RV College of Engineering®

Master Of Technology (M. Tech.)

In

COMPUTER NETWORK ENGINEERING (MCN)

Scheme And Syllabus Of I & IV Semester
(2022 Scheme)

2024

96TH NIRF RANKING IN ENGINEERING (2023)

TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023
1501+
TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023 (ADA)
501-600

EDUFUTURE EXCELLENCE AWARD
BEST PRIVATE ENGINEERING UNIVERSITY (SOUTH)
BY ZEE DIGITAL

1001+ SUBJECT RANKING (ENGINEERING)

801+ SUBJECT RANKING (COMPUTER SCIENCE)

IIRF 2023 ENGINEERING RANKING INDIA
NATIONAL RANK-10
STATE RANK – 2
ZONE RANK – 5

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

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

17 Centers of Excellence

11 Centers of Competence

1381 Publications On Web Of Science

397 Publications On Web Of Science

1699 Citations

78 Patents Filed

38 Patents Granted

58 Published Patents

11 Skill Based Laboratories Across Four Semesters

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

EXECUTED MORE THAN RS.40 CRORES WORTH SPONSORED RESEARCH PROJECTS & CONSULTANCY WORKS SINCE 3 YEARS

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.	TL	Theory Integrated with Laboratory
40.	VTU	Visvesvaraya Technological University

POSTGRADUATE 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

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

VISION

To achieve leadership in the field of Computer Science and Engineering by strengthening fundamentals and facilitating interdisciplinary sustainable research to meet the ever-growing needs of the society.

MISSION

1. To evolve continually as a centre of excellence in quality education in computers and allied fields.
2. To develop state-of-the-art infrastructure and create environment capable for interdisciplinary research and skill enhancement
3. To collaborate with industries and institutions at national and international levels to enhance research in emerging areas.
4. To develop professionals having social concern to become leaders in top-notch industries and/or become entrepreneurs with good ethics.

PROGRAMME OUTCOMES (PO)

M. Tech in **Computer Network Engineering** graduates will be able to:

PO1: Independently carry out research and development work to solve practical problems related to the Computer Network domain.

PO2: Write and present a substantial technical report/document.

PO3: Demonstrate a degree of mastery over the area of Computer Network Engineering Program.

PO4: Explore, enhance and solve complex problems with a research perspective by evaluating, analysing, designing and applying computer networking principles to solve real world scenarios by engaging in lifelong learning.

PO5: Demonstrate leadership skills and apply computer-networking principles for projects considering ethical factors to accomplish a common goal for a sustainable society.

PO6: Explore, select, learn and model computer network applications through use of tools.

M.Tech in Computer Network Engineering: MCN

I SEMESTER M.Tech

Sl. No.	Course Code	Course Title	L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MMA202T	Linear Algebra, Probability and Queuing Theory	3	1	0	**4**	MA	Theory	1.5	100	3	100
2	MCN201I	Advances in Computer Networks	3	0	1	**4**	CS	Theory+Lab	1.5	100	3	100
3	MCN202T	Information & Network Security	3	1	0	**4**	CS	Theory	1.5	100	3	100
4	MCN401L	Software Defined Networks Lab	1	0	1	**2**	CS	Lab	1.5	50	3	50
5	XXXXXXAX	Elective A (Professional Elective)	3	0	0	**3**	CS	Theory	1.5	100	3	100
6	XXXXXXBX	Elective B (Professional Elective)	3	0	0	**3**	CS	Theory	1.5	100	3	100

Note: For the course code MHS191, Students need to select one ONLINE MOOC course as recommended by HSS BoS. This course can be selected anytime between I to III semester and it will be evaluated during IV semester.

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Code	Elective A (Professional Elective)	Code	Elective B (Professional Elective)
MCE301A1	Artificial Intelligence and Machine Learning	MCN201B1	Social Network Analysis
MCN301A2	Blockchain Technologies	MCN201B2	Distributed and Cloud Computing
MIT301A3	Mobile Application Development	MCN201B3	Software Defined Networks
MCN301A4	Advances in Network Management	MCN201B4	Advances in Storage Area Networks

II SEMESTER M.Tech

Sl. No.	Course Code	Course Title	L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MIM431T	Research Methodology	3	0	0	**3**	IM	Theory	1.5	100	3	100
2	MCN331I	Network Programming	3	0	1	**4**	CS	Theory+Lab	1.5	100	3	100
3	MCN332T	Advanced Wireless Networks	3	0	0	**3**	CS	Theory	1.5	100	3	100
4	XXXXXXCX	Elective C (Professional Elective)	3	0	0	**3**	CS	Theory	1.5	100	3	100
5	XXXXXXGX	Elective D (Global Elective)	3	0	0	**3**	Res. BoS	Theory	1.5	100	3	100
6	MCN431L	Open Source Simulation Lab	1	0	1	**2**	CS	Lab	1.5	50	3	50
7	MHS131T	Professional Skills Development-I	2	0	0	**2**	HSS	Theory*	1.5	50	2	50

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Code	Elective C (Professional Elective)
MSE333C1	Robotic Process Automation
MCE333C2	Embedded Systems
MCN333C3	Advanced Algorithms
MCN333C4	˙Internet of Things and Edge Computing

Elective D (Global Elective)			
MBT331G	Bioinspired Engineering	MET331G	Tracking and Navigation Systems
MBT332G	Health Informatics	MIM331G	Project Management
MCS331G	Business Analytics	MIS331G	Database and Information Systems
MCV331G	Industrial and Occupational Health and Safety	MIS332G	Management Information Systems
MCV332G	Intelligent Transportation Systems	MMA331G	Statistical and Optimization Methods
MEC331G	Electronic System Design	MME331G	Industry 4.0
MEC332G	Evolution of Wireless Technologies		

III SEMESTER M.Tech

Sl. No.	Course Code	Course Title	L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MCN361T	Network Routing and Protocols	3	1	0	**4**	CS	Theory	1.5	100	3	100
2	XXXXXXDX	Elective E (Professional Elective)	3	1	0	**4**	CS	Theory	1.5	100	3	100
3	MCN461N	Internship	0	0	6	**6**	CS	Internship	1.5	50	3	50
4	MCN461P	Minor Project	0	0	6	**6**	CS	Project	1.5	50	3	50

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Code	Elective E (Professional Elective)
MIT362D1	Augmented Reality and Virtual Reality
MCE362D2	Cyber Security
MCE362D3	Software Product Development (DevOps)
MCE362D4	Intelligent Systems

IV SEMESTER M.Tech

Sl. No.	Course Code	Course Title	L	T/ SDA	P	Total	BoS	Category	CIE Duration (H)	Max Marks CIE	SEE Duration (H)	Max Marks SEE
1	MCN491P	Major Project	0	0	18	**18**	CS	Project	1.5	100	3	100
2	MHS191	Professional Skills Development-II	2	0	0	**2**	HSS	NPTEL	--	50	ONLINE	50
Student need to submit the certificate for the evaluation of Course code 22HSS42												

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SEMESTER: I				
Course Code	:	MMA202T	**LINEAR ALGEBRA, PROBABILITY AND**	CIE Marks	:	100
Credits L-T-P	:	3 - 1 - 0	**QUEUING THEORY**	SEE Marks	:	100
Hours	:	42L+28T	*Common Course (MCE, MCN)*	SEE Durations	:	3 Hrs

Faculty Coordinator:	Dr. C Nandeeshkumar

UNIT - I	**09 Hrs**

Matrices and Vector spaces: Geometry of system of linear equations, vector spaces and subspaces, linear independence, basis and dimension, four fundamental subspaces, change of basis. Rank-nullity theorem (without proof), linear transformations, representation of transformations by matrices.

UNIT - II	**09 Hrs**

Orthogonality and least square approximations: Inner product, orthogonal vectors, orthogonal projections, orthogonal bases, Fourier expansion. Eigen subspaces, Gram-Schmidt orthogonalization process. QR factorisation, least square problems, application to linear models (least square lines and least square fitting of other curves).

UNIT - III	**08 Hrs**

Symmetric and Quadratic forms:
Quadratic forms, constrained optimization, symmetric forms, diagonalization, singular value decomposition, mean and covariance matrix, principal component analysis.

UNIT - IV	**08 Hrs**

Multiple Random variables: Joint probability mass functions and probability density functions, marginal density function, conditioning of random variables, statistical independence, correlation and covariance functions, covariance and correlation matrices, transformation of random variables, Markov and Chebyshev inequalities, Gaussian distribution-Multivariate normal density and its properties.

UNIT - V	**08 Hrs**

Queuing Theory:
Symbolic Representation of a Queuing Model, Poisson Queue system, Little Law, Types of Stochastic Processes, Birth-Death Process, The M/M/1 Queuing System, The M/M/s Queuing System, The M/M/s Queuing with Finite buffers.

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

CO1	:	Illustrate the fundamental concepts of vector spaces, orthogonality, joint probability distributions and queuing theory arising in various fields engineering.
CO2	:	Derive the solution by applying the acquired knowledge and skills of linear algebra/probability/optimization techniques to solve problems of probability distributions, linear algebra and queuing theory.
CO3	:	Evaluate the solution of the problems using appropriate linear algebra, statistical and optimization techniques to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of multivariate probability distributions, linear algebra and optimization methods gained to engage in life – long learning.

Reference Books:

1. Alberto Leon-Garcia, "Probability, Statistics, and Random Processes for Electrical Engineering", Pearson Prentice Hall, 3rd Edition, 2008, ISBN: 978-0-13-147122-1.

2. Edgar G. Goodaire "Linear Algebra: Pure & Applied Kindle Edition", World Scientific, 1st Edition, 2013, ISBN-13: 978-9814508360.

3. Gilbert Strang, "Linear Algebra and its Applications", Cengage Learning, 4th Edition, 2006, ISBN: 97809802327.

4. Hwei P. Hsu, Schaum's Outline of Theory and Problems of Probability, Random Variables, and Random Processes, McGraw Hill Education, 2017, ISBN-10: 978-0070589506.

5. T. Veerarajan, Probability, Statistics and Random Processes, Tata McGraw Hill Education Private Limited, 3rd Edition, 2008, ISBN: 978-0-07-066925-3.

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Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

Go, change the world

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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*		
SLNo	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I					
Course Code	:	MCN201I	**ADVANCES IN COMPUTER NETWORKS**	CIE Marks	: 100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	: 100
Hours	:	42L + 28P	*(Professional Core - 1)*	SEE Durations	: 3 Hrs
Faculty Coordinator:		Dr. Sandhya S and Prof. Srividya M S			

UNIT - I	9 Hrs

Foundation: Introduction to Networks, Network Architecture- Layering and Protocols, OSI & Internet Architecture, Implementing Network Software- Application Programming Interface (sockets), Performance, Bandwidth and Latency, Delay X Bandwidth Product, Reliable Transmission, Stop-and-Wait, Sliding Window, Concurrent Logical Channels, Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing.

UNIT - II	9 Hrs

Internetworking Bridges and LAN Switches-Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges. Basic Internetworking (IP), Service Model, Global Addresses, Datagram Forwarding in IP, sub netting and classless addressing-Classless Addressing, IP Forwarding Revisited, Address Translation (ARP), Host Configuration (DHCP), Error Reporting (ICMP), Virtual Networks and Tunnels.

UNIT - III	8 Hrs

Advanced Internetnetworking: Network as a Graph, Distance Vector (RIP),Link State(OSPF)–Reliable flooding, route calculation, The Open Source Shortest Path First Protocol, Metrics, The Global Internet, Routing Areas, Interdomain Routing, Challenges in Interdomain Routing, Routing among Autonomous systems (BGP), Common AS Relationships and Policies, IP Version 6 (IPv6)-Advantages, Historical Perspective, Addresses and Routing, Address Space Allocation, Address Notation, Global Unicast Addresses, IPv6 Packet Format, Auto-configuration, Advanced Routing Capabilities, Transition from IPv4 to IPv6 Routing Among Mobile Devices - Challenges for Mobile Networking, Routing to Mobile Hosts (Mobile IP), Route Optimization in Mobile IP,Mobility in IPv6.

UNIT - IV	8 Hrs

End-to-End Protocols Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination-Three-Way Handshake, State-Transition Diagram, Sliding Window Revisited-Reliable and Ordered Delivery, Flow Control, Protecting against Wraparound, Keeping the Pipe Full, Triggering Transmission- Silly Window Syndrome, Nagle's Algorithm, Adaptive Retransmission-Original Algorithm, Karn/Partridge Algorithm, Jacobson/Karels Algorithm.

UNIT - V	8 Hrs

TCP CongestionControl: Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery. SCTP (Stream Control Transmission Protocol): SCTP services, SCTP Features, Packet format, An SCTP association, Flow Control and Error Control.
Applications - Traditional Application: Electronic Mail (SMTP, MIME, IMAP) - Message Format, Message Transfer, Mail Reader. Domain Name System(DNS) : Name space, Domain namespace, Distribution of Name Space, DNS in the Internet, Resolution, DNS messages, Type of records, Registrars.

LABORATORY	28 Hrs

Implement the following using C/C++ or any programming languages equivalent with LINUX/Windows environment
1. Implement client-server communication employing socket API's to illustrate the usage of TCP/UDP protocol.
2. Write a program to archive Traffic management at Flow level by implementing Closed Loop Control technique. (Leaky Bucket Algorithm)
3. Write a program to implement Link State Routing (Dijkstra Algorithm).
Simulation Programs using OPNET /NS2/NS3 or any other equivalent software
4. Simulate a 3 node point to point network with duplex links between them. Set the Queue size, vary the bandwidth, and find the number of packets dropped. 5. Simulate a four-node point-to-point network, and connect the links as follows: n0->n2, n1->n2 and n2->n3. Apply TCP agent changing the parameters and determine the number of packets sent/received by TCP/UDP. 6. Explore Network Simulation Tools like Wireshark, packet tracer, GSN3, NS2, NS3 etc., and creation of scenario with submission of report.

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

CO1	:	Explore different network layers and analyze the functionalities and services w.r.t each layer.

	CO2	:	Analyze protocol stack and services provided by various layers of TCP/IP model to build effective solutions.
	CO3	:	Design Algorithms/techniques towards sustainable networking solutions by exploring modern tools.
	CO4	:	Demonstrate network configuration, protocol usage and performance evaluation in networks by applying emerging networking topics to solve challenges like congestion control in real world.

Reference Books

1. Larry Peterson and Bruce S Davis "Computer Networks: A System Approach", 5th Edition, Elsevier, 2014, ISBN-13:978-0123850591, ISBN-10:0123850592.

2. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, Tata McGraw Hill, 2013,ISBN: 9781259064753

3.S.Keshava, "An Engineering Approach to Computer Networking", 1st Edition, Pearson Education , ISBN-13: 978-0-201-63442-6

4. Andrew S Tanenbaum, Computer Networks, 5th edition, Pearson, 2011, ISBN-9788-177-58-1652.

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 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 average 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 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 (20) adding upto 30 marks.
Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16 Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with Laboratory

RUBRIC of CIE			*RUBRIC of SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	10	Each unit consists of TWO questions of 16 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.		
2	Tests – T1 & T2	30			
3	Experiential Learning – EL1 & EL2	30	1 & 2	Unit-1: Question 1 or 2	16
4	Laboratory	30	3 & 4	Unit-2: Question 3 or 4	16
	Total Marks	100	5 & 6	Unit-3: Question 5 or 6	16
			7 & 8	Unit-4: Question 7 or 8	16
	NO SEE for Laboratory		9 & 10	Unit-5: Question 9 or 10	16
			11	Laboratory Component (Compulsory)	20
				Total Marks	100

SEMESTER: I					
Course Code	:	MCN202T	**INFORMATION AND NETWORK SECURITY**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*(Professional Core - 1)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Sowmyarani C N and Dr. Chethana R Murthy				

UNIT - I	9 Hrs

Basics of Information Security: NSTISSC security model; Components of an Information System, Securing components, Balancing Information Security and Access, Approaches to Information Security implementation; The Security System Development Life Cycle. Introduction; Information Security Policy, Standards, and Practices

UNIT - II	9 Hrs

Classical Encryption Techniques Symmetric Cipher Model- Cryptography, Cryptanalysis and Brute-Force Attack, Block Ciphers and the Data Encryption Standard - Traditional Block Cipher Structure- Stream Ciphers and Block Ciphers, Feistel Cipher Structure, The Data Encryption Standard-Encryption and Decryption, Strength of DES, Block Cipher Design Principles, Advanced Encryption Standard-AES Structure-General and Detailed.

UNIT - III	8 Hrs

Public Key Cryptography and RSA Principles of Public-Key Cryptosystems-Public-Key Cryptosystems, Applications for Public-Key Cryptosystems, Requirements for Public-Key Cryptosystems, Public-Key Cryptanalysis, The RSA algorithm-Algorithm, Computational Aspects, The security of RSA, Other Public key cryptography algorithms- Diffie-Hellman Key Exchange

UNIT - IV	8 Hrs

Cryptographic Hash Functions Applications of Cryptographic Hash Functions, Secure Hash Algorithms-SHA-512 Logic, Message Authentication Codes – Message Authentication Requirements, Message Authentication Functions-Message Encryption, Message Authentication Code, Digital Signatures-Properties, Attacks and Forgeries, Digital Signature Requirements, Direct Digital Signature, Remote Authentication: KERBEROS.

UNIT - V	8 Hrs

Transport Layer Security and Network Security Applications: Web Security Considerations, Secure Socket Layer, Transport Layer security, HTTPS, Secure Shell-SSH. Pretty good privacy, notation, operational description. Block chain: Introduction to block chain, types of block chain. CAP Theorem and Block Chain, Benefits and Limitations of Block Chain.

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

CO1	:	Analyze security policies and standards at organizational level.
CO2	:	Analyze the requirement of various security issues, block chain and provide a secure solution for applications.
CO3	:	Develop applications to ensure Confidentiality, Integrity and Authenticity of the information
CO4	:	Apply appropriate cryptographic algorithms to ensure security of information through network

Reference Books

1.Principles of Information Security, Michael E. Whitman and Herbert J. Mattord, Cengage Learning; 4th Edition, 2012, ISBN-10: 1111138214.

2. Cryptography and Network Security, William Stallings, 6th Edition, ISBN-13: 978-0-13-335469-0

3. Computer Network Security, Joseph Migga Kizza, Springer International Edition, 2009, ISBN 978-1-84800-916-5.

4. Mastering Block chain Packet Publishing Ltd. Imran Bashir, 1st Edition, 2017, ISBN 978-1-78712-544-5

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	
SLNo	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	**100**	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	**100**

SEMESTER: I					
Course Code	:	MCN401L	**SOFTWARE DEFINED NETWORKS LAB**	CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Ashok Kumar A R and Prof. Sneha M			

Content 28 Hrs
1. Introduction to Mininet.
2. Create SDN topology and binding to a controller, packet analysis using wireshark.
3. Experimenting/Simulate load balancing in SDN framework.
4. Demonstrate firewall and statistics collection module in SDN framework.
5. Demonstrate use of multiple controllers in SDN framework.
6. Demonstrate the movement of hosts in a given topology in SDN framework.
7. Demonstrate with a simple example for sending output to multiple files and monitoring them in an SDN framework.
8. Demonstrate Network Address Translation(NAT) in Mininet for SDN framework.

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

CO1	:	Explore the fundamental definitions, standards, protocols and framework of Software defined Networks (SDN).
CO2	:	Analyse new paradigm of network programmability through programmable switches and controller that develop into SDN framework .
CO3	:	Apply the concepts of network programmability to develop network applications using SDN framework.
CO4	:	Design network applications for the present needs of Data Centers, WAN, and others using the SDN concept.

