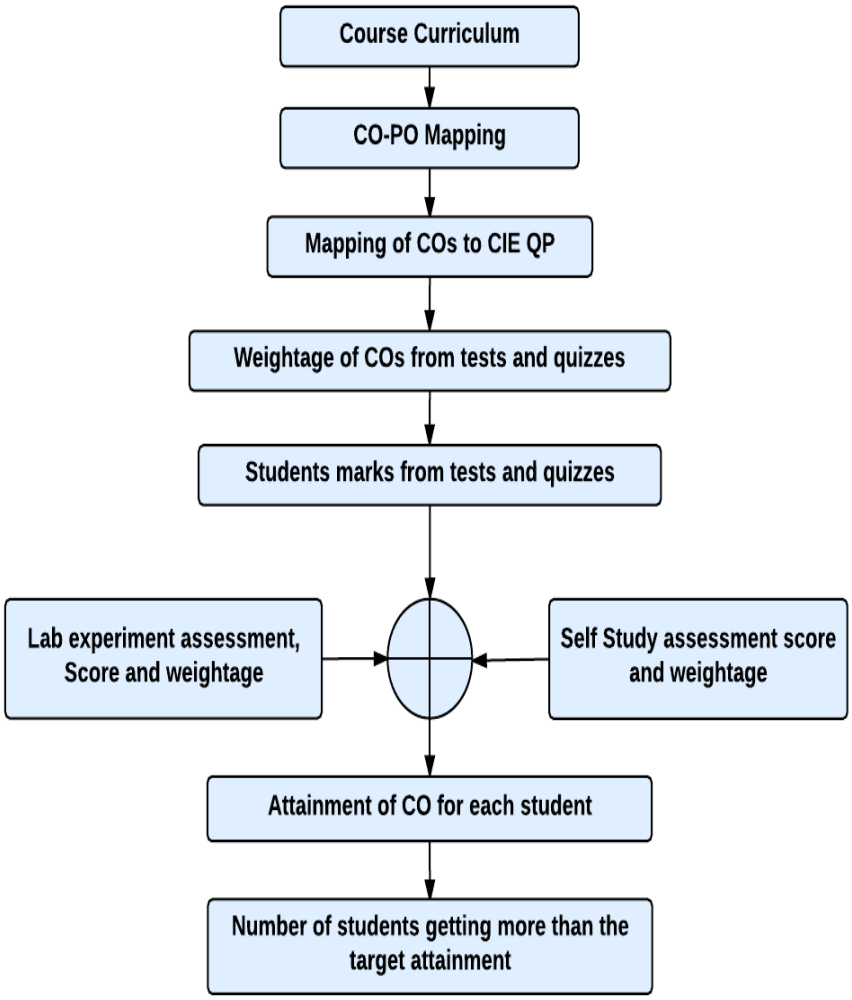

Figure 3: Process for Course Outcome Attainment

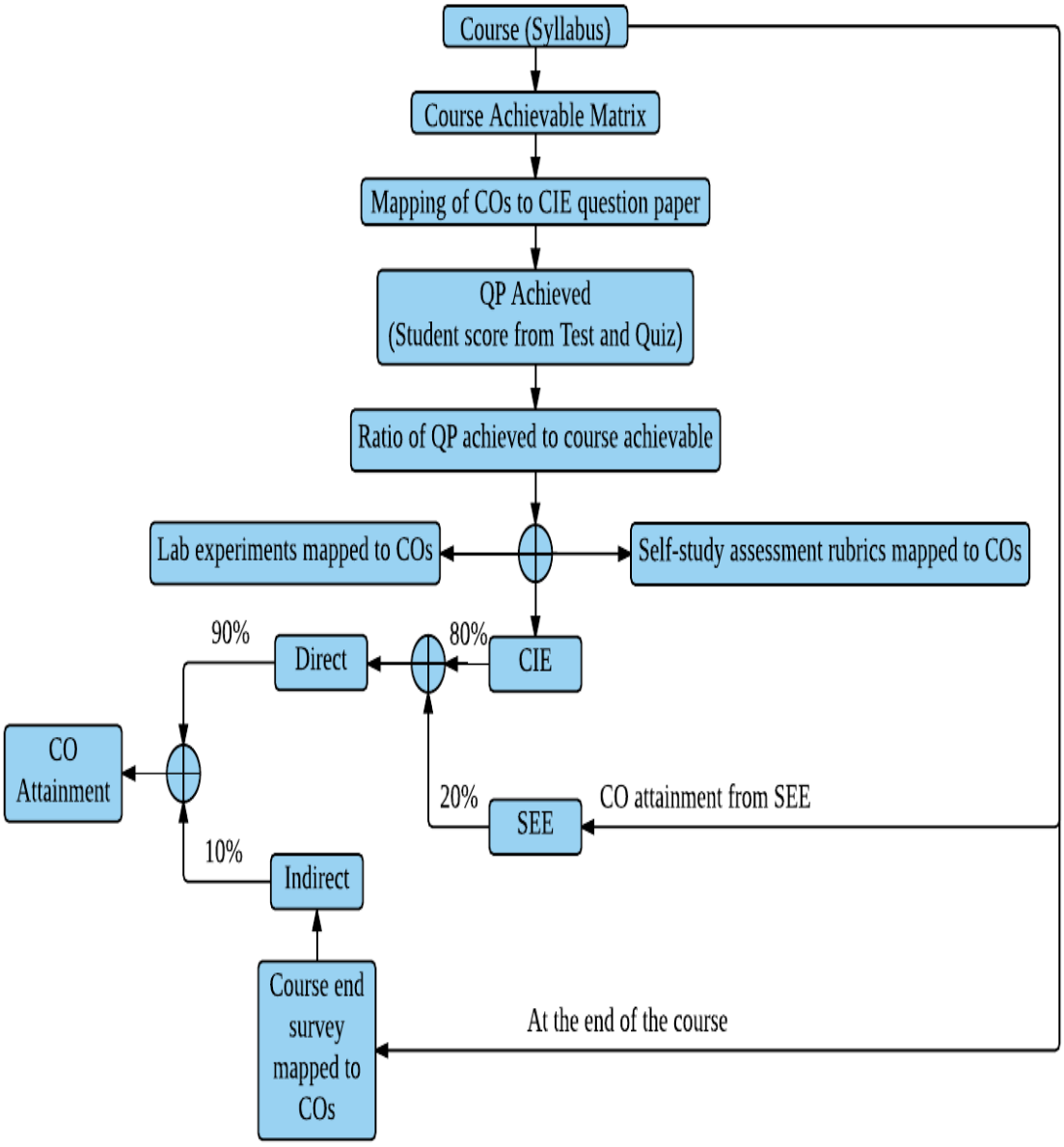

Figure 4: Final CO Attainment Process