Reference Books

1. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, Second Edition, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
2 Software Defined Networking with OpenFlow, by Siamak Azodolmolky, Packt Publishing Limited, Second Edition, October 2013, ISBN-10: 1849698724, ISBN-13 : 9781849698726.
3 SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, Second Edition, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50. Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40 Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks					
RUBRIC FOR CIE			**RUBRIC FOR SEE**		
Sl.No	Content	Marks	Content	Marks	
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions	40	
2	Innovative Experiment/Concept Design & Implementation	10			
3	Laboratory Internal	10	Viva Voce	10	
	Total Marks	50	Total Marks	50	

SEMESTER: I					
Course Code	:	MCE301A1	**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Shanta Rangaswamy and Dr. Soumya A			

UNIT - I	**9 Hrs**

Introduction: Intelligent agents, searching: Basics of AI, Intelligent Agents: Agents and environment; Rationality; the nature of environments; the structure of agents. Problem-solving: Problem-solving agents; Searching for solution; Uninformed search strategies; Informed search strategies, Heuristic Functions

UNIT - II	**9 Hrs**

Adversarial search, constraint satisfaction problems, logical agents: Games, Optimal decision in games, Alpha-Beta Pruning, Defining Constraint satisfaction problems; Backtracking search for CSPs;Knowledge-based agents
Probabilistic reasoning: Representing knowledge in an uncertain domain; Semantics of Bayesian Networks; Efficient representation of conditional distributions; Exact inference in Bayesian Networks; Approximate inference in Bayesian Networks

UNIT - III	**8 Hrs**

Introduction, Concept Learning and Decision Trees Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning –Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning– Representation – Algorithm – Heuristic Space Search.

UNIT - IV	**8 Hrs**

Bayesian And Computational Learning Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model

UNIT - V	**8 Hrs**

Instant Based Learning K- Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning Reinforcement Learning: The Learning Task, Q-Learning, Temporal Difference Learning

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

CO1	:	Explore the fundamentals of Artificial intelligence technology and Machine learning algorithms
CO2	:	Apply the working of various searching algorithms, games, pruning, inferencing, etc. with suitable examples.
CO3	:	Analyze and determine appropriate algorithms and techniques for AI and ML applications.
CO4	:	Evaluate AI and ML based solutions for classical problems.

Reference Books

1 AI – A Modern Approach, Stuart Russel, Peter Norvig, 3rd Edition, 2010, Pearson, ISBN-13: 978-0136042594.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, July 2017, McGraw Hill Education, 1st Edition, ISBN-10 1259096955, ISBN-13 978-1259096952
3. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2007, ISBN 9788131714720
4. T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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**		
SLNo	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

SEMESTER: I					
Course Code	: MCN301A2	**BLOCKCHAIN TECHNOLOGIES**	CIE Marks	:	100
Credits L-T-P	: 3- 0 - 0		SEE Marks	:	100
Hours	: 42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:	Dr. Ramakanth Kumar P and Dr. Sharvani G S				

UNIT - I	9 Hrs
Blockchain: Distributed systems, History of blockchain, Introduction to blockchain, Types of blockchain, CAP theorem and blockchain, Benefits and limitations of blockchain	

UNIT - II	9 Hrs
Decentralization and Cryptography: Decentralization using blockchain, Methods of decentralization, Routes to decentralization, Decentralized organizations. Cryptography and Technical Foundations: Cryptographic primitives, Asymmetric cryptography, Public and private keys	

UNIT - III	8 Hrs
Bitcoin and Alternative Coins A: Bitcoin, Transactions, Blockchain, Bitcoin payments B: Alternative Coins, Theoretical foundations, Bitcoin limitations, Namecoin, Litecoin, Primecoin, Zcash	

UNIT - IV	8 Hrs
Smart Contracts and Ethereum: Smart Contracts: Definition, Ricardian contracts. Ethereum: Introduction, Ethereum blockchain, Elements of the Ethereum blockchain, Precompiled contracts.	

UNIT - V	8 Hrs
Alternative Blockchains: Blockchains Blockchain-Outside of Currencies: Internet of Things, Government, Health, Finance, Media	

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

CO1	:	Apply fundamentals, technologies and models of blockchain
CO2	:	Develop decentralised systems using bitcoin, smart contracts and Etherum platform to implement the Block chain Application
CO3	:	Design secure decentralization algorithm using block chains for real time use cases
CO4	:	Analyze the function of Blockchain as a method of securing distributed ledgers in different case studies.

Reference Books

1. Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained, Author- Imran Bashir, Packt Publishing Ltd, Second Edition,ISBN 978-1- 78712-544-5, 2017 .

2. Bitcoin and Cryptocurrency Technologies, Author- Arvind Narayanan, Joseph Bonneau,Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University, 2016, ISBN: 9780691171692

3. Blockchain Basics: A Non-Technical Introduction in 25 Steps, Author- Daniel Drescher,Apress, First Edition, 2017, ISBN-13 : 978-1484226032

4. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, Andreas M. Antonopoulos,O'Reilly Media, First Edition, 2014, ISBN-13: 978-1449374044

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents		Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40				
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2		20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4		20
			5 & 6	Unit-3: Question 5 or 6		20
			7 & 8	Unit-4: Question 7 or 8		20
			9 & 10	Unit-5: Question 9 or 10		20
				Total Marks		100

SEMESTER: I					
Course Code	:	MIT301A3	**MOBILE APPLICATION DEVELOPMENT**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Prof. Sharadadevi K			

UNIT - I	**9 Hrs**

Essentials For Mobile Application Development : Background about mobile technologies, Overview of Android, Android architecture, Android for mobile application development, Android development Framework – Android SDK, Emulators / Android AVD Android Project Framework ,Setting up development environment, Running android app, Dalvik Virtual Machine & .apk file extension, android debug bridge. Fundamentals: Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents & Intent Filters, Android API levels (versions & version names)

UNIT - II	**9 Hrs**

Android UI Architecture & UI Widgets : Application context, Intents, Activity life cycle, Supporting different devices, multiple screen sizes, Fundamental Android UI design – Layouts, Drawable resources, UI widgets, Notification, Toasts, Menu, Dialogs, Lists & Adapters, Building dynamic UI with fragments.

UNIT - III	**8 Hrs**

Data Storage, Services & Content Providers : Saving Data, Interacting with other Applications, Working with system permissions, Applications with content sharing, Shared Preferences, Preferences activity, Files access, SQLite database, Threads, Overview of services in Android, Implementing a Service, Service lifecycle, Inter Process Communication.

UNIT - IV	**8 Hrs**

Advanced Android : Building apps with Multimedia, Building apps with Graphics & Animations, Building apps with Location Based Services and Google maps, Building apps with Connectivity & Cloud, Sensors, Bluetooth, Camera, Telephony Services.

UNIT - V	**8 Hrs**

Testing, Debugging & Deployment of Android Application : Role and use of Dalvik Debug Monitor Server (DDMS), adb tool, How to debug Android application, Use of Step Filters, Breakpoints, Suspend and Resume, How to use LogCat, Preparing for publishing – Signing & Versioning of apps, Using Google Play to distribute & Monetize, Best practices for security & privacy.

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

CO1	:	Comprehend the basic features of Android Platform and the Application Development Process. Acquire familiarity with basic building blocks of Android Application and its architecture.
CO2	:	Apply and explore the basic framework, usage of SDK to build apps incorporating Android features in developing mobile applications.
CO3	:	Demonstrate proficiency in coding on a mobile programming platform using advanced Android technologies like multimedia, involving the sensors and hardware features of the phone.
CO4	:	Demonstrate proficiency in testing, debugging and deployment of Android applications.

Reference Books

1. Android Programming, Phillips, Stewart, Hardy and Marsicano, 2nd edition, 2015; Big Nerd Ranch Guide; ISBN-13 978-0134171494

2. Professional Android 2 Application Development; Reto Meier; 1st Edition; 2012;Wiley India Pvt.ltd; ISBN-13: 9788126525898

3. Beginning Android 3; Mark Murphy; 1st Edition; 2011; A press Springer India Pvt Ltd. ; ISBN-13: 978-1-4302-3297-1

4. Android Programming – Pushing the limits by Hellman; Eric Hellman; Wiley; 2013; ISBN 13: 978-1118717370

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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**		
SLNo	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I					
Course Code	:	MCN301A4	**ADVANCES IN NETWORK MANAGEMENT**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective A (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. G S Nagaraja and Prof. Srividya M S			

UNIT - I	9 Hrs

Data Communications and Network Management Overview: Data and Telecommunication Network, Distributed Computing Environments, Networks, Systems and Services, Case Studies on Network, System and Service Challenges of Information Technology Managers, Network Management Goals, Organization and Functions, Network Provisioning, Network Operations and the NOC, Network Installation and Maintenance, Network Management Architecture and Organization, Network Management Perspectives, NMS platform, Current status and Future of Network Management, introduction to IOS commands and configuration Commands of Routers, Switches and other devices.

UNIT - II	9 Hrs

SNMP and Network Management: Network Management Standards, Network Management Models, Organizational Model, Information model, Management Information Tree (MIT), Managed Object Perspective, Communication Model, and Abstract Syntax Notation One: Terminology, Symbols and Conventions, Objects and Data Types, Object Names, Encoding Structure, Macros, Functional Model. SNMPv1 Network Management Models The SNMP Model, The Organization Model, System Overview, Information model, Introduction, The structure of Management Information, Managed Objects, Management Information Base (MIB). SNMP Communication Model, The SNMP Architecture, The Administrative Model, SNMP Protocol Specifications, SNMP Operations, The SNMP MIB Group, Functional Model

UNIT - III	8 Hrs

SNMP Management: SNMPv2 SNMPv2 System architecture, SNMPv2 Structure of management Information, SNMPv2Management Information Base, SMI Definitions for SNMPv2, Information Modules, Module Definitions, Object Definitions, Notification Definitions, Textual Conventions, Conformance Statements, SNMPv2 Protocol. SNMP Management:SNMPv3 SNMPv3 Key features, Architecture, SNMPv3 applications, SNMPv3 Management Information base, Security, SNMPv3 Security Threats, Security Model, Access Control, Elements of the model, VACM Process, VACM MIB.

UNIT - IV	8 Hrs

Remote Network Monitoring: RMON1, RMON1 Textual Conventions, RMON1 Groups and Functions, Relationships between Controland Data Tables, RMON1 Common and Ethernet Groups, RMON Token-Ring Extension GroupsRemote Network Monitoring: RMON2 RMON2 Management Information Base, RMNO2 Conformance Specifications, ATM RemoteMonitoring, Cable Modem Technology, Cable Access Network Management, A case study on Internet Traffic using RMON.

UNIT - V	8 Hrs

Network Management Tools, Systems and Engineering System Utilities for management: Basic Tools, SNMP Tools, Protocol Analyser, Network Statistics Measurement Systems: Traffic Load Monitoring, Protocol Statistics, Data and Error Statistics, MIB Engineering: General Principles and Limitations of SMI, Counters vs Rates, Object-Oriented Approach to MIB Engineering, SMI Tables, SMI Actions, SMI Transactions. NMS Design: Functional requirements, Architecture of the NMS server, Key Design decisions, Discovery Module, Performance Manager, Distributed management approaches, Server platforms, NMS Client Design

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

CO1	:	Apply various Network Management Protocols to Manage small, medium, large and complex Networks.
CO2	:	Design and development of network models for different requirements / applications.
CO3	:	Analysis of advanced network model issues and performance metrics using system network tools and protocols.

CO4	:	Examine the various components of network and tools required to formulate the scheme for managing the network resources.

Reference Books

1. Network Management – Principles and Practice, Mani Subramanian, 2nd Edition, Pearson Education Publication, 2012, ISBN-10: 8131727599, ISBN-13: 978-813172759.

2. Network management Concepts and Practices: a Hands-On Approach **,** J. Richard Burke 1st Edition, PHI, 2008, ISBN-10: 8131718492, ISBN-13: 978-8131718490

3. Network management , Stephen B. Morris, 1st Edition, Pearson Education, 2008, ISBN-10: 0131011138, ISBN-13: 978-0131011137

4. Internetworking Troubleshooting Handbook, Cisco Press,1999, ISBN-1-57870-024-8

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: I					
Course Code	: MCN201B1	**SOCIAL NETWORK ANALYSIS**	CIE Marks	:	100
Credits L-T-P	: 3- 0 - 0		SEE Marks	:	100
Hours	: 42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:	Dr. Deepamala N and Prof. Prapulla S B				

UNIT - I	8 Hrs

Overview: Aspects of Networks, Central Themes and Topics **Graphs** Basic Definitions, Paths and Connectivity, Distance and Breadth-First Search, Network Datasets: An Overview

UNIT - II	9 Hrs

Strong and Weak Ties Triadic Closure, The Strength of Weak Ties, Tie Strength and Network Structure in Large-Scale Data, Tie Strength, Social Media, and Passive Engagement, Closure, Structural Holes, and Social Capital, Advanced Material: Betweenness Measures and Graph Partitioning **Networks in Their Surrounding Contexts** Homophily, Mechanisms Underlying Homophily: Selection and Social Influence, Affiliation, Tracking Link Formation in On-Line Data, A Spatial Model of Segregation

UNIT - III	8 Hrs

Games What is a Game? Reasoning about Behaviour in a Game, Best Responses and Dominant Strategies, Nash Equilibrium, Multiple Equilibria: Coordination Games, Multiple Equilibria: The Hawk-Dove Game **Mixed Strategies:** Examples and Empirical Analysis, Pareto-Optimality and Social Optimality, Advanced Material: Dominated Strategies and Dynamic Games

UNIT - IV	9 Hrs

The Structure of the Web The World Wide Web, Information Networks, Hypertext, and Associative Memory, The Web as a Directed Graph, The Bow-Tie Structure of the Web, The Emergence of Web 2.0 **Link Analysis and Web Search** Searching the Web: The Problem of Ranking, Link Analysis using Hubs and Authorities, PageRank, Applying Link Analysis in Modern Web Search, Applications beyond the Web, Advanced Material: Spectral Analysis, Random Walks, and Web Search

UNIT - V	8 Hrs

Power Laws and Rich-Get-Richer Phenomena Popularity as a Network Phenomenon, Power Laws, Rich-Get-Richer Models, The Unpredictability of Rich-Get-Richer Effects, The Long Tail, The Effect of Search Tools and Recommendation Systems, Advanced Material: Analysis of Rich-Get-Richer Processes **Applications of Social Networks** Fraud, Crime, terrorism etc.

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

CO1	:	Explore notation and terminology used in Social Networks.
CO2	:	Analyse basic principles behind Social Network analysis algorithms.
CO3	:	Design applications like web search using algorithms of social networks
CO4	:	Apply social networks on real world applications

Reference Books

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010. ISBN: 978-05211953311.

2. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994. ISBN: 978-0521387071

3. Eric Kolaczyk, Gabor Csardi, "Statistical Analysis of Network Data with R", Springer, 2014. ISBN: 978-1-4939-0983-4

4. Newman, Mark, "Networks", Oxford university press, 2018. ISBN:978-0199206650

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based Seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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*			
SLNo	**Content**	**Marks**	**Q. No**	**Contents**			**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).			
2	Tests – T1 & T2	40					
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2			20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4			20
			5 & 6	Unit-3: Question 5 or 6			20
			7 & 8	Unit-4: Question 7 or 8			20
			9 & 10	Unit-5: Question 9 or 10			20
						Total Marks	100

SEMESTER: I				
Course Code	: MCN201B2	**DISTRIBUTED AND CLOUD COMPUTING**	CIE Marks	: 100
Credits L-T-P	: 3- 0 - 0		SEE Marks	: 100
Hours	: 42L	*Elective B (Professional Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Dr. Sharvani G S and Prof. Jyoti Shetty			

UNIT - I	9 Hrs
Distributed System Models & Enabling technology: Scalablecomputing over the internet, Technologies for network-based system, System models for distributed & cloud, Software environments fordistributed & Cloud, performance security and energy efficiency	

UNIT - II	9 Hrs
Introduction to Cloud Computing: Cloud Computing in a Nutshell, System Model for Distributed and Cloud Computing, Roots of Cloud Computing, Grid and Cloud, Layers and Types of Clouds, Desired Features of a Cloud, Basic Principles, of Cloud Computing, Challenges and Risks, Service Models	

UNIT - III	8 Hrs
Service Oriented Architecture for Distributed Computing: Services & SOA, Message Oriented Middleware, Workflow in SOA.Cloud Programming & Software Environments: Features of Cloud &Grid, Parallel & Distributed programming paradigms, Programming support of Google Cloud, Amazon AWS & Azure.	

UNIT - IV	8 Hrs
Virtual Machines and Virtualization of Cluster and Data Centres Levels of Virtualization, Virtualization structures/Tools and Mechanism,Virtualization of CPU, Memory and I/O Devices, Virtual Clusters an Resources Management, Virtualization Data-Centre Automation, Virtual Machine Migration Services, VM Provisioning and Migration in Action	

UNIT - V	8 Hrs
DESIGNING DISTRIBUTED SYSTEMS: GOOGLE CASE STUDY: Introducing the case study: Google Overall architecture and design philosophy Underlying communication paradigms, Data storage and coordination services Distributed computation services	

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

CO1	:	Apply the distributed and cloud computing concepts to solve problems in computing domain.
CO2	:	Analyse various architectures, work flow models and algorithms used to implement cloud and distributed systems.
CO3	:	Design solutions using modern tools to solve applicable problems in cloud and distributed systems.
CO4	:	Demonstrate effective communication , report writing and usage of modern tools for implementing cloud and distributed systems applications

Reference Books

1.Kai Hwang. Geoffrey C. Fox, Jack J. Dongarra, "Distributed and Cloud Computing from parallel processing to the internet of things", Elsevier, 1st Edition, ISBN: 9780123858801-1, 2013

2. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski, "Cloud Computing: principles and paradigms (Wiley Series on Parallel and Distributed Computing), Wiley Publishing (c) 201, 1st edition, ISBN:978-0470887998, 2013

3. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, DISTRIBUTED SYSTEMS Concepts and Design, Fifth Edition, Addison- Wesley, ISBN:978-0132143011, 2012

4. Cloud Computing Theory and Practice, Dan Marinescu,ISBN: 9780323852777 eBook ISBN: 9780323910477, 3rd Edition 2022

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	**100**	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	**100**

SEMESTER: I					
Course Code	:	MCN201B3	**Software Defined Networks**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective B (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Pavithra H and Prof. Sneha M		

UNIT - I	**9 Hrs**
Introduction : The Modern Data Center, Traditional Switch Architecture, Autonomous and Dynamic Forwarding Tables, Can We Increase the Packet-Forwarding IQ? Open Source and Technological Shifts. **Why SDN?** Evolution of Switches and Control Planes, Cost, SDN Implications for Research and Innovation, Data Center Innovation, Data Center Needs	

UNIT - II	**9 Hrs**
The Genesis of SDN: The Evolution of Networking Technology, Forerunners of SDN, Software Defined Networking is Born, Sustaining SDN Interoperability, Legacy Mechanisms Evolve Toward SDN, Network Virtualization. May I Please Call My Network SDN? **How SDN Works:** Fundamental Characteristics of SDN, SDN Operation, SDN Devices, SDN Controller, SDN Applications, Alternate SDN Methods.	

UNIT - III	**8 Hrs**
The OpenFlow Specification - OpenFlow Overview, OpenFlow 1.0 and OpenFlow Basics, OpenFlow 1.1 Additions, OpenFlow 1.2 Additions, OpenFlow 1.3 Additions, OpenFlow Limitations.	

UNIT - IV	**8 Hrs**
SDN in the Data Center- Data Center Definition, Data Center Demands, Tunnelling Technologies for the Data Center, Path Technologies in the Data Center, Ethernet Fabrics in the Data Center, SDN Use Cases in the Data Center, Open SDN versus Overlays in the Data Center, Real-World Data Center Implementations. **SDN Applications**- Reactive versus Proactive Applications, Reactive SDN Applications, Proactive SDN Applications, Analysing Simple SDN Applications, A Simple Reactive Java Application, Background on Controllers, Using the Floodlight Controller, Using the Open Daylight Controller, Switch Considerations.	

UNIT - V	**8 Hrs**
Hands on for creating SDN applications using Mininet: Introducing to OpenFlow, Implementing OpenFlow Switch, The OpenFlow Controllers, Setting up the Environment, Net APP Development.	

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

CO1	:	Explore the fundamental definitions, standards, protocols and framework of Software defined Networks (SDN).
CO2	:	Analyse new paradigm of network programmability through programmable switches and controller that develop into SDN framework .
CO3	:	Apply the concepts of network programmability to develop network applications using SDN framework.
CO4	:	Design network applications for the present needs of Data Centers, WAN, and others using the SDN concept.

Reference Books

1. Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, Second Edition, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844

2 . Software Defined Networking with OpenFlow, by Siamak Azodolmolky, Packt Publishing Limited, Second Edition, October 2013, ISBN-10: 1849698724, ISBN-13 : 9781849698726.

3. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, Second Edition, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.

4. Network Innovation through OpenFlow and SDN: Principles and Design, Edited by Fei Hu, CRC Press, First Edition, 2016, ISBN-10: 1466572094.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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**		
SLNo	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

Course Code	:	MCN201B4	**ADVANCES IN STORAGE AREA NETWORKS**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	***Elective B (Professional Elective)***	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Vinay Hegde and Dr. Chethana R Murthy				

UNIT - I	**9 Hrs**

Storage Fundamentals: Computer system architecture: Memory Bandwidth requirements, Memory hierarchy of a computer system Hard Disk Drive (HDD) :Disk geometry and Disk characteristics; Disk Access time and Disk erformance parameters. Solid State Device (SSD) :Flash Memory: NAND and NOR Organization, R/W performance of Flash memory. Array of Disks: Disk Reliability and different RAID Levels (0,1,2,3,4,5,6,1+0,0+1),RAID performance parameters, RAID Implementations Introduction to information storage: Information storage, Evolution of storage architecture, Data center infrastructure, Virtualization and Cloud Computing.

UNIT - II	**9 Hrs**

File Systems and I/O Methods: Unix file system as an example,Files and File descriptors, Virtual file system ,Local file system. Journaling Flash File System (JFFS) for SSDs: Wear level algorithm, Garbage collection. I/O Techniques: Polling, Interrupt, DMA and I/O Processors. Buses as data transporter: System Bus, I/O Bus, and PCI Bus protocol, SCSI Bus protocol and commands.
Network Attached Storage: Network Attached Storage (NAS) ,NAS architectures and objectives, NAS File Server. Network File System protocol (NFS),Remote procedure call (RPC),NFS operation, NFS vs. CIFS (Common Internet File System) NFS performance Issues, Inconsistency.

UNIT - III	**8 Hrs**

Storage Applications: Data Replication Technologies: Synchronous vs. Asynchronous, Application Layer, Logical Volume Manager based Replication, Hypervisor based replication, Array based replication, Asynchronous Replication: Snapshot and Journal based replication, Replication Topologies: Three site cascade, Three site multi-target, Three site triangle.
Storage Virtualization: SNIA shared storage model, Host based and Network based, Storage and Controller based virtualization, Capacity Optimization, Thin and Thick Provisioning, Compression, De-duplication, Storage Tiering

UNIT - IV	**8 Hrs**

Storage Area Networks (SANs) :Fibre Channel Protocol Stack, SAN vs. NAS, Protocol layers, Components, FC-SAN ports and connectivity, Fibre Channel SAN,
FC-SAN topologies, Hardware Components of FC-SAN,FC-SAN Configurations and Traffic Management, SAN Addressing ,Zoning and Multi-pathing, Trunking and LUN Masking. IP-SAN Solutions :iSCSI SAN, iFCP SAN,FCIP SAN,Storage Traffic over Ethernet (FCoE)

UNIT - V	**8 Hrs**

Backup and Recovery: Backup methods (Hot, Offline, LAN based, and SAN based) Backup types (Full, Incremental, Differential, Synthetic Application aware),Backup retention policies and Archiving, Network Data Management Protocol (NDMP) Capacity Management: Over provisioning, Trending, De-duplication and compression
Performance Management: Latency and Response time, Performance Metrics Storage performance factors, Storage and the Cloud, Cloud storage model Data Durability and Consistency Model.

Course Outcomes:	

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

CO1	:	Apply different storage architectures and key data center elements in classic, virtualized and cloud environments.
CO2	:	Identify and describe the different types of storage networking technologies such as FC SAN, NAS.
CO3	:	Analyze the issues and challenges pertaining to storage virtualization functions in typical data center environment.
CO4	:	Examine and Articulate business continuity solutions such as backup , replication and archive for managing fixed content.

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Go, change the world

Reference Books
1. Storage Networking-Real World Skills for the CompTIA Storage+ Certification and Beyond by Nigel Poulton, Publishers, SYBEX a Wiley brand, 2015: 2nd Edition, ISBN-13 : 978-8126557677
2. Storage Networks Explained – by Ulf Troppens, Wolfgang Muller-Freidt, Rainer Wolafka, IBM Storage Software Development, Germany. Publishers: Wiley brand, Second Edition, 2014 ISBN: 3-89864-135-X
3. Information storage and management- Somasundaram, Gnanasundaram, AlokShrivatsava, 2nd Edition, 2015, Wiley publishing ISBN 978-81-265-3750-1.
4. Storage Networks Explained – Ulf Troppens, Rainer Erkens and Wolfgang Muller, 2012, 2nd Edition, John Wiley & Sons, ISBN: 978-81-265-1832-6.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MIM431T	**RESEARCH METHODOLOGY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Common Course to all M.Tech Programs*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Rajeswara Rao K V S			

UNIT - I	8 Hrs

Research Problem: Problem Solving – General Problem Solving, Logical Approach, Soft System Approach, Creative Approach, Group Problem Solving Techniques for Idea Generation. Formulation of Research Problems – Approaches to Research Problem, Exploration for Problem Identification, Hypothesis Generation and Formulation of the problem.

UNIT - II	9 Hrs

Research Design: Experimental Design – Principles of Experiment, Laboratory Experiment, Experimental Design, Quasi Experimental Design, Action. Research, Validity and Reliability of Experiment and Quasi Experiments. Ex Post Facto Research – Exploratory Research, Historical Research, Descriptive Research, Field Studies, Survey Research, Qualitative Research Methods.

UNIT - III	8 Hrs

Research Design for Data Acquisition: Measurement Design – Primary types of Measurement scales, Validity and Reliability Measurement, Sample Design – Non-Probability Sampling, Probability Sampling. Data Collection Procedures – Sources of secondary data, Primary data collection methods, Validity and Reliability of data collection procedures.

UNIT - IV	9 Hrs

Data Analysis: Exploratory Data Analysis, Statistical Estimation, Hypothesis Testing, Parametric Tests, Non-Parametric Tests, Multiple Regression, Factor Analysis, Cluster Analysis

UNIT - V	8 Hrs

Research Proposal: Purpose, Types, Development of Proposal, Evaluation of Research Proposal.
Report Writing: Pre-writing consideration, Format of Reporting, Briefing, Best practices for Journal writing.

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

CO1	:	Recognize the principles and concepts of research types, data types and analysis procedures.
CO2	:	Apply appropriate method for data collection and analyze the data using statistical principles.
CO3	:	Express research output in a structured report as per the technical and ethical standards.
CO4	:	Develop a research design for the given engineering and management problem context.

Reference Books:

1. Krishnaswami, K.N., Sivakumar, A. I. and Mathirajan, M., Management Research Methodology, Integration of Principles, Methods and Techniques, 17th Impression, Pearson India Education Services Pvt. Ltd, 2018. ISBN: 978-81-7758-563-6

2. William M. K. Trochim, James P. Donnelly, The Research Methods Knowledge Base, 3rd Edition, Atomic Dog Publishing, 2006, ISBN: 978-1592602919

3. Kothari C.R., Research Methodology Methods and Techniques, 4th Edition, New Age International Publishers, 2019, ISBN: 978-93-86649-22-5.

4. Levin, R.I. and Rubin, D.S., Statistics for Management, 8th Edition, Pearson Education: New Delhi, 2017, ISBN-13- 978-8184957495.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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*		
SLNo	**Content**	**Marks**	**Q. No**	**Contents**		**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40				
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2		20
	Total Marks	**100**	3 & 4	Unit-2: Question 3 or 4		20
			5 & 6	Unit-3: Question 5 or 6		20
			7 & 8	Unit-4: Question 7 or 8		20
			9 & 10	Unit-5: Question 9 or 10		20
				Total Marks		**100**

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SEMESTER: II					
Course Code	:	MCN331I	**Network Programming**	CIE Marks	:	100
Credits L-T-P	:	3-0-1	*(Theory & Practice)*	SEE Marks	:	100
Hours	:	42L + 28P	*(Professional Core - 3)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Deepamala N and Dr. Praveena T			

UNIT - I	**9 Hrs**
The Transport Layer: **TCP, UDP, and SCTP** Introduction, The Big Picture, UserDatagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transmission Protocol (SCTP), TCP Connection Establishment and Termination, TIME_WAIT State, SCTP Association Establishment and Termination, Port Numbers, TCP Port Numbers and Concurrent Servers, Buffer Sizes and Limitations **Elementary Sockets** sockets Introduction, Socket Address Structures, Value-Result Arguments, Byte Ordering Functions, Byte Manipulation Functions, inet_aton, inet_addr, and inet_ntoa Functions, inet_pton and inet_ntop Functions, sock_ntop and Related Functions	

UNIT - II	**9 Hrs**
Elementary TCP Sockets Introduction, socket Function, connect Function, bind Function, listen Function, accept Function, fork and exec Functions, Concurrent Servers, close Function, getsockname and getpeername Functions **TCP Client/Server** Example Introduction, TCP Echo Server:main Function, TCP Echo Server: str_echo Function, TCP Echo Client: main Function, TCP Echo Client: str_cli Function, Normal Startup, Normal Termination	

UNIT - III	**8 Hrs**
Socket Options Introduction, getsockopt and setsockopt Functions, Checking if an Option Is Supported and Obtaining the Default, Socket States, Generic Socket Options, IPv4 Socket Options, ICMPv6 Socket Option, IPv6 Socket Options, TCP Socket Options **Elementary UDP Sockets** Introduction, recvfrom and sendto Functions, UDP Echo Server: main Function, UDP Echo Server: dg_echo Function, UDP Echo Client: main Function, UDP Echo Client: dg_cli Function, Lost Datagram	

UNIT - IV	**8 Hrs**
Name and Address Conversions Introduction, Domain Name System (DNS), gethostbyname Function, gethostbyaddr Function, getservbyname and getservbyport Functions, getaddrinfo Function, gai_strerror Function, freeaddrinfo Function, getaddrinfo Function: IPv6 **Daemon Processes and the inetd Superserver** Introduction, syslogd Daemon, syslog Function, daemon_init Function, inetd Daemon, daemon_inetd Function	

UNIT - V	**8 Hrs**
Advanced UDP Sockets Introduction, Receiving Flags, Destination IP Address, and Interface Index, Datagram Truncation, When to Use UDP Instead of TCP, Adding Reliability to a UDP Application, Binding Interface Addresses, Concurrent UDP Servers, IPv6 Packet Information, IPv6 Path MTU Control	

LABORATORY	**28 Hrs**

List of Experiments
PART - A: EXPERIMENTS
1. Implement client and server communication using sockets programming of IPv4 and observe the packets using wireshark.
2. Write a program to implement distance vector routing protocol for a simple topology of routers.
3. Write a program to implement error detection and Correction concept using Checksum and Hamming code.
4. Implement a simple multicast routing mechanism.
5. Implementation of concurrent and iterative echo server using both connection and connectionless socket system calls. 6. Implementation of remote command execution using socket system calls. 7. Write a program to encrypt and decrypt the data using RSA and Exchange the key securely using Diffie-Hellman Key exchange protocol.
8. Implement client and server communication using sockets programming of IPv6 and observe the packets using wireshark.
Note: The above experiments shall be conducted using C / C++ on Linux Operating System.
PART – B: SIMULATION
1. Setup an IEEE 802.3 network with a) hub b) switch c) Hierarchy of switch. Apply the FTP, Telnet applications between nodes. Vary the number of nodes. Vary the bandwidth queue size and observe the packet drop probability.
2. Setup a wireless sensor networks with atleast two device co-coordinators and nodes. Provide Constant Bit Rate (CBR), Variable Bit Rate (VBR) application between several nodes. Increase the number of co-coordinators and nodes in the same area and observe the performance at physical and MAC layers.
3. Setup an IEEE 802.11 network with atleast two access points. Apply the CBR, VBR applications between devices belonging to same access points and different access points. Provide roaming of any device. Vary the number of access points and devices. Find out the delay in MAC layer, packet drop probability.

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

CO1	:	Explore the network concepts and transport layer protocols
CO2	:	Analyse functionality and utilization of socket APIs
CO3	:	Design and demonstrate client/server programs on Unix platforms to create robust real-world sockets-based applications.
CO4	:	Apply socket programming and related technology to build applications.

Reference Books

1. UNIX Network Programming – The sockets networking API, W.Richard Stevens, Bill Fenner, Andrew M. Rudoff, Vol.I , 3rd edition, 2010, PHI. ISBN-13: 978-0131411555 ISBN-10: 9780131411555.
2. Internetworking with TCP/IP, Douglas E. Comer, David L. Stevens, Vol. III, 6th Edition, 2015, Paperback, Publisher: Pearson India, ISBN-10: 9332549877, ISBN-13: 978- 9332549876.
3. Learning Network Programming with Java, Richard M Reese, First Published: December 2015, Packet Publishing Ltd.,ISBN-13: 978-0123742551
4. IPv6 Essentials, Silvia Hagen, 3rd Edition, 2014 O'Reilly media. ISBN: 9781449319212

Scheme of Continuous Internal Evaluation (CIE): 10 + 30 + 30 + 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 average 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 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 (20) adding upto 30 marks.
Laboratory: Conduction of laboratory exercises, Lab report & observation & analysis (30 Marks), Lab Test (10 Marks) & Innovative Experiment/Concept Design & Implementation (10 Marks) adding up to 50 Marks. The final marks will be reduced to 30 Marks.

Scheme of Semester End Examination (SEE) for 100 marks: Each unit consists of TWO Questions of 16 Marks each. Answer FIVE full questions selecting one from each unit (from 1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.

Rubric for CIE & SEE for Integrated Theory courses with Laboratory					
RUBRIC of CIE			RUBRIC of SEE		
SL.No	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	10	Each unit consists of TWO questions of 16 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5). Question No. 11 is compulsory (Laboratory component) for 20 Marks.		
2	Tests – T1 & T2	30			
3	Experiential Learning – EL1 & EL2	30	1 & 2	Unit-1: Question 1 or 2	16
4	Laboratory	30	3 & 4	Unit-2: Question 3 or 4	16
	Total Marks	100	5 & 6	Unit-3: Question 5 or 6	16
			7 & 8	Unit-4: Question 7 or 8	16
NO SEE for Laboratory			9 & 10	Unit-5: Question 9 or 10	16
			11	Laboratory Component (Compulsory)	20
				Total Marks	100

SEMESTER: II					
Course Code	: MCN332T	**Advanced Wireless Technologies**	CIE Marks	:	100
Credits L-T-P	: 3- 0- 0		SEE Marks	:	100
Hours	: 42L	*(Professional Core - 4)*	SEE Durations	:	3 Hrs
Faculty Coordinator:	Dr. Vishalakshi Prabhu and Dr. H K Krishnappa				

UNIT - I	**9 Hrs**
Introduction to Wireless Communication Systems: Second generation (2G) cellular networks, Evolution of 2.5G wireless networks and standards, Third Generation (3G) Wireless Networks, Fourth Generation (4G) wireless networks, Evolution of LTE Technology, Fifth Generation (5G) Wireless Networks: Ten Pillars of 5G, 5G Architecture	
UNIT - II	**9 Hrs**
The Cellular Concept-System Design Fundamentals: Introduction, Frequency reuse, channel assignment strategies, handoff strategies – prioritizing handoffs, Practical Handoff considerations, Interference and system capacity, co-channel interference and system capacity, channel planning for wireless systems, adjacent channel interference, power control for reducing interference, Capacity of cellular systems (FDMA and TDMA), Capacity of cellular CDMA systems	
UNIT - III	**8 Hrs**
Mobile Radio Propagation and fading: Introduction to radio wave propagation, Free space propagation model, Three basic propagation mechanisms, Reflection, Diffraction- Fresnel Zone geometry, knife edge diffraction model, Scattering, Practical Link budget design- Log distance path loss model, log normal shadowing, Small scale multipath propagation- factors influencing small scale fading, Doppler shift, Types of small scale Fading-Fading effects due to multipath time delay spread and Doppler spread.	
UNIT - IV	**8 Hrs**
Small Cells for 5G Mobile Networks: What are Small Cells? Wi-Fi and Femtocells as Candidate Small-Cell Technologies, Wi-Fi and Femto Performance – Indoors vs Outdoors, Capacity Limits and Achievable Gains with Densification, Gains with Multi-Antenna Techniques, Gains with Small Cells, Mobile Data Demand, Approach and Methodology, Demand vs Capacity, Small-Cell Challenges	
UNIT - V	**8 Hrs**
Cognitive Radio for 5G Wireless Networks Introduction, Overview of Cognitive Radio Technology in 5G Wireless, Spectrum Optimization using Cognitive Radio, Relevant Spectrum Optimization Literature in 5G, Dynamic Spectrum Access, Spectrum Regulatory Policy, Marketing Policy and Model, Cognitive Radio and Carrier Aggregation, Energy-Efficient Cognitive Radio Technology, Key Requirements and Challenges for 5G Cognitive Terminals, 5G Devices as Cognitive Radio Terminals, 5G Cognitive Terminal Challenges White Spaces for 5G: TV White Space Technology, Standards, Approaches to White Space, White Space Spectrum Opportunities and Challenges, TV White Space Applications, Fixed Wireless Networking, Public Safety Applications, Mobile Broadband	

Course Outcomes:	
After going through this course the student will be able to:	
CO1	:	Describe the existing wireless networks, issues, challenges and opportunities
CO2	:	Analyse the range of signals and path loss models in real world cellular system scenarios
CO3	:	Assess different radio spectrum allocation mechanisms for device energy management
CO4	:	Design wireless network and frameworks for next generation applications

Reference Books
1. Theodore S Rappaport, Wireless Communications, Principles and Practice, Pearson Education Asia, 2nd edition, 2009, ISBN: 9780133755367
2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", 1st edition, May 2015, ISBN: 978-1-118-86752-5

3. Vijay Garg, "Wireless Communications and Networking", Morgan Kaufmann Publishers, Indian Reprint, 2009, ISBN: 978-81-312-1889-1

4. Yulei Wu , Sukhdeep Singh , Tarik Taleb ,Abhishek Roy, Harpreet S. Dhillon, Madhan Raj Kanagarathinam, Aloknath De (Editors), "6G Mobile Wireless Networks (Computer Communications and Networks)", 1st Edition, August 2021, Springer Nature Switzerland AG, ISBN-13: 978-3030727765

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MSE333C1	**Robotic Process Automation**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. G S Mamatha and Dr. B K Srinivas			

UNIT - I	**9 Hrs**

What is Robotic Process Automation? Scope and Techniques of automation: what should be automated? What can be automated? Techniques of automation Roboic Process Automation: What can RPA do? Benefits of RPA Components of RPA, RPA platforms. About UiPath. The future of automation. Record and Play: UiPath stack, Downloading and Installing UiPath Studio, Learning UiPath Studio, Task Recorder, Emptying trash in Gmail, Emptying Recycle Bin.