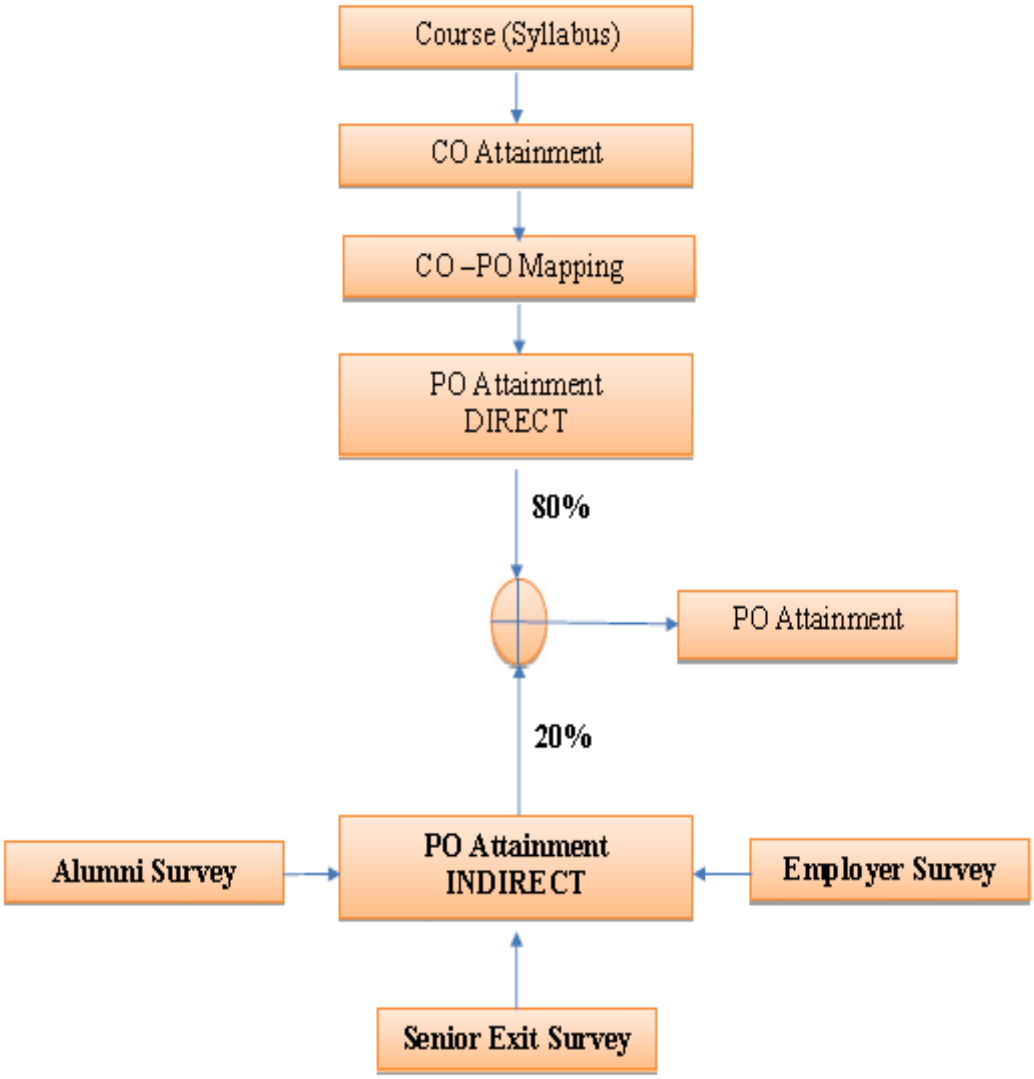

Figure 5: Program Outcome Attainment Process

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.