UNIT - II	**9 Hrs**

Sequence, Flowchart, and Control Flow: Sequencing the workflow, Activities, Control flow, various types of loops, and decision making, how to use a sequence, how to use a flowchart, step by step example using sequence and control flow. Data Manipulation: Variables and scope, Collections, Arguments-purpose and use, Data table usage with examples, Clipboard management, File operation with step-by-step example. CSV/Excel to data table and vice versa examples.

UNIT - III	**8 Hrs**

Taking control of the controls : Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls-mouse and keyboard activities, working with UiExplorer, Handling events, Revisit recorder, Screen scraping, When to use OCR, Types of OCR available, How to use OCR, Avoiding typical failure points. Tame that Application with Plugins and Extensions Terminal plugin: SAP automation, Java Plugin, Citrix automation, Mail plugin, PDF plugin, web integration, Excel and Word plugins, Credential management.

UNIT - IV	**8 Hrs**

Handling User Events and Assistant Bots: What are assistant bots? Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event. Exception Handling, Debugging, and Logging Exception handling: Common exceptions and ways to handle them, Logging and taking screenshots, Debugging techniques, Collecting crash dumps, Error reporting.

UNIT - V	**8 Hrs**

Managing and Maintaining the Code: Project Organization, Nesting workflows, Reusability of workflows, commenting techniques, State Machine, When to use Flowcharts, State Machines or sequences, Using config files and examples of a config file. Deploying and Maintaining the Bot: Publishing using publish utility, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots.

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

CO1	:	Apply the concept of Robotic Process Automation to automate various applications.
CO2	:	Analyse the usage of appropriate Robotic Process Automation technique for a given application.
CO3	:	Design and implement techniques of Robotic Process Automation.
CO4	:	Evaluate the code for deployment and maintenance.

Reference Books

1. Alok Mani Tripathi, Learning Robotic Process Automation, 1st Edition, Packpub.com, 2018, ISBN: 178847094X

2. Ed Freitas, Robotic Process Automation Succinctly, Succinctly EBook Series, 2020, ISBN: 978-1-64200-199-0

3. Nividous, Robotic Process Automation, www.nividous.com, 2018

4. Vaibhav Srivastava, Getting started with RPA using Automation Anywhere, BPB publishers, 2018, ISBN: 9789389898286

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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

SL.No	RUBRIC for CIE Content	Marks	Q. No	RUBRIC for SEE Contents	Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MCE333C2	**Embedded Systems**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Badarinath K and Prof. M S Srividya			

UNIT - I	**9 Hrs**
Introduction to Embedded Systems: Outline an embedded system, its components and applications, The role of embedded systems in the Internet of Things (IoT) and the context of ubiquitous computing, Identify the challenges of incorporating embedded devices into IoT systems , The benefits of microcontroller-based embedded systems , Iidentify important trade-offs of embedded systems including cost and performance Overview of ARM and Intel Processor and Controller families: ARM- ARM Processor families, Cortex A, Cortex R and Cortex M. Intel : Overview Of Intel Processors & features	

UNIT - II	**9 Hrs**
The Arm Cortex-M4 Processor Architecture: Key features of Arm architectures and processors, Features and layout of the Arm Cortex-M4 processor, Sstructure and purpose of specific registers in the Arm Cortex-M4 processor. **Introduction to Arm Cortex-**M4 Programming: Compare the C and Assembly programming languages, Program-generation flow, including compilation and program images, different data formats and how they are stored in memory, Mixed assembly and C programming. **Overview Of IO Interfaces & Peripheral Programming:** Digital Input and Output (IO), Analog Input and Output, Interrupts and Low Power Features, Timer and Pulse-width Modulation	

UNIT - III	**8 Hrs**
Serial Communications: Outline the concept of serial communication and its benefits, Comparison of synchronous and asynchronous serial communication, Popular Embedded System serial communication methods - UART, SPI, and I2C. **Real-Time Operating System:** Describe what an operating system is, its features, and types of operating systems, Outline features of a real-time operating system (RTOS), concurrency tools such as threads, mutex and semaphores	

UNIT - IV	**8 Hrs**
Introduction to System-on-Chip Design: Explain why the SoC concept developed, describe scaling and its effect on the cost of chip fabrication, Outline strategies to improve the productivity of IC design engineers, Define the meaning of SoC and list its basic components, Explain the advantages of SoC over system on boards, Explain the limitations of SoC design	

UNIT - V	**8 Hrs**
Intel FPGAs: Introduction to Intel FPGAs and Intel Quartus Prime Design Software- FPGA design and implementation. **Introduction to Timing Analysis** - Applying Timing Constraints-Timing Exceptions - False Paths and Multicycle Paths - Achieving timing closure. **Intel SoC FPGAs**: Introduction to Intel SoC FPGAs - IP design and Platform designer, Embedded System design using Cyclone V and ARM -SoC Design Flow Getting started with the NIOS V Processor,Software development using NIOS V Processor, Debugging the NIOS V Processor using the RISC Free IDE for Intel FPGAs	

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

CO1	:	Analyse and explore the impact of Embedded Systems and different processors and controller families.
CO2	:	Identify and build different Embedded Systems using ALP, embedded C programming using different sub systems like GPIO, Analog, Timers, PWM and Interrupts.
CO3	:	Apply the concepts of Embedded system serial protocols and RTOS in the embedded systems design
CO4	:	Development of required FPGAs, SOCs and identify the applications of them in the industry.

Reference Books
1. Embedded Systems Fundamentals on Arm Cortex-M based Microcontrollers: A Practical Approach by Alexander G. Dean, FRDM-KL25Z Edition, March 2017, ISBN - 978-1-911531-03-6

2 Embedded Systems- Architecture, Programming and Design, by Raj Kamal, McGraw Hill Education ,3rd Edition, ISBN-13 : 978-9332901490
3 System-on-Chip Design with Arm Cortex-M Processors ,Joseph Yiu, August 2019, ISBN – 978-1-911531-18-0
4. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison: https://community.arm.com/developer/ip-products/processors/b/processors-ip-blog/posts/white-paper-cortex-m-for-beginners-an-overview-of-the-arm-cortex-m-processor-family-and-comparison

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based Seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	: MCN333C3	**Advanced Algorithms**	CIE Marks	:	100
Credits L-T-P	: 3- 0 - 0		SEE Marks	:	100
Hours	: 42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:	Dr. Sandhya S and Dr. Praveena T				

UNIT - I	**9 Hrs**
Analysis techniques: Role of algorithms in computing, Analyzing algorithms, Growth of functions: Asymptotic notation, Standard notations and common functions, Substitution method for solving recurrences, Recursion tree method for solving recurrences, Master theorem. **Heapsort:** Heaps, Maintaining the heap property, Building a Heap, The Heap sort algorithm, priority queues.	

UNIT - II	**9 Hrs**
Advanced Design and Analysis Technique Matrix-chain multiplication, Longest common subsequence. An activity-selection problem, Elements of the greedy strategy **Amortized Analysis:** Aggregate analysis, The accounting method , The potential method	

UNIT - III	**8 Hrs**
Graph Algorithms Bellman-Ford Algorithm, Shortest paths in a DAG, Dijkstra algorithm, The Floyd-Warshall algorithm, Johnson's Algorithm for sparse graphs. **Maximum Flow:** Flow networks, Ford Fulkerson method and Maximum Bipartite Matching	

UNIT - IV	**8 Hrs**
Advanced Data structures Definition of B-trees, Basic operations on B-trees, Deleting a key from B-tree, Structure of Fibonacci heaps, Mergeable-heap operations, Decreasing a key and deleting a node, Disjoint-set operations, Linked-list representation of disjoint sets, Disjoint-set forests. **String Matching Algorithms:** Naïve algorithm, Rabin-Karp algorithm, String matching with finite automata, Knuth-Morris-Pratt algorithm	

UNIT - V	**8 Hrs**
Multithreaded Algorithms The basics of dynamic multithreading, Multithreaded matrix multiplication, Multithreaded merge sort, **Medians and order statistics**: minimum and maximum, selection in expected linear time, selection in worst case linear time, **Sorting in linear time:** counting sort, radix sort, bucket sort	

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

CO1	:	Explore the fundamentals in the area of algorithms by analysing various types of algorithms.
CO2	:	Analyse algorithms for time and space complexity for various applications
CO3	:	Apply appropriate mathematical techniques to construct robust algorithms.
CO4	:	Demonstrate the ability to critically analyse and apply suitable algorithm for any given problem

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms; Columbia University , 3rd Edition, 2009, ISBN: 978-0262033848

2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++ , Addison-Wesley, 3rd Edition, 2007, ISBN: 978-0132847377

3.Kozen DC, The design and analysis of algorithms , Springer Science & Business Media, 2012, ISBN: 978-03879768737

4.Kenneth A. Berman, Jerome L. Paul, Algorithms , Cengage Learning, 2002. ISBN: 978-8131505212

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents		Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40				
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2		20
	Total Marks	**100**	3 & 4	Unit-2: Question 3 or 4		20
			5 & 6	Unit-3: Question 5 or 6		20
			7 & 8	Unit-4: Question 7 or 8		20
			9 & 10	Unit-5: Question 9 or 10		20
					Total Marks	**100**

SEMESTER: II					
Course Code	:	MCN333C4	**Internet of Things and Edge Computing**	CIE Marks	:	100
Credits L-T-P	:	3- 0 - 0		SEE Marks	:	100
Hours	:	42L	*Elective C (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Sharvani G S and Prof. Prapulla S B			

UNIT - I	9 Hrs

Overview of IoT: Overview of Wireless Sensor Networks, Overview of Internet of Things, IoT Conceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT, M2M Communication. Design Principles: IoT/M2M Systems Layers and Design Standardization, Communication Technologies, Data Enrichment, Data Consolidation and Device Management at Gateway Examples of IoT, Ease of Designing and Affordability

UNIT - II	9 Hrs

Design Principles for Web Connectivity: Introduction, Web Communication Protocols: Constrained Applications Protocol (CoAP), Lightweight Machine-to-Machine Communication; Message Communication Protocols: Message Queue Telemetry Transport (MQTT)

UNIT - III	8 Hrs

Internet of Things Privacy, Security and Governance-Introduction, Overview of Activity Chain — Governance, Privacy and Security Issues, Contribution From FP7 Project, Security and Privacy Challenge in Data Aggregation for the IoT in Smart Cities-Security, Privacy and Trust in Iot-Data Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach

UNIT - IV	8 Hrs

Internet of Things (IoT) and New Computing Paradigms Fog and Edge Computing Completing the Cloud ,Advantages of FEC: SCALE , How FEC Achieves. These Advantages: SCANC 9,Hierarchy of Fog and Edge Computing , Business Models ,Addressing the Challenges in Federating Edge Resources and Networking Challenge.

UNIT - V	8 Hrs

The Management Challenge ,Integrating IoT + Fog + Cloud ,Management and Orchestration of Network Slices in 5G, Fog, Edge, and Clouds Introduction ,Background ,Network Slicing in 5G , Network Slicing in Software-Defined Clouds ,Network Slicing Management in Edge and Fog

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

CO1	:	Apply and Explore Internet of Things (IoT) with New Computing Paradigms like 5G, Fog, Edge, and Clouds
CO2	:	Analyze Prototyping and demonstrate resource management concepts in New Computing Paradigms
CO3	:	Implement optimal technology of Internet of Things and edge computing for different applications
CO4	:	Design Web Connectivity in IoT and Orchestration of Network Slices in 5G, Fog, Edge, and Cloud

Reference Books

1.Raj Kamal, "Internet of Things: Architecture and Design Principles". TMH Publications,1st Edition, 2017 ISBN: 9789352605224.

2. Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems, Dr. Ovidiu Vermesan, Dr. Peter Friess, River Publishers, 2013, ISBN: 978-87- 92982-73-5(Print) ISBN: 978-87-92982-96-4(E-Book)

3. Rajkumar Buyya , Satish Narayana Srirama," Fog and Edge Computing: Principles and Paradigms" ,Wiley series on parallel and distributed computing, 1st Edition, 2019 ISBN: 978-1-119-52498-4.

4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, 2014 VPT, ISBN: 978-0996025515.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

<div align="center">Rubric for CIE & SEE Theory courses</div>

\hfill *RUBRIC for CIE*			\hfill *RUBRIC for SEE*		
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

<table>
<tr><td colspan="5" align="center">SEMESTER: II</td></tr>
<tr><td>Course Code</td><td>:</td><td>MBT331G</td><td rowspan="3" align="center">BIOINSPIRED ENGINEERING</td><td>CIE Marks</td><td>:</td><td>100</td></tr>
</table>

Course Code	:	MBT331G	**BIOINSPIRED ENGINEERING**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hr
Faculty Coordinator:		Dr Nagashree Rao and Dr Ashwani Sharma				

UNIT - I	8 Hrs

Introduction to Bio-inspired Engineering: Macromolecules, Stem cells; types and applications. Synthetic Biology; Bottom-up' and 'top-down' engineering approaches. Synthetic/ artificial life. Biological Clock, Genetic Algorithms.

UNIT - II	9 Hrs

Principles of bioinspired materials: Biological and synthetic materials, Self-assembly, hierarchy and evolution. Biopolymers, Bio-steel, Bio-composites, multi-functional biological materials. Thermal Properties. Antireflection and photo-thermal biomaterials, Microfluidics in biology, Invasive and non-invasive thermal detection inspired by skin

UNIT - III	9 Hrs

Lessons from Nature:Bioinspired Materials and mechanism: Firefly-Bioluminescence, Cockleburs –Velcro, Lotus leaf - Self-cleaning materials, Gecko - Gecko tape, Whale fins - Turbine blades, Box Fish / Bone - Bionic car, Shark skin - Friction reducing swim suits, Kingfisher beak - Bullet train, Coral - Calera cement, Forest floor / Ecosystem functioning - Flooring tiles, Morpho butterfly- Structural color, Namib beetle- Water collecting, Termite mound passive cooling, Birds/Insects-flights/ aerodynamics, Mosquito inspired micro needle.

UNIT - IV	8 Hrs

Biomedical Inspiration-Concept and applications: Organ system- Circulatory- artificial blood, artificial heart, pacemaker. Respiratory- artificial lungs. Excretory- Artificial kidney and skin. Artificial Support and replacement of human organs: artificial liver and pancreas. Total joint replacements- artificial limbs. Visual prosthesis -artificial eye/ bionic eye.

UNIT - V	8 Hrs

Biomimetics: Inventions in nature for Human Innovation: Photosynthesis and Photovoltaic cells, Bionic/Artificial leaf. Bio-ink and 3D-Bioprinting. Cellular automata. Biosensors: Artificial tongue and nose. Biomimetic echolation. Insect foot adaptations for adhesion. Thermal insulation and storage materials. Bees and Honeycomb Structure. Artificial Intelligence, Neural Networking and bio-robotics.

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

CO1	:	Elucidate the concepts and phenomenon of natural processes
CO2	:	Apply the basic principles for design and development of bioinspired structures
CO3	:	Analyse and append the concept of bio-mimetics for diverse applications
CO4	:	Designing technical solutions by utilization of bio-inspiration modules.

Reference Books:

1. D. Floreano and C. Mattiussi, Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, 1st edition, MIT Press, 2008, ISBN: 9780262062718

2. Guang Yang, Lin Xiao, and Lallepak Lamboni. Bioinspired Materials Science and Engineering. 1st edition, John Wiley, 2018, ISBN: 978-1-119-3903362

3. M.A. Meyers and P.Y. Chen. Biological Materials, Bioinspired Materials, and Biomaterials, 1st edition, Cambridge University Press, 2014, ISBN 978-1-107-01045.

4. Tao Deng. Bioinspired Engineering of Thermal Materials, 1st edtion, Wiley-VCH Press, 2018. ISBN: 978-3-527-33834-4.

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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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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

SL.No	RUBRIC for CIE Content	Marks	Q. No	RUBRIC for SEE Contents	Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MBT332G	**HEALTH INFORMATICS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr A H Manjunatha Reddy			

UNIT - I	8 Hrs

Introduction, Healthcare data, information and knowledge: Data types, data conversion, clinical data warehouse, data analytics, challenges, role of informatics in analytics, future trends

UNIT - II	8 Hrs

Electronic health records: Introduction, scope for the e health records, challenges, examples, logical steps to selecting and implementing EHR

UNIT - III	8 Hrs

Data standards and medical coding: Introduction, medical content standards, termonology standards, transport standards, medical coding and reimbursement, future trends,

UNIT - IV	9 Hrs

Healthcare Enterprise: Overview of Health Informatics: Introduction, Key players in HI, organizations involved, barriers, programs, organizations and career, HI Resoruces

UNIT - V	9 Hrs

Health Information privacy and security: Introduction, basic security principles, authentication and identity management, data security in the cloud and client/server management

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

CO1	:	Understand the basic principles of Health informatics
CO2	:	Data capture to data transformation and to analysis
CO3	:	Creation of E health records, identify the challenges
CO4	:	Improvise the significant factors as per the spatio-temporal requirements

Reference Books:

1. Robert E. Hoyt Ann K. Yoshihashi, Health Informatics, Practical guide for Healthcare and Information Technology Professionals, 6th edition, Informatics Education, 2014, ISBN: 978-0-9887529-2-4

2. Kathryn J. Hannah Marion J. Ball, Health Informatics, Springer Series edition, Springer, 2005, ISBN: 1-85233-826-1

3. William R Hersh, Health Informatics, a Practical guide, 8th edition. 2022, ISBN 978-1-387-85475-2

4. Pentti Nieminen. Medical informatics and data analysis 1st edition, MDPI AG, 2021, ISBN-13 : 978-3036500980

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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**	
SLNo	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II				
Course Code	: MCS331G	**BUSINESS ANALYTICS**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Dr. Azra Nasreen and Dr. Badarinath K			

UNIT - I	9 Hrs

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling.

UNIT - II	9 Hrs

Trendiness and Regression Analysis Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT - III	8 Hrs

Organization Structures of Business analytics Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, Predictive Analytics, Predicative Modelling, Predictive analytics analysis.

UNIT - IV	8 Hrs

Forecasting Techniques Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

UNIT - V	8 Hrs

Decision Analysis Formulating Decision Problems, Decision Strategies with and without Outcome, Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

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

CO1	:	Apply the concepts and methods of business analytics to solve business problems
CO2	:	Analyse, model and solve decision problems in different settings
CO3	:	Interpret results/solutions and identify appropriate courses of action for a given business scenario
CO4	:	Demonstrate skills like investigation, effective communication, working in team/Individual and following ethical practices by implementing solutions to decision making problems

Reference Books:

1. Business analytics Principles, Concepts, and Applications FT Press Analytics, Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, 1st Edition, 2014, ISBN-13: 978-0133989403, ISBN-10: 0133989402

2. The Value of Business Analytics: Identifying the Path to Profitability, Evan Stubs , John Wiley & Sons, |DOI:10.1002/9781118983881,1st Edition 2014, ISBN:978111898388

3. Business Analytics, James Evans, Pearsons Education 2nd Edition, ISBN-13: 978-0321997821 ISBN-10: 0321997824

4. Predictive Business Analytics Forward Looking Capabilities to Improve Business, Gary Cokins and Lawrence Maisel, Wiley; 1st Edition, 2013, ISBN: 978-1-118-17556-9 .

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MCV331G	**INDUSTRIAL AND OCCUPATIONAL HEALTH AND SAFETY**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr.V.AnanthaRam			

UNIT - I	08Hrs
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods.	

UNIT - II	09Hrs
Occupational health and safety: Introduction, Health, Occupational health: definition, Interaction between work and health, Health hazards, workplace, economy and sustainable development, Work as a factor in health promotion. Health protection and promotion Activities in the workplace: National governments, Management, Workers, Workers' representatives and unions, Communities, Occupational health professionals. Potential health hazards: Air contaminants, Chemical hazards, Biological hazards, Physical hazards, Ergonomic hazards, Psychosocial factors, Evaluation of health hazards: Exposure measurement techniques, Interpretation of findings recommended exposure limits. Controlling hazards: Engineering controls, Work practice controls, Administrative controls. Occupational diseases: Definition, Characteristics of occupational diseases, Prevention of occupational diseases.	

UNIT - III	09Hrs
Hazardous Materials characteristics and effects on health: Introduction, Chemical Agents, Organic Liquids, Gases, Metals and Metallic Compounds, Particulates and Fibers, Alkalies and Oxidizers, General Manufacturing Materials, Chemical Substitutes, Allergens, Carcinogens, Mutagens, Reproductive Hazards, Sensitizers and Teratogens, Recommended Chemical Exposure Limits. Physical Agents, Noise and Vibration, Temperature and Pressure, Carcinogenicity, Mutagenicity and Teratogenicity. Ergonomic Stresses: Stress-Related Health Incidents, Eyestrain, Repetitive Motion, Lower Back Pain, Video Display Terminals.	

UNIT - IV	08 Hrs
Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.	

UNIT - V	08 Hrs
Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, over hauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.	

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

CO1	:	Explain the Industrial and Occupational health and safety and its importance.
CO2	:	Demonstrate the exposure of different materials, occupational environment to which the employee can expose in the industries.
CO3	:	Characterize the different type materials, with respect to safety and health hazards of it.
CO4	:	Analyze the different processes with regards to safety and health and the maintenance required in the industries to avoid accidents.

Reference Books:

1.Maintenance Engineering Handbook, Higgins & Morrow, SBN 10: 0070432015 / ISBN 13: 9780070432017, Published by McGraw-Hill Education. Da Information Services.
2. H. P. Garg, Maintenance Engineering Principles, Practices & Management, 2009,S. Chand and Company, New Delhi, ISBN:9788121926447
3.Fundamental Principles of Occupational Health and Safety, Benjamin O. ALLI, Second edition,2008 International Labour Office – Geneva: ILO, ISBN 978-92-2-120454-1
4.Foundation Engineering Handbook, 2008, Winterkorn, Hans, Chapman & Hall London. ISBN:8788111925428.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

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Rubric for CIE & SEE Theory courses

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	RUBRIC for CIE			*RUBRIC for SEE*	
Sl.No	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II				
Course Code	: MCV332G	**INTELLIGENT TRANSPORTATION SYSTEMS**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Dr.Sunil S			

UNIT - I	8 Hrs

Introduction: –Historical Background, Definition, Future prospectus, ITS training and educational needs.
Fundamentals of Traffic Flow and Control- Traffic flow elements, Traffic flow models, Shock waves in Traffic streams, Traffic signalization and control principles, Ramp metering, Traffic simulation

UNIT - II	9 Hrs

ITS User services-User services bundles, Travel and Traffic management, Public Transportation Operations, Electronic Payment, Commercial Vehicles Operations, Emergency Management, Advanced Vehicle Control and safety systems, Information Management, Maintenance and construction Management. ITS Architecture-Regional and Project ITS Architecture, Need of ITS architecture, concept of Operations, National ITS Architecture, Architecture development tool

UNIT - III	9 Hrs

Technology Building Blocks for ITS-Introduction, Data acquisition, Communication Tools, Data Analysis, and Traveller Information. Various detection, identification and collection methods for ITS. ITS Applications and their benefits-Freeway and incident management systems, Advanced arterial traffic control systems, Advanced Public Transportation Systems, Multimodal Traveller Information systems

UNIT - IV	8 Hrs

ITS Planning-Transportation planning and ITS, Planning and the National ITS Architecture, Planning for ITS, Integrating ITS into Transportation Planning, relevant case studies. ITS Standards-Standard development process, National ITS architecture and standards, ITS standards application areas, National Transportation Communications for ITS Protocol, Standards testing

UNIT - V	8 Hrs

ITS Evaluation – Project selection at the planning level, Deployment Tracking, Impact Assessment, Benefits by ITS components, Evaluation Guidelines, Challenges and Opportunities. ITS for Law Enforcement: Introduction, Enhance and support the enforcement traffic rules and regulations, ITS Funding options and ITS case studies

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

CO1	:	Identify and apply ITS applications at different levels
CO2	:	Illustrate ITS architecture for planning process
CO3	:	Examine the significance of ITS for various levels
CO4	:	Compose the importance of ITS in implimentions

Reference Books:

1. Pradip Kumar Sarkar and Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning Private Limited, Delhi,2018, ISBN-9789387472068

2. Choudury M A and Sadek A, "Fundamentals of Intelligent Transportation Systems Planning" Artech House publishers (31 March 2003); ISBN-10: 1580531601

3. Bob Williams, "Intelligent transportation systems standards", Artech House, London, 2008. ISBN-13: 978-1-59693-291-3

4. Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, Ignacio Julio García Zuazola "Intelligent Transport Systems: Technologies and Applications" Wiley Publishing ©2015, ISBN:1118894782 9781118894781

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II				
Course Code	: MEC331G	**ELECTRONIC SYSTEM DESIGN**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Prof. Ravishankar Holla			

UNIT - I	9 Hrs

Design Process & its Fundamentals: Life Cycle of Electronic Products, Design and Development Process, Guidance for Product Planning, Design and Development, Technical Drawings, Circuit Diagrams, Computer-Aided Design (CAD)

UNIT - II	9 Hrs

System Architecture and Protection Requirements: Introduction - Terminology, Functions and Structures, Systems Design Architecture, Electronic System Levels, System Protection
Experiential Learning: (4 quizzes on the below mentioned topics other than CIE) Reliability Analysis: Introduction, Calculation Principles, Exponential Distribution, Failure of Electronic, Components, Failure of Electronic Systems, Reliability Analysis of Electronic Systems, Recommendations for Improving Reliability of Electronic Systems

UNIT - III	8 Hrs

Thermal Management and Cooling: Introduction - Terminology, Temperatures and Power Dissipation, Calculation Principles, Heat Transfer, Methods to Increase Heat Transfer, Application Examples in Electronic Systems, Recommendations for Thermal Management of Electronic Systems, Cooling systems, liquid, air and non cooling systems.

UNIT - IV	8 Hrs

Electromagnetic Compatibility (EMC):
Introduction, Coupling Between System Components, Grounding Electronic Systems, Shielding from Fields, Electrostatic Discharge (ESD), Recommendations for EMC-compliant Systems Design

UNIT - V	8 Hrs

Recycling Requirements and Design for Environmental Compliance: Introduction - Motivation and the Circular Economy, Manufacture, Use, and Disposal of Electronic Systems in the Circular Economy, Product Recycling in the Disposal Process, Material Recycling in the Disposal Process, Design and Development for Disassembly, Material Suitability in Design and Development, Recommendations for Environmentally Compliant Systems

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

CO1	:	Realize the fundamentals of Design, Architecture, thermal management, EMC and Recycling requirements of Electronic System Design
CO2	:	Analyze the various application wise design requirements in Electronic systems along with the related concepts of implementations, standards and Compliances.
CO3	:	Use modern open source tools to realize the various concepts of Electronic system design
CO4	:	Engage in self-study through assignments, simulations, case studies and projects

Reference Books:

1. Fundamentals of Electronic Systems Design, Jens Lienig, Hans Brümmer 2017, Springer International Publishing, ISBN 978-3-319-55839-4, DOI:10.1007/978-3-319-55840-0

2. "Embedded System Design", Marwedel, Peter, Springer Nature, 10.1007/978-3-030-60910-8

3. "Electromagnetic Compatibility Engineering", Henry W. Ott, WILEY Publication, ISBN: 978-0-470-18930-6

4. "Handbook of Electronic Systems Design" by Charles A. Harper, McGraw-Hill Inc.,US , 0070266832, 978-0070266834

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**		**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).			
2	Tests – T1 & T2	40				
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2		20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4		20
			5 & 6	Unit–3: Question 5 or 6		20
			7 & 8	Unit–4: Question 7 or 8		20
			9 & 10	Unit–5: Question 9 or 10		20
					Total Marks	100

SEMESTER: II					
Course Code	: MEC332G	**EVOLUTION OF WIRELESS TECHNOLOGIES**		CIE Marks	: 100
Credits L-T-P	: 3-0-0			SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*		SEE Durations	: 3 Hrs
Faculty Coordinator: Dr. Mahesh A					

UNIT - I	9 Hrs
Introduction to cellular systems: Overview of Cellular Systems and evolution 2G/3G/4G/5G, Cellular Concepts – Frequency reuse, Co channel and Adjacent channel Interference, C/I, Handoff, Blocking, Erlang Capacity, Bluetooth, WiFi, WWAN and PAN.	

UNIT - II	9 Hrs
Fundamentals of wireless communication: Wireless Channel, Wireless propagation, Link budget, Free-space path loss, Noise figure of receiver, Multipath fading, Shadowing, Fading margin, Shadowing margin, Wireless Channel Capacity, OFDM and LTE, Large Scale Propagation effects and Channel Models	

UNIT - III	8 Hrs
Fundamentals of 5G architecture: Difference between 4G and 5G, 5G Architecture, Planning of 5G Network, Quality of Service, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States	

UNIT - IV	8 Hrs
mmWave and Visible Light Communications: Back ground and concept of mmWave Communications, Frequency bands, propagation characteristics, channel models, applications and challenges in 5G	

UNIT - V	8 Hrs
Future Generations: Future Generations(where is the 6G?), Health Considerations, Identifiers, Interfaces, ,Key Derivation, Location Based Services, Massive Internet of Things, Measurements, Network Functions Virtualization, Network Slicing, Open Source, , User Equipment, Vehicle-to-Vehicle communications (V2V),Virtual Reality (VR/AR/XR). Case study- Bharath Stack	

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

CO1	:	Demonstrate their understanding on functioning of wireless communication system and evolution of different wireless communication systems and standards
CO2	:	Compare different technologies used for wireless communication systems.
CO3	:	Demonstrate an ability explain recent techniques for Wireless Communication systems
CO4	:	Update the latest trends in wireless communications

Reference Books:

1. Theodore S. Rappaport, "Wireless Communications: Principles and Practice", Pearson, 2nd Edition.
2. Aditya K Jagannatham, "Principles of Modern Wireless Communications", McGraw Hill, 2017
3. Robin Chataut, Robert Akl, "Massive MIMO Systems for 5G and beyond Networks—Overview, Recent Trends, Challenges, and Future Research Direction" Sensors, May 2020
4. A. N. Uwaechia and N. M. Mahyuddin, A Comprehensive Survey on Millimeter Wave, Communications for Fifth-Generation Wireless Networks: Feasibility and Challenges, in IEEE, Access, vol. 8, pp. 62367-62414, 2020

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MET331G	**TRACKING AND NAVIGATION SYSTEMS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Shambulinga .M, Dr. B. Roja Reddy			

UNIT - I	**9 Hrs**
An Introduction to Radar: Basic Radar, The simple form of the Radar Equation, Radar Block Diagram, Radar Frequencies, Application of radar, Types of Radars. Detection of signals in Noise, Receiver Noise and the Signal-to Noise Ratio, Probability of Detection and False alarm, Introduction to Doppler, MTI, UWB Radars	
UNIT - II	**8 Hrs**
Terrestrial Network based positioning and navigation: General Issues of wireless positions location, Fundamentals, positioning in cellular networks, positioning in WLANs, Positioning in Wireless sensor networks.	
UNIT - III	**8 Hrs**
Satellite-based navigation systems: Global Navigation satellite systems (GNSS), GNSS receivers.	
UNIT - IV	**9 Hrs**
LiDAR: Introduction to LiDAR, context and conceptual discussion of LiDAR, Types of LiDARS, LiDARS Detection modes, Flash LiDAR versus Scanning LiDAR, Monostatic versus Bistatic LiDAR, Major Devices in a LiDAR, LiDAR remote sensing, Basic components and physical principles of LiDAR, LiDAR accuracy and data formats.	
UNIT - V	**8 Hrs**
SONAR: Underwater acoustics, applications, comparison with radar, submarine detection and warfare, overcoming the effects of the ocean, sonar and information processing.Transmission of the acoustic signal: Introduction, detection contrast and detection index, transmission equation, equation of passive and active sonar.	

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

CO1	:	Understand the concepts of Radar, LiDAR, Sonar, terrestrial and satellite based navigation system
CO2	:	Apply the concepts of radars, LiDAR, Sonar, cellular networks, WLAN, sensor networks and satellites in determining the user position and navigation.
CO3	:	Analyze the different parameters of satellite and terrestrial networks for navigation systems.
CO4	:	Evaluate the Radar, LiDAR, Sonar systems and satellite and terrestrial network based navigation and tracking systems

Reference Books:

1. M. L Skolnik,Introduction to RADAR Systems,3rd edition, 2017,TATA Mcgraw-Hill, ISBN: 978-0070445338

2. Mark A Richards, James A Scheer, William A Holam,Principles of Modern Radar Basic Principles, 2010, 1st edition,SciTech Publishing Inc, ISBN:978-1891121524 .

3. Davide dardari, Emanuela Falletti, Marco Luise, Satellite and Terrestrial Radio Positioning techniques- A signal processing perspective, 1st Edition, 2012, Elsevier Academic Press, ISBN: 978-0-12-382084-6.

4. Paul McManamon,LiDAR Technologies and Systems, SPIE press, 2019.

5. Pinliang Dong and Qi Chen,LiDAR Remote Sensing and Applications, CRC Press, 2018, ISBN: 978-1-4822-4301-7

6. Jean-Paul Marage, Yvon Mori, Sonar and Underwater Acoustics, Wiley, 2013, ISBN: 9781118600658

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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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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					
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Sl.No	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
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3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II				
Course Code	: MIM331G	**PROJECT MANAGEMENT**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Dr. Vikram N Bahadurdesai			

UNIT - I	8 Hrs

Introduction: Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS), Introduction to Agile Methodology.

UNIT - II	8 Hrs

Capital Budgeting: Capital Investments: Importance and Difficulties, phases of capital budgeting, levels of decision making, facets of project analysis, feasibility study – a schematic diagram, objectives of capital budgeting

UNIT - III	9 Hrs

Project Costing: Cost of Project, Means of Finance, Cost of Production, Working Capital Requirement and its Financing, Profitability Projections, Projected Cash Flow Statement, Projected Balance Sheet, Multi-year Projections, Financial Modeling, Social Cost Benefit Analysis

UNIT - IV	8 Hrs

Tools & Techniques of Project Management: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Critical Path Method (CPM), Computerized project management

UNIT - V	9 Hrs

Project Management and Certification: An introduction to SEI, CMMI and project management institute USA – importance of the same for the industry and practitioners. PMBOK 6 - Introduction to Agile Methodology, hemes / Epics / Stories, Implementing Agile.
Domain Specific Case Studies on Project Management: Case studies covering project planning, scheduling, use of tools & techniques, performance measurement.

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

CO1	:	Explain project planning activities that accurately forecast project costs, timelines, and quality.
CO2	:	Evaluate the budget and cost analysis of project feasibility.
CO3	:	Analyze the concepts, tools and techniques for managing projects.
CO4	:	Illustrate project management practices to meet the needs of Domain specific stakeholders from multiple sectors of the economy (i.e. consulting, government, arts, media, and charity organizations).

Reference Books:

1. Prasanna Chandra, Project Planning Analysis Selection Financing Implementation & Review, Tata McGraw Hill Publication, 8th Edition, 2010, ISBN 0-07-007793-2.

2. Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Edition, 2013, ISBN: 978-1-935589-67-9

3. Harold Kerzner, Project Management A System approach to Planning Scheduling & Controlling, John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.

4. Rory Burke, Project Management – Planning and Controlling Techniques, John Wiley & Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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

SL.No	Content	Marks	Q. No	Contents	Marks
	RUBRIC for CIE			**RUBRIC for SEE**	
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II				
Course Code	: MIS331G	**DATABASE AND INFORMATION SYSTEMS**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Prof.Smitha G R			

UNIT - I	**8 Hrs**
Advanced Database Models, Systems, and Applications : Enhanced Data Models: Introduction to Active, Temporal, Spatial, Multimedia, and Deductive Databases . Distributed Database Concepts : Distributed Database Concepts, Data Fragmentation, Replication, and Allocation Techniques for Distributed Database Design, Overview of Concurrency Control and Recovery in Distributed Databases	

UNIT - II	**8 Hrs**
Introduction to Information Retrieval and Web Search : Information Retrieval (IR) Concepts Retrieval Models, Types of Queries in IR Systems , Text Preprocessing , Inverted Indexing, Evaluation Measures of Search Relevance ,Web Search and Analysis, Trends in Information Retrieval .	

UNIT - III	**8 Hrs**
Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues, Ethical and Social issues in Information Systems: Understanding ethical and Social issues related to Information Systems, Ethics in an information society, The moral dimensions of information society. A Case study on business planning.	

UNIT - IV	**9 Hrs**
Achieving Operational Excellence and Customer Intimacy: Enterprise systems, Supply chain management(SCM) systems, Customer relationship management(CRM) systems, Enterprise application. E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, The mobile digital platform and mobile E-commerce, Building and E-commerce web site. A Case study on ERP.	

UNIT - V	**9 Hrs**
Managing Knowledge: The knowledge management landscape, Enterprise-wide knowledge management system, Knowledge work systems, Intelligent techniques. Enhancing Decision Making: Decision making and information systems, Business intelligence in the enterprise. Business intelligence constituencies. Building Information Systems: Systems as planned organizational change, Overview of systems development.	

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

CO1	:	Understand the different models for Infromation Retrieval.
CO2	:	Appricieate the technology of Information Retrieval and Web Search
CO3	:	To understand the basic principles and working of information technology.
CO4	:	Describe the role of information technology and information systems in business.

Reference Books:

1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.

2. Fundamentals of Database Systems, Ramez Elmasri, Shamkant B. Navathe, 7th Edition, 2016, Published by Pearson, Copyright © , ISBN-10: 0133970779

3. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN: 978-0072823110.

4. Database Management Systems, Raghu Ramakrishnan and Johannes Gehrke, 3rd Edition, 2003, McGraw-Hill, ISBN: 9780071231510

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.
Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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

SL.No	Content (RUBRIC for CIE)	Marks
1	Quizzes – Q1 & Q2	20
2	Tests – T1 & T2	40
3	Experiential Learning – EL1 & EL2	40
	Total Marks	**100**

Q. No	Contents (RUBRIC for SEE)	Marks
	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
1 & 2	Unit-1: Question 1 or 2	20
3 & 4	Unit-2: Question 3 or 4	20
5 & 6	Unit-3: Question 5 or 6	20
7 & 8	Unit-4: Question 7 or 8	20
9 & 10	Unit-5: Question 9 or 10	20
	Total Marks	**100**

SEMESTER: II				
Course Code	:	MIS332G	**MANAGEMENT INFORMATION SYSTEMS**	CIE Marks	:	100

SEMESTER: II
Course Code	: MIS332G		**MANAGEMENT INFORMATION SYSTEMS**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L		*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
	Faculty Coordinator:		Prof. Vanishree K
colspan="5" align="center"	**UNIT - I**	**8 Hrs**
Overview: Introduction: Professional Software Development, Software Engineering Ethics, Case studies. Software Processes: Models, Process activities, Coping with Change, Process improvement. The Rational Unified Process. Computer Aided Software Engineering. Agile Software Development: Introduction to agile methods, Agile development techniques, Agile project management and scaling agile methods. Information Systems in Global Business Today: The role of information systems in business today, Perspectives on information systems, Contemporary approaches to information systems
	**UNIT - II**	**9 Hrs**
Requirements Engineering and System Modeling: Software Requirements: Functional and Non-functional requirements. Requirements Elicitation, Specification, Validation and Change. System Modeling: Context models, Interaction models, Structural models, Behavioural models, Model driven architecture. Information Systems, Organizations and Strategy: Organizations and information systems, How information systems impact organization and business firms, Using information systems to gain competitive advantage, management issues
	**UNIT - III**	**9 Hrs**
Development and Testing: Design and implementation: Object oriented design using UML, Design patterns, Implementation issues, Open-source development. Software Testing: Development testing, Test-driven development, Release testing, User testing. Securing Information Systems: System vulnerability and abuse, Business value of security and control, Establishing framework for security and control, Technology and tools for protecting information resources. A case study on cybercrime.
colspan="5" align="center"	**UNIT - IV**	**8 Hrs**
Advanced Software Engineering: Dependable systems: Dependability properties, Sociotechnical systems, dependable processes, formal methods and dependability, A15 Availability and reliability, reliability requirements, Reliability measurements E-commerce: Digital Markets Digital Goods: E-commerce and the internet, E-commerce-business and technology, A Case study on ERP.
	**UNIT - V**	**8 Hrs**
Software Management: Project Management: Risk Management, Managing People, Teamwork, Project Planning: Software Pricing, Plan driven development, Project Scheduling, Agile planning, Estimation Techniques, COCOMO cost modeling. Building Information Systems: Systems as planned organizational change, Overview of systems development.
Course Outcomes: **After going through this course the student will be able to:**
	CO1 :		Understand and apply the fundamental concepts of software engineering for information systems.
	CO2 :		Develop the knowledge about software engineering for management of information systems.
	CO3 :		Interpret and recommend the use information technology to solve business problems.
	CO4 :		Apply a framework and process for aligning organization's IT objectives with business strategy.
Reference Books:
1. Kenneth C. Laudon and Jane P. Laudon: Management Information System, Managing the Digital Firm, Pearson Education, 14th Global edition, 2016, ISBN:9781292094007.
2. Ian Sommerville,— Software Engineering, 9th Edition, Pearson Education, 2013, ISBN: 9788131762165
3. W.S. Jawadekar: Management Information Systems, Tata McGraw Hill, 2006, ISBN: 9780070616349.
4. James A. O' Brien, George M. Marakas: Management Information Systems, Global McGraw Hill, 10th Edition, 2011, ISBN: 978-0072823110

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MMA331G	**STATISTICAL AND OPTIMIZATION METHODS**	CIE Marks	:	100
Credits L-T-P	:	3-0-0		SEE Marks	:	100
Hours	:	42L	*Elective D (Global Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. PRAKASH R			

UNIT - I	**9 Hrs**

Random Vectors:
Probability models of N random variables, Vector notation, Marginal probability functions, Independence of random variables and random vectors, Functions of random vectors, Expected value vector and Correlation matrix, Gaussian random vectors, Expected values of sums, Probability density function of the sum of two random variables, Moment Generating Functions (MGF), MGF of the sum of independent random variables, Characteristic function and Probability generating function.

UNIT - II	**8 Hrs**

Estimation: Point estimation, Estimator and estimate, Criteria for good estimates - unbiasedness, consistency, efficiency and sufficiency, Variance of a point estimator, Methods of point estimation - Method of moments and Method of maximum likelihood, Bayesian estimation of parameters.

UNIT - III	**9 Hrs**

Inferential Statistics: Principles of Statistical Inference, Formulation of the problems with examples. Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors: level of significance, Rejection regions and power, Standard Normal null distribution (Z-test), Z-tests for means and proportions, Duality: two-sided tests and two-sided confidence intervals, P-value, Inference about variances, Special tests of significance for large and small samples (F, Chi – square, Z, t – test).

UNIT - IV	**8 Hrs**

Fuzzy Optimization:
Basic concepts of fuzzy sets - Operations on fuzzy sets, Fuzzy relation equations, Fuzzy logic control, Fuzzification, Defuzzificatiuon, Knowledge base, Decision making logic, Membership functions, Rule base.
Artificial Neural Networks: Introduction - Neuron model, Multilayer perceptions - Back propagation algorithm and its variants, Loss functions in artificial neural networks, Stochastic gradient descent method.

UNIT - V	**8 Hrs**

Machine Learning Algorithms:
Data mining, Hierarchy Clustering, k-Means Clustering, Distance Metric, Data mining for Big data, Characteristics of Big data, Statistical nature of Big data, Support Vector Machines, Statistical Learning Theory, Linear Support Vector Machine, Kernel functions and Nonlinear Support Vector Machines.

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

CO1	:	Illustrate the fundamental concepts of statistics, random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms.
CO2	:	Derive the solution by applying the acquired knowledge of random variables, estimation, inferential statistics, fuzzy optimization and machine learning algorithms to the problems of engineering applications.
CO3	:	Evaluate the solution of the problems using appropriate statistical and probability techniques to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of statistics, probability distributions and estimation, tests of hypothesis and optimization gained to engage in life – long learning.

Reference Books:

1. Roy D. Yates, David J. Goodman, "Probability and Stochastic Processes", 3rd Edition, An Indian Adaptation, Wiley, 2021, ISBN: 9789354243455.

2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 7th Edition, John Wiley & Sons, 2019, ISBN: 9781119570615.

3. Trevor Hastie Robert Tibshirani Jerome Friedman, "The Elements of Statistical Learning - Data Mining, Inference, and Prediction", 2nd Edition, Springer, 2009 (Reprint 2017), ISBN-10: 0387848576, ISBN-13: 9780387848570.

4. Michael Baron, "Probability and Statistics for Computer Scientists", 2nd Edition, CRC Press, 2014, ISBN- 13: 978-1-4822-1410-9.

5. Shai Shalev-Shwartz and Shai Ben-David "Understanding Machine Learning: From Theory to Algorithms", 1st Edition, Cambridge University Press, 2014, ISBN: 978-1-107-05713-5.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit–1: Question 1 or 2	20
	Total Marks	**100**	3 & 4	Unit–2: Question 3 or 4	20
			5 & 6	Unit–3: Question 5 or 6	20
			7 & 8	Unit–4: Question 7 or 8	20
			9 & 10	Unit–5: Question 9 or 10	20
				Total Marks	**100**

SEMESTER: II				
Course Code	: MME331G	**INDUSTRY 4.0**	CIE Marks	: 100
Credits L-T-P	: 3-0-0		SEE Marks	: 100
Hours	: 42L	*Elective D (Global Elective)*	SEE Durations	: 3 Hrs
Faculty Coordinator:	Dr. Gopalakrishna H D			

UNIT - I	**8 Hrs**

Fundamentals of Industry 4.0

Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS) Industry 4.0 across the Sectors Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics 4.0 (Implications), Fundamentals of Industry 4.0, Introduction, Industry 4.0, RAMI 4.0 (Reference Architecture Model Industry 4.0), Servitization, Product Service-System (PSS)

Industry 4.0 across the Sectors

Introduction, Transportation 4.0: Multimodal Transportation Systems, Rail 4.0, Digital Transformation of Railways, Logistics 4.0 (Implications)

UNIT - II	**8 Hrs**

The Concept of the IIoT: Modern Communication Protocols, Wireless Communication Technologies, Proximity Network Communication Protocols, TCP/IP, API: A Technical Perspective, Middleware Architecture.

UNIT - III	**8 Hrs**

Data Analytics in Manufacturing: Introduction, Power Consumption in manufacturing, Anomaly Detection in Air Conditioning, Smart Remote Machinery Maintenance Systems with Komatsu, Quality Prediction in Steel Manufacturing. Internet of Things and New Value Proposition, Introduction, Internet of Things Examples, IoTs Value Creation Barriers: Standards, Security and Privacy Concerns.

Advances in Robotics in the Era of Industry 4.0, Introduction, Recent Technological Components of Robots, Advanced Sensor Technologies, Artificial Intelligence, Internet of Robotic Things, Cloud Robotics.

UNIT - IV	**9 Hrs**

Additive Manufacturing Technologies and Applications: Introduction, Additive Manufacturing (AM) Technologies, Stereo lithography, 3DP, Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing, Laser Engineered Net Shaping, Advantages of Additive Manufacturing, Disadvantages of Additive Manufacturing.

Advances in Virtual Factory Research and Applications, The State of Art, The Virtual Factory Software , Limitations of the Commercial Software.

UNIT - V	**9 Hrs**

Augmented Reality: Definitions and application of AR, VR, MR, Limitations of AR, VR, Hardware devices and Software systems, Technical issues and challenges in AR, Industrial applications, IoT and the Need for Data Rationalization

Internet of Things (IoT), Internet of Things Vision, Internet of Things (IoT) Frameworks, Architecture of Internet of Things (IoT), Visualizing the Internet of Things (IoT), Essential Technologies of the Internet of Things (IoT), Key Technologies Involved in Internet of Things, Enablers of IoT, Collaborative Operations , Training.

Smart Factories: Introduction, Smart factories in action, Importance, Real world smart factories, The way forward.

A Roadmap: Digital Transformation, Transforming Operational Processes, Business Models, Increase Operational Efficiency, Develop New Business Models.

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

CO1	:	Understand the opportunities, challenges brought about by Industry 4.0 for benefits of organizations and individuals
CO2	:	Analyze the effectiveness of Smart Factories, Smart cities, Smart products and Smart services
CO3	:	Apply the Industrial 4.0 concepts in a manufacturing plant to improve productivity and profits
CO4	:	Evaluate the effectiveness of Cloud Computing in a networked economy

Reference Books:

1. Alasdair Gilchrist, Industry 4.0 The Industrial Internet Of Things, Apress Publisher, ISBN-13 (pbk): 978-1-4842-2046-7

2. Alp Ustundag, Emre Cevikcan, Industry 4.0: Managing The Digital Transformation, Springer, 2018 ISBN 978-3-319-57869-9.

3.Ovidiu Vermesan and Peer Friess, Designing the industry - Internet of things connecting the physical, digital and virtual worlds, Rivers Publishers, 2016 ISBN 978-87-93379-81-7

4.Christoph Jan Bartodziej, The concept Industry 4.0- An Empirical Analysis of Technologies and Applications in Production Logistics, Springer Gabler, 2017 ISBN 978-3-6581-6502-4.

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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*		
SLNo	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: II					
Course Code	:	MCN431L	**OPEN SOURCE SIMULATION LAB**	CIE Marks	:	50
Credits L-T-P	:	1 - 0 - 1		SEE Marks	:	50
Hours	:	14L + 28P	*(Coding / Skill Laboratory)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Vishalakshi Prabhu and Prof. Suma B			

Content 28 Hrs

The purpose of the Open-Source Simulation Lab is to educate students in all aspects of simulation and system modelling and thus prepare them for prototyping emerging technologies in networking (wired, wireless), computing and IoT informatics. The research in the lab mainly focuses on next-generation wireless networks and issues on performance of protocols with emphasise on heterogeneous information networks and social computing.

The Lab mainly necessary software platforms and tools for the following domains of research:
• Wired networks (Ethernet, Optical fibres)
• Wireless Networks (4G, 5G, 6G)
• WLAN (IEEE 802.11 series)
• Sensor Networks (IEEE 802.15.4 and ZigBee)
• Wireless NOC
Simulation software's:
• Qualnet (Licenced)
• NS2/NS3
• LTE-Sim
• 5G-air-simulator
• Noxim
• iFogSim Lab Experiments
1. Introduction to Simulation.
2. Create Ethernet topology using switches and packet analysis using Wireshark.
3. Experimenting/Simulate Wi-Fi framework.
4. Demonstrate 4G, 5G architecture and VoIP connections.
5. Demonstrate use of LTE and VoLTE for voice traffic.
6. Demonstrate the roaming of UE under different Base-Stations in a given wireless network
7. Demonstrate energy models in various sensor nodes
8. Model Bluetooth Low Energy network

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

CO1	:	Explore the popular topologies, standards, protocols and range of wireless Networks.
CO2	:	Analyse new paradigm of wireless network connectivity through spectrum dependency, channel size, antennas and physical layer protocols.
CO3	:	Apply the concepts of heterogeneous networks for seamless connectivity in next generation network applications
CO4	:	Design sensor networks and applications for the various IoT use cases.

Scheme of Continuous Internal Evaluation (CIE- Laboratory) : Only LAB Course 30 + 10 + 10 = 50. The Laboratory session is held every week as per the timetable and the performance of the student is evaluated in every session. The average of marks over number of experiments conducted over the weeks is considered for 30 Marks i.e (Lab Report, Observation & Analysis). The students are encouraged to implement additional innovative experiments in the lab (10 marks). At the end of the semester a test is conducted for 10 Marks (Lab Test). This adds to 50 Marks.

Scheme of Semester End Examination (SEE- Laboratory) : Only LAB Course 40 + 10 =50. Students will be evaluated for Write-up, Experimental Setup, Experiment Conduction with Results, Analysis & Discussions for 40 Marks and Viva will be conducted for 10 Marks adding to 50 Marks.

Only LAB Courses with 50 Marks

	RUBRIC FOR CIE			RUBRIC FOR SEE	
Sl.No	Content	Marks		Content	Marks
1	Write Up, Setup, Conduction Results, Analysis & Discussions	30	1. Write Up, Setup, Conduction 2. Results, Analysis & Discussions		40
2	Innovative Experiment/Concept Design & Implementation	10			
3	Laboratory Internal	10	Viva Voce		10
	Total Marks	50		Total Marks	50

SEMESTER: II					
Course Code	:	**MHS131T**	**PROFESSIONAL SKILL DEVELOPMENT- I**	CIE Marks	:	50
Credits L-T-P	:	2-0-0		SEE Marks	:	50
Hours	:	28L	*Common Course to all M.Tech Programs*	SEE Durations	:	2 Hrs
Faculty Coordinator:		Dr. C.Bindu Ashwini				

UNIT - I	4 Hrs
Communication Skills: Basics of Communication, Personal Skills & Presentation Skills – Introduction, Application, Simulation, Attitudinal Development, Self Confidence, SWOC analysis. Resume Writing: Understanding the basic essentials for a resume, Resume writing tips Guidelines for better presentation of facts. Theory and Applications.	

UNIT - II	8 Hrs
Quantitative Aptitude and Data Analysis: Number Systems, Math Vocabulary, fraction decimals, digit places etc. Simple equations – Linear equations, Elimination Method, Substitution method, Inequalities. Reasoning – a. Verbal - Blood Relation, Sense of Direction, Arithmetic & Alphabet. b. Non- Verbal reasoning - Visual Sequence, Visual analogy and classification. Analytical Reasoning - Single & Multiple comparisons, Linear Sequencing. Logical Aptitude, - Syllogism, Venn-diagram method, Three statement syllogism, Deductive and inductive reasoning. Introduction to puzzle and games organizing information, parts of an argument, common flaws, arguments and assumptions. Verbal Analogies/Aptitude – introduction to different question types – analogies, Grammar review, sentence completions, sentence corrections, antonyms/synonyms, vocabulary building etc. Reading Comprehension, Problem Solving,	

UNIT - III	6 Hrs
Interview Skills: Questions asked & how to handle them, Body language in interview, and Etiquette – Conversational and Professional, Dress code in interview, Professional attire and Grooming, Behavioral and technical interviews, Mock interviews - Mock interviews with different Panels. Practice on Stress Interviews, Technical Interviews, and General HR interviews	

UNIT - IV	5 Hrs
Interpersonal and Managerial Skills: Optimal co-existence, cultural sensitivity, gender sensitivity; capability and maturity model, decision making ability and analysis for brain storming; Group discussion(Assertiveness) and presentation skills;	

UNIT - V	5 Hrs
Motivation: Self-motivation, group motivation, Behavioral Management, Inspirational and motivational speech with conclusion. (Examples to be cited). Leadership Skills: Ethics and Integrity, Goal Setting, leadership ability.	

Course Outcomes:		
After going through this course the student will be able to:		
CO1	:	Develop professional skill to suit the industry requirement.
CO2	:	Analyze problems using quantitative and reasoning skills
CO3	:	Develop leadership and inter personal working skills.
CO4	:	Demonstrate verbal communication skills with appropriate body language.

Reference Books:
1. The 7 Habits of Highly Effective People, Stephen R Covey Free Press, 2004 Edition, ISBN: 0743272455
2. How to win friends and influence people, Dale Carnegie General Press, 1st Edition, 2016, ISBN: 9789380914787

3. Crucial Conversation: Tools for Talking When Stakes are High, Kerry Patterson, Joseph Grenny, Ron Mcmillan 2012 Edition, McGraw-Hill Publication ISBN: 9780071772204

4. Ethnus, Aptimithra: Best Aptitude Book ,2014 Edition, Tata McGraw Hill ISBN: 9781259058738

Phase *	Activity
I	Test 1 is conducted after the completion of 9 hours of training programme (3 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers.
II	Test 2 is conducted after the completion of 18 hours of training programme (6 Classes). Question paper will have two parts. Part A will be Quiz for 10 Marks and Part B for 50 Marks Descriptive answers. Total test marks will be reduced to 30 Marks and Total Quiz marks will be 20 Marks. Final CIE would be 50 Marks.
CIE marks 20 Quiz + 30 Test = 50 Marks	

Semester End Examination: SEE is conducted for 50 Marks for a duration of 2 hours.

SEMESTER: III					
Course Code	:	MCN361T	**NETWORK ROUTING and PROTOCOLS**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Professional Core - 5*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Nagaraja G S and Prof. Veena Gadad			

UNIT - I	9 Hrs

Internet Protocol Traffic Engineering: Routing Protocol, Routing Algorithm, and Routing Table Routing Information Representation and Protocol Messages, Traffic, Stochasticity, Delay and Utilization, Applications View, An Architectural Framework, Traffic Engineering, IGP Metric, Determining IGP Link Weights via Duality of MCNF Problems, Illustration of Link Weight Determination Through Duality, Link Weight Determination, Large Networks.

UNIT - II	9 Hrs

Hierarchical and Dynamic Call Routing in the Telephone Network: Hierarchical Routing, Overall Hierarchical Routing Architecture, The Road to Dynamic Routing, Limitations of Hierarchical Routing, Call Control and Crankback, Trunk Reservation, Mixing of OCC and PCC, Dynamic Non-hierarchical Routing, Dynamically Controlled Routing, Dynamic Alternate Routing, Real-Time Network Routing, Classification of Dynamic Call Routing Maximum Allowable Residual Capacity Routing, Dynamic Routing and Its Relation to Other Routing

UNIT - III	8 Hrs

Traffic Engineering in the Voice Telephone Network: Traffic Engineering, Traffic Load and Blocking, Computing Erlang-B Loss Formula, Grade-of-Service and Trunk Occupancy, Centi-Call Seconds and Determining Based Load, Economic CCS Method Network Controls for Traffic Engineering, Guidelines on Detection of Congestion Examples of Controls, Communication of Congestion Control Information, Congestion Manifestation, State-Dependent Call Routing, Three-Node Network, N-Node Symmetric Network, N-Node Symmetric Network with Trunk Reservation, Illustration Without and with Trunk Reservation.

UNIT - IV	8 Hrs

IP Packet Filtering and Classification: Importance of Packet Classification, Packet Classification Problem, Expressing Rules, Performance Metrics, Packet Classification Algorithms, Naïve Solutions, Two-Dimensional Solutions and its types, Approaches for d Dimensions, Extending Two-Dimensional Solutions Divide and Conquer Approaches Tuple Space Approaches, Decision Tree Approaches, Hardware-Based Solutions Ternary Content Addressable Memory (TCAM).

UNIT - V	8 Hrs

VoIP Routing: Interoperability Through IP and PSTN: Traffic Engineering of IP/MPLS Networks, VPN Traffic Engineering, PSTN Call Routing Using the Internet, PSTN Call Routing: Managed IP Approach, IP-PSTN Interworking for VoIP, IP Multimedia Subsystem, Multiple Heterogeneous Providers Environment, All-IP Environment of VoIP Services

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

CO1	:	Explore different types of traffic engineering adopted in an Internet based services
CO2	:	Apply various approaches and standards used to optimize the routing in different types of networks.
CO3	:	Analyse the issues related to routing in an IP traffic engineering Networks
CO4	:	Examine the various algorithms of routing in VoIP call services and Traffic Engineering.

Reference Books

1. Deepak Medhi, Karthik Ramasamy, and Network Routing: Algorithms, Principles and Architectures, Second Edition, Morgan Kaufmann publications, 2018, ISBN: 978-0-12-800737-2.
2. Ravi Malhotra, IP Routing, First Edition, Oreilly Publication, 2002, ISBN: 81-7366-337-8
3. Kevin Dooley, Designing Large-Scale LANs, First Edition, Oreilly Publication, 2002, ISBN: 81-7366-337-2.
4. Technical and Research Papers on Traffic Engineering, VoIP, PSTN and Hierarchical Routing

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20	Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III					
Course Code	:	**MIT362D1**	**Augmented Reality & Virtual Reality**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:			Prof. Ashwini K B		

UNIT - I	**9 Hrs**

Introduction to Virtual Reality and its applications, Geometry of Virtual Worlds: Geometric models, Transforming models, 2D and 3D rotation yaw, pitch, and roll Programming with Unity: Unity Basics, Manipulating the Scene, Code blocks and Methods, Debugging Conditional and looping statements

UNIT - II	**9 Hrs**

Programming with Unity: Working with objects, Working with Scripts, Player movement, Camera Movement, Menu and UI, Advanced 3D movement Further Learning for Unity: The Asset Store. Mouse-Aimed camera: First Person Controller, Third Person Controller.

UNIT - III	**8 Hrs**

Augmented Reality, Mixed Reality and its applications, Tracking: Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion. Computer Vision for Augmented Reality : Marker-based tracking, Marker-less tracking.

UNIT - IV	**8 Hrs**

Modeling Tools for AR : An introduction to Blender. Modeling of an object, Sculpting objects, Importing from Blender to Unity, Modifiers, Particle system, Animation.

UNIT - V	**8 Hrs**

Introduction to WebXR: Entering VR through WebXR, Life cycle of WebXR application, Creating an XR session through WebXR. Creating an AR website with WebXR: Object creation, spatial tracking, start AR session, animate, create an event handling function for the end of the session.

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

CO1	:	Understand the concepts of Virtual Reality/Augmented Reality and its Applications
CO2	:	Identify immersive effects and its usage to experience AR/VR through exploration of its environment
CO3	:	Apply virtual/augmented environment to captivate its experiences
CO4	:	Analyze the technology for unimodal/multimodal user interaction in AR and VR

Reference Books

1. "Virtual Reality", Steven M. LaValle, Copyright Steven M. LaValle 2017 Available for downloading at http://vr.cs.uiuc.edu/

"AR and VR Using the WebXR API", Rakesh Baruah, 2021, ISBN-13 (pbk): 978-1-4842-6317-4 ISBN-13 (electronic): 978-1-4842-6318-1 https://doi.org/10.1007/978-1-4842-6318-1

3. Augmented Reality Principles and Practice", Dieter Schmalstieg Tobias Höllerer, 2016 Pearson Education, Inc., ISBN-13: 978-0-321-88357-5

4. Blender 3D: Designing Objects" , Romain Caudron, Pierre-Armand Nicq, Enrico Valenza, 2016, Packt Publishing Ltd, ISBN 978-1-78712-719-7

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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		
SLNo	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III					
Course Code	:	**MCE362D2**	**CYBER SECURITY**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Sowmyarani C N and Dr. Sindhu D V			

UNIT - I	9 Hrs

Cyber Security FundamentalsNetwork and Security Concepts, Information Assurance Fundamentals, Basic Cryptography, Symmetric Encryption, Public Key Encryption, The Domain Name System (DNS), Firewalls, Virtualization, Radio-Frequency Identification, Microsoft Windows Security Principles, Windows Tokens, Window Messaging, Windows Program Execution, The Windows Firewall

UNIT - II	9 Hrs

Attacker Techniques and Motivations How Hackers Cover Their Tracks (Anti-forensics), How and Why Attackers Use Proxies, Tunneling Techniques, Fraud Techniques, Phishing, Smishing, Vishing and Mobile Malicious Code, Rogue Anti-Virus, Click Fraud, Threat Infrastructure, Botnets, Fast-Flux, Advanced Fast-Flux.

UNIT - III	8 Hrs

Exploitation Techniques to Gain a Foothold, Shell code, Integer Overflow, Vulnerabilities, Stack-Based Buffer Overflows, Format-String Vulnerabilities, SQL Injection, Malicious PDF Files, Race Conditions, Web Exploit Tools, *DoS Conditions, Cross-Site Scripting (XSS).

UNIT - IV	8 Hrs

Malicious CodeSelf-Replicating Malicious Code, Worms, Viruses, Evading Detection and Elevating Privileges ,Obfuscation ,Virtual Machine Obfuscation ,Persistent Software Techniques, Rootkits, Spyware, Attacks against Privileged User Accounts and Escalation of Privileges, Stealing Information and Exploitation, Form Grabbing, Man-in-the-Middle Attacks.

UNIT - V	8 Hrs

Digital Forensics Process Model:Introduction to cybercrime scene, Documenting the scene and evidence, maintaining the chain of custody, forensic cloning of evidence, Live and dead system forensic, Hashing concepts to maintain the integrity of evidence, Report drafting.

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

CO1	:	Apply the concepts of cyber security to various applications.
CO2	:	Analyze the patterns and techniques used by attackers.
CO3	:	Analyze various types of malicious codes and exploit to attack the system resources.
CO4	:	Develop a defence mechanism to handle attacks.

Reference Books

1. Cyber Security Essentials, James Graham, Richard Howard, Ryan Olson- CRC Press, 2011 by Taylor and Francis Group. ISBN13: 978-1-4398-5126-5.

2. Cyber security: turning national solutions into international cooperation, James A. Lewis, Volume 25, Number 4, 2003 by center for strategic and international studies, ISBN: 0-89206-426-9.

3.Cyber security: The Essential Body of Knowledge, Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin 2012 by cengage learning, Import Edition ISBN13:978-1-4354-8169-5.

4. The basics of digital Forensics (Latest Edition) – The primer for getting started in digital forensics by John Sammons – Elsevier Syngress Imprint

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents	Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	100

SEMESTER: III					
Course Code	:	MCE362D3	**SOFTWARE PRODUCT DEVELOPMENT (DevOps)**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Badarinath K and Prof. Girish Rao Salanke			

UNIT - I	9 Hrs

Introduction to DevOps:
Agile Way of Thinking, Agile Frameworks, - Scrum Events and Artifacts, Scrum Roles, Agile Estimating, Planning, Monitoring and Control DevOps Overview, Relationship between Agile and DevOps, DevOps Toolchain, DASA DevOps Principles, Challenges with the Traditional Approach, Addressing Challenges through DevOps, DevOps Approach to the challenges, Overview of DevOps Tools, Best Practices for DevOps, Categories of DevOps Tools, Workflow of DevOps

UNIT - II	9 Hrs

Version Control Systems:
Overview of Version Control Systems, Role of Version Control Systems, Types of Control Systems and Their Supporting Tools, Overview of Git, Overview of Source code and Version Control Hosts, Deploy the Files to GitHub via Git

UNIT - III	8 Hrs

Continuous Integration and Continuous Deployment:
Overview and Importance of Continuous Integration , Overview and Features of Jenkins,
Set up Jenkins, Build Tools and Their Uses, Continuous Integration with Jenkins and Maven

UNIT - IV	8 Hrs

Configuration Management Tools and Containerization with Docker:
Overview of Configuration Management Tools, Managing Infrastructure, Types of Configuration Management Tools, Overview of Puppet, Demonstrate Puppet Configuration, Overview of Chef, Demonstrate Chef Configuration Overview of Docker, Overview of Virtualization, Docker Installation on Multiple OS, MySQL Database in Docker Container, Docker Installation on Multiple OS, Using Docker Compose to Manage a Container, Docker Registry, Run Docker Registry with Centos, Docker Networking, Demonstrate Docker Networking with Two SSHs

UNIT - V	8 Hrs

Continuous Monitoring and Need of Cloud in DevOps:
Overview of Continuous Monitoring, Types of Monitoring Systems, Demonstrate Nagios, Working with Nagios Monitoring Tool, Overview of Grafana , ELK Stack. Containers Infrastructure Management tool - Kubernetes, Adding a Linux Node to the Kubernetes Cluster Overview of Cloud Computing, Cloud Services and Models, Using AWS in DevOps

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

CO1	:	Explain the need for Optimization and improvements in core business, SCRUM methodology, the opportunities Based by DevOps and the automation in new product development.
CO2	:	Apply DevOps tools for Configuration Management, Continuous Integration, Deployment, Delivery, and Monitoring.
CO3	:	Demonstrate DevOps Tools - Git, Docker, Chef, Puppet, Jenkins and Nagios
CO4	:	Analyse Application of appropriate tools to implement Cloud Computing and DevOps projects

Reference Books

1. Effective Devops: Building A Culture of Collaboration, Affinity, And Tooling At Scale, Shroff/O'OReilly; First edition, 2016, ISBN-10: 9352133765, ISBN-13: 978-9352133765

2. Accelerate: The Science of Lean Software and Devops: Building and Scaling High Performing Technology Organizations, IT Revolution Press; 1st edition, 2018, ISBN-10: 1942788339, ISBN-13: 978-1942788331

3.Site Reliability Engineering: How Google Runs Production Systems- 1st Edition, O'Reilly Publication, by Niall Richard Murphy, Betsy Beyer, Chris Jones, Jennifer Petoff ISBN-13: 978-1491929124, ISBN-10: 149192912X

4. Practical DevOps - Second Edition, byJoakim Verona, Packt Publisher, ISBN – 9781788392570

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	**Content**	**Marks**	**Q. No**	**Contents**	**Marks**
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).	
2	Tests – T1 & T2	40			
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2	20
	Total Marks	**100**	3 & 4	Unit-2: Question 3 or 4	20
			5 & 6	Unit-3: Question 5 or 6	20
			7 & 8	Unit-4: Question 7 or 8	20
			9 & 10	Unit-5: Question 9 or 10	20
				Total Marks	**100**

SEMESTER: III					
Course Code	:	MCE362D4	**Intelligent Systems**	CIE Marks	:	100
Credits L-T-P	:	3- 1 - 0		SEE Marks	:	100
Hours	:	42L+28T	*Elective E (Professional Elective)*	SEE Durations	:	3 Hrs
Faculty Coordinator:		Dr. Badarinath K and Prof. Anitha Sandeep				

UNIT - I	**9 Hrs**

Introduction: The Foundations of Artificial Intelligence, History of Artificial Intelligence,The State of the Art, Intelligent Agent: Introduction, How Agents Should Act, Structure ofIntelligent Agents, Problem-solving: Solving Problems by Searching Search Strategies,Avoiding Repeated States ,Avoiding Repeated States

UNIT - II	**9 Hrs**

Informed Search Methods: Best-First Search, Heuristic Functions, Memory Bounded Search, Iterative Improvement AlgorithmsGame Playing: Introduction: Games as Search Problems, Perfect Decisions in Two-Person, Games Imperfect Decisions, Alpha-Beta Pruning, Games That Include an Element of Chance

UNIT - III	**8 Hrs**

Knowledge InferenceKnowledge representation -Production based system, Frame based system. Inference Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certaintyfactors, Bayes Rule, Uncertainty Principles, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

UNIT - IV	**8 Hrs**

Learning from Observations: A General Model of Learning Agents, Inductive Learning,Learning Decision Trees, Using Information Theory, Learning General Logical Descriptions, Why Learning Works: Computational Learning TheoryReinforcement Learning: Passive Learning in a Known Environment, Passive Learning in an Unknown Environment, Active Learning in an Unknown Environment

UNIT - V	**8 Hrs**

Expert Systems, Components, Production rules, Statistical reasoning, certaintyfactors, measure of belief and disbelief, Meta level knowledge, Introspection. Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

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

CO1	:	Analyze and explain basic intelligent system algorithms to solve problems
CO2	:	Apply Artificial Intelligence and various logic-based techniques in real world problems.
CO3	:	Assess their applicability by comparing different Intelligent System techniques
CO4	:	Demonstrate skills like investigation, effective communication, working inteam/Individual and following ethical practices by implementing intelligent systems concepts.

Reference Books

1. Artificial Intelligence – A Modern Approach ,Stuart Russel, Peter Norvig , 3rd Edition, Pearson Education, 2010 , ISBN-10 : 0132071487 , ISBN-13 : 978-0132071482

2. Artificial Intelligence (SIE) ,Kevin Night, Elaine Rich, Nair B., ,McGraw Hill, 1st Edition, 2008, ISBN: 9780070087705

3. Introduction to AI and ES ,Dan W. Patterson, Pearson Education, 1st Edition , 2007, ISBN: 0132097680

4. Introduction to Expert Systems , Peter Jackson, 3rd Edition, Pearson Education, 2007, ISBN-978-0201876864

Scheme of Continuous Internal Evaluation (CIE): 20 + 40 + 40 = 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 40 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 (15), Video based seminar/presentation/demonstration (25) adding upto 40 marks.

Scheme of Semester End Examination (SEE) for 100 marks: The question paper will have FIVE 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	Content	Marks	Q. No	Contents		Marks
1	Quizzes – Q1 & Q2	20		Each unit consists of TWO questions of 20 Marks each. Answer FIVE full questions selecting ONE from each unit (1 to 5).		
2	Tests – T1 & T2	40				
3	Experiential Learning – EL1 & EL2	40	1 & 2	Unit-1: Question 1 or 2		20
	Total Marks	100	3 & 4	Unit-2: Question 3 or 4		20
			5 & 6	Unit-3: Question 5 or 6		20
			7 & 8	Unit-4: Question 7 or 8		20
			9 & 10	Unit-5: Question 9 or 10		20
				Total Marks		100

SEMESTER III					
Course Code	: MCN461N	**INTERNSHIP**	CIE Marks	:	50
Credits L-T-P	: 0 - 0 - 6		SEE Marks	:	50
Hours/Week	: 12		SEE Durations	:	3 Hrs

Guidelines:

1. The duration of the internship shall be for a period of 6 weeks on full time basis after II semester final exams and before the commencement of III semester.

2. The student must submit letters from the industry clearly specifying his / her name and the duration of the internship on the company letter head with authorized signature.

3. Internship must be related to the field of specialization of the respective PG programme in which the student has enrolled.

4. Students undergoing internship training are advised to report their progress and submit periodic progress reports to their respective guides.

5. Students have to present the internship activities carried out to the departmental committee and only upon approval by the committee, the student can proceed to prepare and submit the hard copy of the final internship report. 6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be softbound in Ivory color for PG circuit Programs and Light Blue for Non-Circuit Programs.

Course Outcomes: After going through the internship the student will be able to

CO1: Apply Engineering and Management principles to solve the problems

CO2: Analyze real-time problems and suggest alternate solutions

CO3: Communicate effectively and work in teams

CO4: Imbibe the practice of professional ethics and lifelong learning

Scheme of Continuous Internal Evaluation (CIE):

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

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

Reviews	Activity	Weightage
I	Application of Engineering knowledge in industries, ability to comprehend the functioning of the Organization/ Departments.	40%
II	Importance of Resource Management, Environment and Sustainability. Demonstration and Presentation of Internship work with Report Submission	60%

Scheme for Semester End Evaluation (SEE):

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

Course Code	: MCN461P	**MINOR PROJECT**	CIE Marks	: 50
Credits L-T-P	: 0 - 0 - 6		SEE Marks	: 50
Hours/Week	: 12		SEE Durations	: 3 Hrs

Guidelines:
1. Each project group will consist of maximum of two students.
2. Each student / group has to select a contemporary topic that will use the technical knowledge of their program of study after intensive literature survey.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The minor project would be performed in-house.
5. The implementation of the project must be preferably carried out using the resources available in the department/college.

Course Outcomes: After completing the course, the students will be able to
CO1: Conceptualize, design and implement solutions for specific problems.
CO2: Communicate the solutions through presentations and technical reports. CO3: Apply resource managements skills for projects.
CO4: Synthesize self-learning, team work and ethics.

Scheme of Continuous Internal Examination
Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor and Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Approval of the selected topic, formulation of Problem Statement and Objectives with Synopsis submission	20 %
II	Mid-term seminar to review the progress of the work with documentation	40 %
III	Oral presentation, demonstration and submission of project report	40 %

* Phase wise rubrics to be prepared by the respective departments

CIE Evaluation shall be done with weightage / distribution as follows:

• Selection of the topic & formulation of Problem Statement and Objectives	10 %
• Design and simulation/ Algorithm development/ Experimental setup	25 %
• Conducting experiments/ Implementation / Testing	25 %
• Demonstration & Presentation	25 %
• Report writing	15 %

Scheme of Semester End Examination (SEE):
The evaluation will be done by ONE senior faculty from the department and ONE external faculty member from Academia / Industry / Research Organization. The following weightages would be given for the examination. Evaluation will be done in batches, not exceeding 6 students.
• Brief write up about the project 05%
• Methodology and Experimental Results & Discussion 20%
• Presentation / Demonstration of the Project 25%
• Report 20%
• Viva Voce 30%

SEMESTER IV					
Course Code	: MCN491P	**MAJOR PROJECT**	CIE Marks	:	100
Credits L-T-P	: 0 - 0 - 18		SEE Marks	:	100
Hours/Week	: 36		SEE Durations	:	3 Hrs

Guidelines:

1. Major Project is to be carried out for a duration of 18 weeks
2. Students must adhere to the Project Presentation Schedule, report to their guide on a weekly basis and get their Project diary signed by their guide 4. Students must execute the Major Project individually and not in teams.
5. It is mandatory for the students to present/publish their project work in National/International Conferences or Journals
6. The reports shall be printed on A4 size with 1.5 spacing and Times New Roman with font size 12, outer cover of the report (wrapper) has to be soft bound and in Ivory color for PG circuit Programs and Light Blue
for Non-Circuit Programs

Course Outcomes: After completing the course, the students 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 managements skills, professional ethics and societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination
Evaluation shall be carried out in three reviews. The evaluation committee shall consist of Guide, Professor, Associate Professor/Assistant Professor.

Phase *	Activity	Weightage
I	Selection of Project Title, Formulation of Problem Statement and Objectives	20 %
II	Design, Implementation and Testing	40 %
II	Experimental Result & Analysis, Conclusions and Future Scope of Work, Report Writing and Paper Publication	40 %

* Phase wise rubrics to be prepared by the respective departments

Scheme for Semester End Evaluation (SEE):
Major Project SEE evaluation shall be conducted in two stages. This is initiated after fulfilment of submission of Project Report and CIE marks.
Stage-1 Report Evaluation: Evaluation of Project Report shall be done by the Guide and an External examiner.
**Stage-2 Project Viva-voce:** Major Project Viva-voce examination is conducted after receipt of evaluation reports from Guide and External examiner.

SEE procedure is as follows:			
Report	Internal Examiner: 100 Marks	**= 200**	
Evaluation	External Examiner: 100 Marks	200 / 2 = **100**	**A**
Viva-Voce	Jointly evaluated by Internal Guide & External Evaluator	**= 100**	**B**
	Total Marks = (A + B) / 2 =	**100**	

Curriculum Design Process
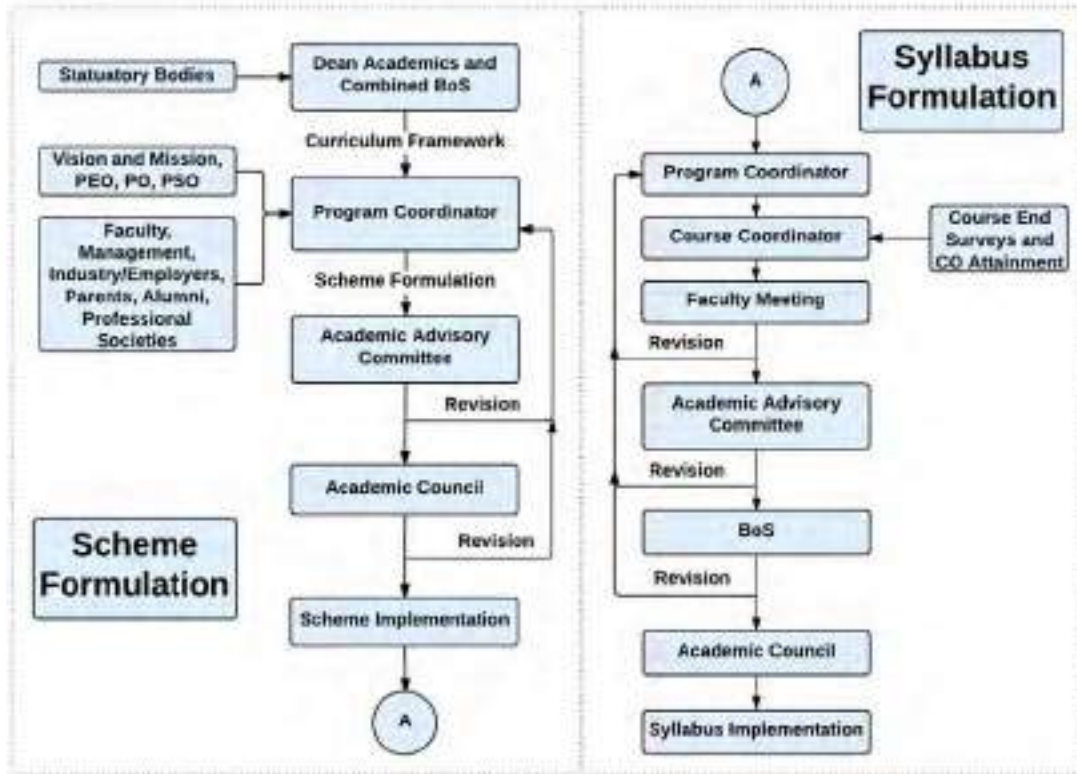
Academic Planning And Implementation
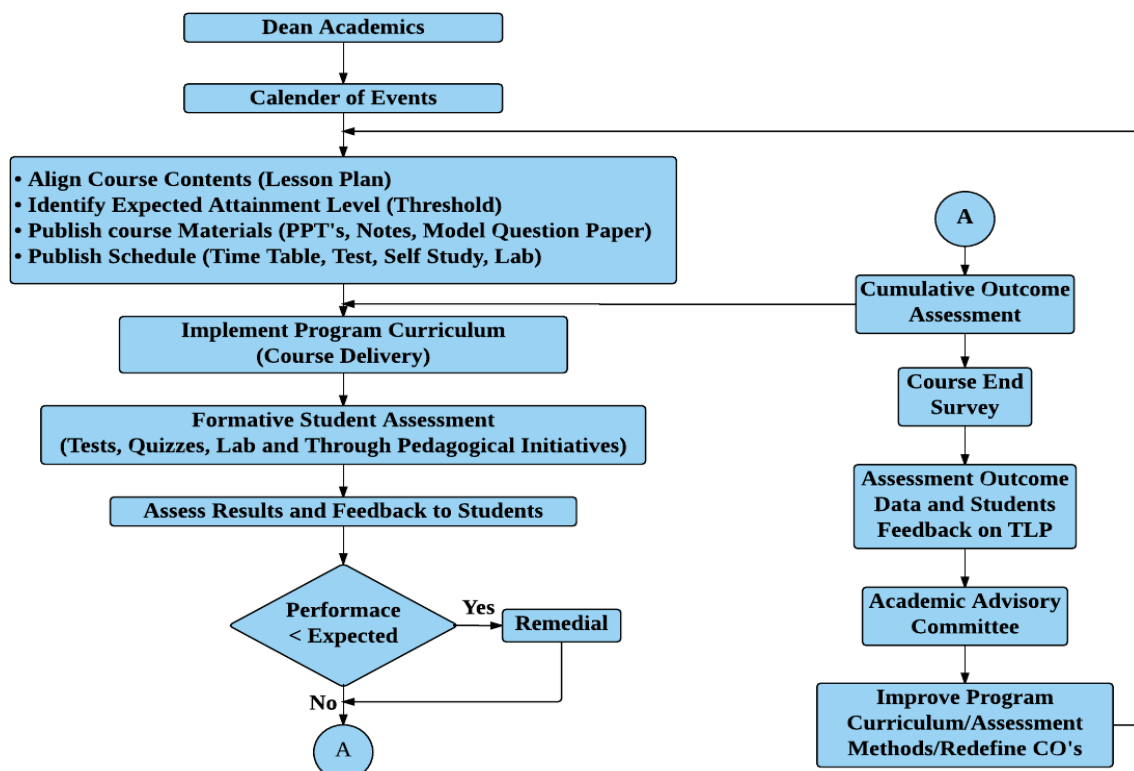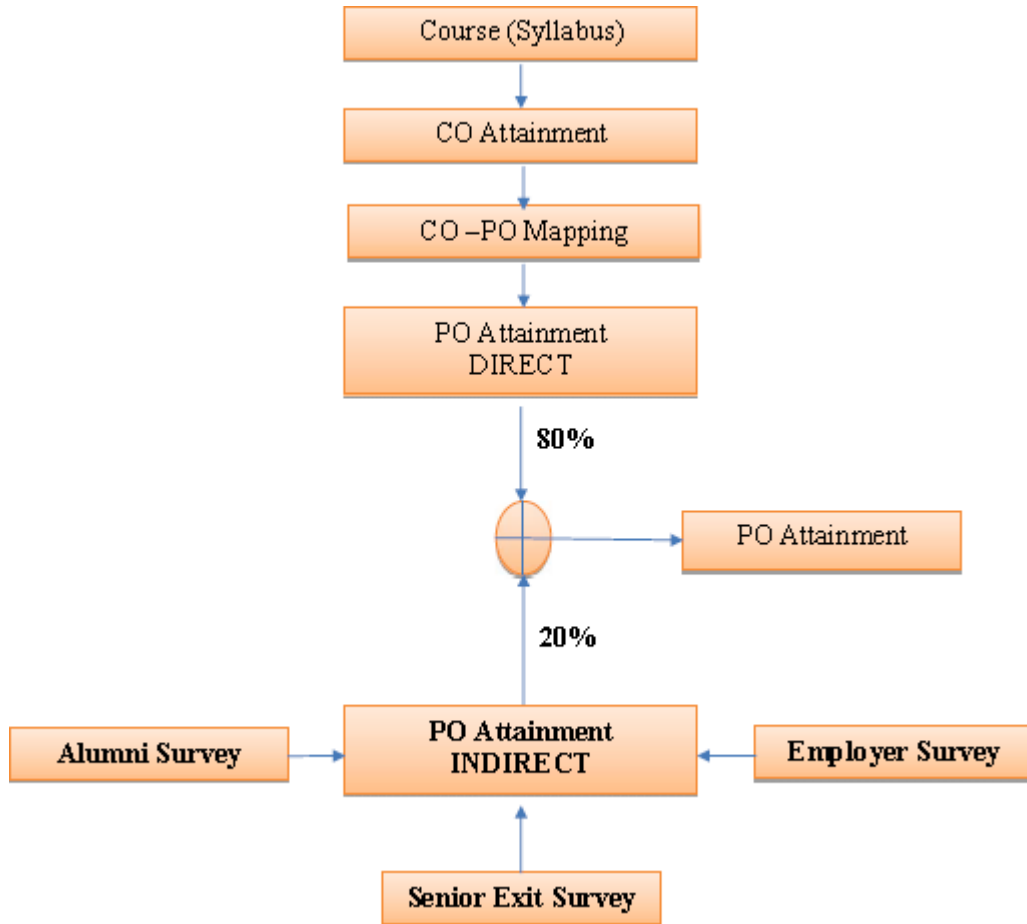
Process For Course Outcome Attainment

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            ┌──────────────────────────────┐
            │      Course Curriculum       │
            └──────────────────────────────┘
                           │
            ┌──────────────────────────────┐
            │        CO-PO Mapping         │
            └──────────────────────────────┘
                           │
            ┌──────────────────────────────┐
            │     Mapping of COs to CIE QP │
            └──────────────────────────────┘
                           │
        ┌──────────────────────────────────────┐
        │  Weightage of COs from tests and quizzes │
        └──────────────────────────────────────┘
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        ┌──────────────────────────────────────┐
        │  Students marks from tests and quizzes │
        └──────────────────────────────────────┘
                           │
┌──────────────────────┐   ◯   ┌──────────────────────────┐
│ Lab experiment       │───►◯◄──│ Self Study assessment    │
│ assessment, Score    │       │ score and weightage      │
│ and weightage        │       │                          │
└──────────────────────┘       └──────────────────────────┘
                           │
        ┌──────────────────────────────────────┐
        │   Attainment of CO for each student   │
        └──────────────────────────────────────┘
                           │
        ┌──────────────────────────────────────┐
        │ Number of students getting more than  │
        │      the target attainment            │
        └──────────────────────────────────────┘
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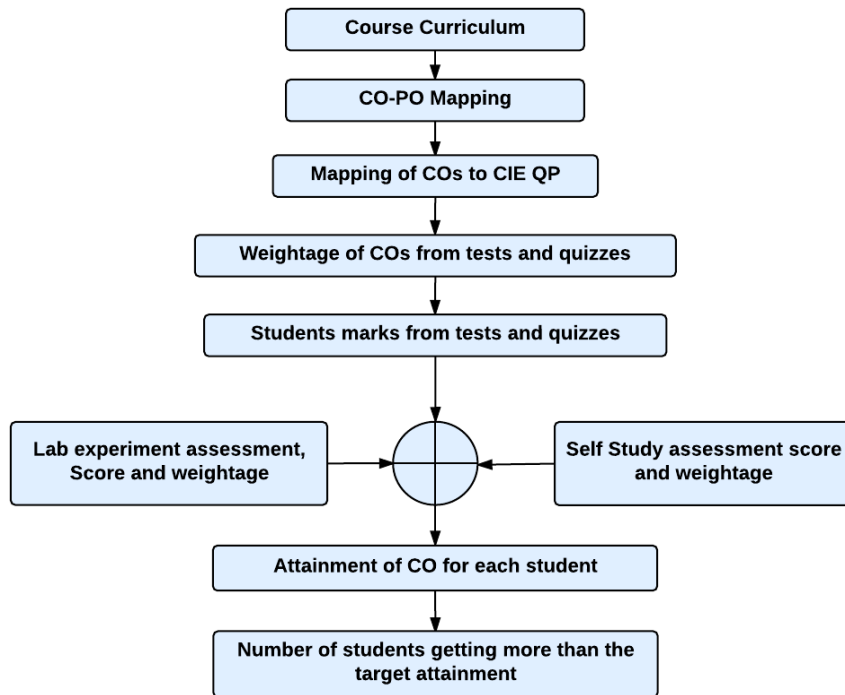
Final CO Attainment Process
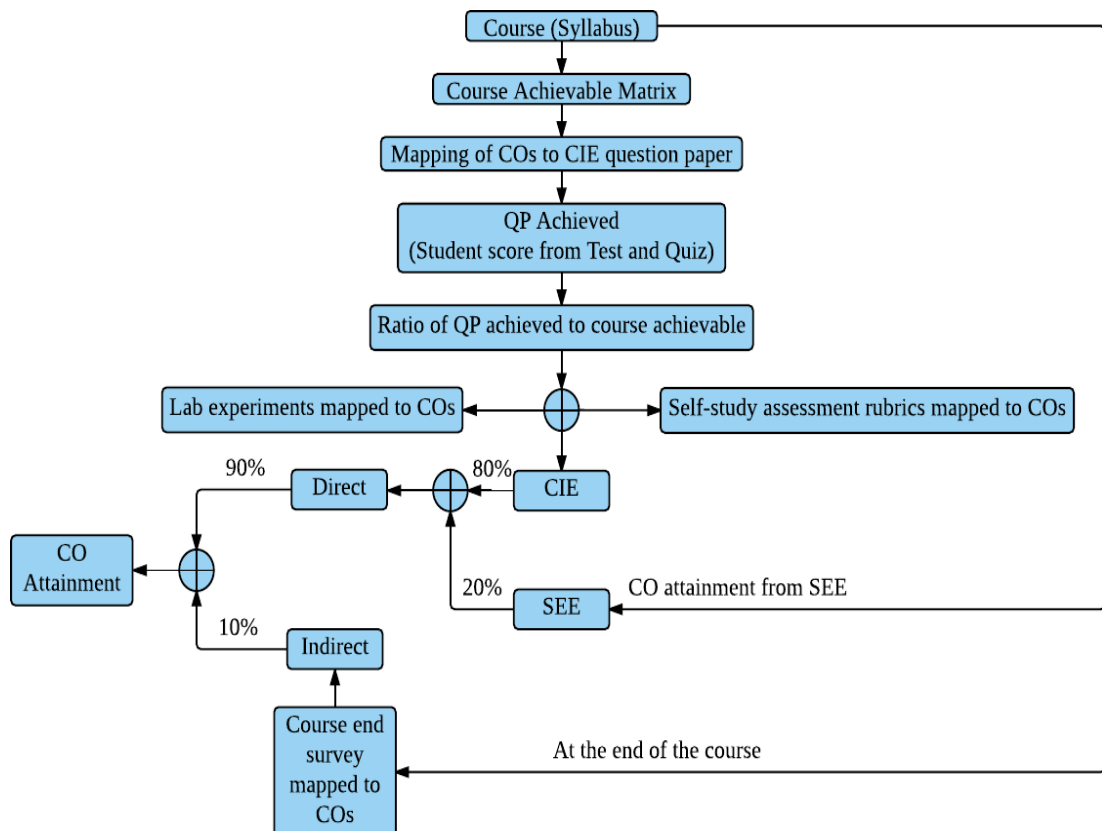
Program Outcome Attainment Process

Innovative Clubs of RVCE

1	**Ashwa Racing**	Ashwa Mobility Foundation (AMF) is a student R&D platform that designs and fabricates Formula theme race cars and future mobility solutions to tackle urban transportation problems.
2	**Astra Robites**	Team involved in the design, fabrication and building application specific robots.
3	**Coding Club**	To facilitate students the skills, confidence, and opportunity to change their world using coding and help them become successful in GSoC, ACM-ICPC, and other recognized coding competitions.
4	**Entrepreneurship Development Cell**	E-Cell is a student run body that aims to promote entrepreneurship by conducting workshops, speaker sessions and discussions on business and its aspects. We possess a mentor board to help startups grow.
5	**Frequency Club**	Team aims at contributing in both software and hardware domains mainly focusing on Artificial Intelligence, Machine Learning and it's advances.
6	Garuda	Design and development of supermileage urban concept electric car. Indigenous development of E-mobility products.
7	Jatayu	Build a low cost Unmanned Aerial Vehicle capable of Autonomous Navigation, Obstacle Avoidance, Object Detection, Localization, Classification and Air Drop of a package of optimum weight.
8	Solar Car	Build a roadworthy solar electric vehicle in order to build a green and sustainable environment.
9	**Team Antariksh**	Team Antariksh is a Space Technology Student Club whose goal is to understand, disseminate and apply the engineering skills for innovation in the field of Space technology, designing Nano-Satellite payload for ISRO PS4 Orbital platform, RVSAT-1 along with developing experimental rockets of various altitude.
10	Team Chimera	Building a Formula Electric Car through Research and Development in E-Mobility. Electrifying Formula Racing.
11	Helios Racing	Team involved in design, manufacturing and testing of All-Terrain Vehicles and other supportive tasks for the functioning of the team. Participating in BAJA competitions organized by SAE in India and the USA.
12	Team Hydra	Developing autonomous underwater vehicles and use it for various real world applications such as water purification, solid waste detection and disposal etc.
13	Team Krushi	Develop low cost equipments, which help farmers in cultivating and harvesting the crops. Use new technology applications to reduce the labour time hand cost for farmers. Aims at developing implants for Tractors.
14	Team vyoma	Design, fabrication and testing of radio controlled aircrafts and research on various types of unmanned aerial vehicles.
15	Team Dhruva	Organizing activities like quizzes based on astronomy.Stargazing and telescope handling sessions.Construction of a standard observatory. working on small projects with organizations like ICTS, IIA, ARIES etc.
16	Ham club	To popularize Amateur Radio as a hobby among students, alongside exploring technical innovations in the communications domain. Intended to provide human capital for service to the nation at times of natural calamities.

NCC

NSS

"Not me but you"
" Education through
Community Service &
Community Service through education"

Cultural Activity Teams

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

INNOVATIVE TEAMS OF RVCE

1. Ashwa Racing : Ashwa Mobility Foundation (AMF) is a student R&D platform that designs   and fabricates Formula-themed race cars and future mobility solutions to tackle urban transportation problems.
2. Astra Robotics Team : Involved in the design, fabrication, and building of application-specific robots.
3. Coding Club : To facilitate students in acquiring the skills, confidence, and opportunities to change their world using coding. The club aims to help students become successful in GSoC, ACM-ICPC, and other recognized coding competitions.
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8. Solar Car : Aims to build a roadworthy solar electric vehicle to contribute to a green and sustainable environment.
9. Team Antariksh : A Space Technology Student Club whose goal is to understand, disseminate, and apply engineering skills for innovation in the field of Space technology, including the development of operational rockets of various altitude platforms.
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13. Team Krushi : Aims to develop low-cost equipment to help farmers in cultivating and harvesting. Uses new technology applications to reduce labor time and cost for farmers. Aims at developing implements for tractors.
14. Team Vyoma : Design, fabrication, and testing of radio-controlled aircraft and research on various types of unmanned aerial vehicles.
15. Team Dhruva : Organizing activities like quizzes based on astronomy, stargazing, and telescope handling sessions. Construction of a standard observatory and working on small projects with organizations like ICTS, IIA, ARIES, etc.
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NSS of RVCE

NCC of RVCE

VISION

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

MISSION

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

QUALITY POLICY

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

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation