RV COLLEGE OF ENGINEERING®

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

Scheme and Syllabus of III & IV Semester

(Autonomous System of 2018 Scheme)

Master of Technology (M.Tech)
in
COMPUTER NETWORK ENGINEERING

DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING

RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
Department of Computer Science and Engineering

M. Tech. in Computer Network Engineering

THIRD SEMESTER							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**			**Total Credits**
				Lecture L	**Tutorial T**	**Practical P**	
1	18 MCN 31	High Speed Networks	CS	4	1	0	5
2	18 MCN 3EX	Elective Group-E	CS	4	0	0	4
3	18 MCN 32	Internship	CS	0	0	5	5
4	18 MCN 33	Dissertation Phase I	CS	0	0	5	5
Total				**8**	**1**	**10**	**19**
Total Number of Hours / Week				**8**	**2**	**20**	**30**

LIST OF ELECTIVE COURSES

(Group E: Core Electives)	
18 MCE 3E1	Software Defined Systems
18 MCN 3E2	Data Storage Technology and Networks
18 MCE 3E3	Cyber Security

FOURTH SEMSESTER							
Sl. No	**Course Code**	**Course Title**	**BoS**	**CREDIT ALLOCATION**			**Credits**
				L	**T**	**P**	
1	18 MCN 41	Dissertation Phase II	CS	0	0	20	20
2	18 MCN 42	Technical Seminar	CS	0	0	2	2
		Total		**0**	**0**	**22**	**22**
Total Number of Hours / Week				**0**	**0**	**44**	**44**

SEMESTER III

High Speed Networks
(Theory)

Course Code	**:**	**18MCN31**		**CIE Marks**	**:**	**100**
Credits	**:**	**L: T: P 4:1:0**		**SEE Marks**	**:**	**100**
Hours	**:**	**48L+24T**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives: Graduates will be able to

1. Explore high speed digital access, broadband technologies and switching techniques used for communication.
2. Appreciate the high speed computer network architecture.
3. Emphasize current and emerging networking technologies.
4. Analyze performance issues and Quality of Service (QoS) required for high Speed Networks.

Unit – I **10 Hrs**

High-Speed Networks: Packet Switching Networks, Frame Relay Networks, The Emergence of High Speed LANs, Ethernet, Fiber Channel, Wireless LANs, Emerging Passive Optical Network Technologies (EPONs), Gigabit Ethernet, 10 Gigabit Ethernet: 802.3ae Emerging Standard, Fiber Optic and the Magic of Light, Wave Length Division Multiplexing (WDM), Dense Wavelength Division Multiplexing (DWDM).

Unit – II **9 Hrs**

Broadband ISDN architecture and Protocols:
Service Capabilities, Bearer Services and Teleservices, Basic and Supplementary services, SS7 Architecture, Protocol Architecture, B-ISDN standards, Broadband services, Requirements, Architecture, B-ISDN Protocol Reference Model, B-ISDN Physical Layer, SONET/ SDH.

Unit – III **10 Hrs**

ATM Traffic and Congestion Control:
Asynchronous Transfer Mode, ATM Protocol Architecture, ATM Logical Connections, Transmission of ATM Cells, ATM Adaption Layers, Requirements for ATM Traffic and Congestion control, ATM Service Categories, ATM Traffic-Related Attributes, Traffic management Framework, Traffic management, ABR Traffic Management.

Unit – IV **9 Hrs**

Congestion and Traffic Management:
Effects of Congestion, Congestion and control, Traffic Management, Congestion Control in packet-Switching Networks, Frame Relay Congestion Control, the need for Flow and Error Control, ARQ Performance, TCP Traffic Control: TCP Flow Control, TCP Congestion Control, Performance of TCP over ATM.

Unit-V **10Hrs**

Performance Modelling and Estimation:
Probability, Random Variables, Stochastic Processes, Queuing Models, Single-Server Queues, Multi-Server Queues, Queues with Priorities, Networks of Queues, Other Queuing Models, Self Similarity, Self-Similar Data traffic, Performance Implications of Self-Similarity, Modeling and Estimation of Self-Similar Data Traffic.

Reference Books:

1	William Stallings, "ISDN and Broadband ISDN with Frame Relay and ATM", 4th Edition, Pearson Education Asia, 2006, ISBN:0-13-243310-9.
2	William Stallings, "High-speed Networks and Internets", 2nd edition, Pearson education,2006, ISBN-13-9788177585698.
3	Glen Carty, "Broad band Networking" Tata McGraw-Hill Edition 2002, ISBN:0-07-052911-6.
4	IEEE / ACM Transactions on :Networking / Computers / Communications

Course Outcomes:

CO1**:**Apply the principles and concepts of high speed networks in performance computing.
CO2: Analyzethe basics of high speed network technologies and its components.
CO3: Analyze the cause of congestion, traffic slow down and related factors for Quality of Service.
CO4: Discover and solve the challenges of high Speed Networks and its related performance.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 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.

Software Defined Systems (Elective–E1)						
Course Code	**:**	**18MCE3E1**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P 4:0:0**		**SEE Marks**	**:**	**100**
Hours	**:**	**48L**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Students will be able to:

1. Explore the emerging definitions, protocols, and standards for SDN
2. Building SDN frame framework using different components
3. Extending the SDN concepts for service virtualization
4. Designing different applications using SDN

Unit – I	**9 Hrs**

Introduction. Centralized and Distributed Control and Data Planes. Introduction -Evolution versus Revolution. What Do They Do? - The Control Plane, Data Plane, Moving Information Between Planes, Why Can Separation Be Important? Distributed Control Planes - IP and MPLS, Creating the IP Underlay, Convergence Time, Load Balancing, High Availability, Creating the MPLS Overlay, Replication. Centralized Control Planes - Logical Versus Literal, ATM/LANE, Route Servers, Segment routing, Overlays – VXLAN, NVERGE.

Unit – II	**10 Hrs**

OpenFlow. Introduction - Wire Protocol, Replication, FAWG (Forwarding Abstraction Workgroup), Config and Extensibility, Architecture. Hybrid Approaches - Ships in the Night, Dual Function Switches. **SDN Controllers.** Introduction. General Concepts – Vmware, Nicira, Vmware/Nicira, OpenFlow-Related, Mininet, NOX/POX. Trema, Ryu, Big Switch Networks/Floodlight. Layer 3 Centric - L3VPN, Path Computation Element Server. OF-CONFIG.

Unit – III	**10 Hrs**

Network Programmability. Introduction. The Management Interface. The Application-Network Divide - The Command-Line Interface, NETCONF and NETMOD, SNMP. Modern Programmatic Interfaces - Publish and Subscribe Interfaces, XMPP. Google's Protocol Buffers - Thrift. JSON, I2RS. Modern Orchestration - OpenStack. CloudStack, Puppet.

Unit – IV	**9 Hrs**

***Network Function Virtualization.** Introduction. Virtualization and Data Plane I/O - Data Plane I/O,I/O Summary. Services Engineered Path. Service Locations and Chaining – Metadata, An Application Level Approach, Scale, NFV at ETSI. Non-ETSI NFV Work - Middlebox Studies, Embrane/Line Rate, Platform Virtualization. Add OVS, OVN, OPNFV, Openstack

Unit – V	**10 Hrs**

Building an SDN Framework. Introduction. Build Code First; Ask Questions Later. The Juniper SDN Framework. IETF SDN Framework(s) – SDN (P), ABNO. Open Daylight Controller/Framework – API, High Availability and State Storage, Analytics. Policy, MD-SAL, VTN, OVSDB. ONOS **Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring.** Introduction. Bandwidth Calendaring - Base Topology andFundamental Concepts, OpenFlow and PCE Topologies, Example Configuration, OpenFlow Provisioned Example, Enhancing the Controller. Overlay Example Using PCE Provisioning, Expanding your reach: Barbarians at the gate. Big Data and Application Hyper-virtualization for Instant CSPF expanding topology.

Course Outcomes: **After going through this course the student will be able to:** CO1: Differentiate between traditional networks and Software defined networks CO2: Analyze the characteristics of OpenFlow and SDN Controller CO3: Explore and apply SDN concepts for network programmability and service virtualization. CO4: Design application in SDN eco-system.	
Reference Books:	
1.	SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, By Thomas D. Nadeau, Ken Gray Publisher: O'Reilly Media, First Edition. August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.
2.	Software Defined Networks: A Comprehensive Approach, by Paul Goransson and Chuck Black, Morgan Kaufmann, First Edition. June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
3.	Software defined networks: Design and Deployment, Particia A. Morreale and James M. Anderson. CRC Press, First edition, December 2014, ISBN: 9781482238631
4.	*Network function virtualization: Challenges and opportunities for innovation" by B Han et al, IEEE Communication Magazines, 2015

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 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.

Data Storage Technology and Networks (Elective-E2)						
Course Code	**:**	**18MCN3E2**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L: T: P 4:0:0**		**SEE Marks**	**:**	**100**
Credits	**:**	**48L**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives:

Graduates shall be able to

1. Learn various data storage technologies like SAN, NAS and DAS and their relative performance.
2. Equipped with the knowledge of various protocols used by storage devices to transfer data and their relative performance measures.
3. Acquire the knowledge of different storage applications like backup, recovery, capacity planning and replication.
4. Understand the concept of storage design and its practices in storage networking.

Unit – I **10 Hrs**

Introduction to Storage Area Networks:

What is storage area Network, SAN Components, SAN Connectivity, SAN storage, SAN Servers, Server centric and storage centric architecture, Architecture of Intelligent Disk sub systems, Hard disks and Internal I/O Channels, JBOD, Storage virtualization using RAID, RAID levels(All), Caching, Intelligent Disk Subsystems. Storage technologies: Direct Attached Storage(DAS), Network Attached Storage(NAS), Storage Area Network(SAS).

Unit – II **10Hrs**

Fiber Channel Internals and Technologies:

Fiber Channel, Layers, Optical Cables, Classes of service,Fiber channel Data movement, Data Tansport, Flow Control, Addressing, Fiber Channel Topologies, Port Types, Fiber Channel arbitrated loop Protocols,Fiber Channel Login, Fiber Channel Fabric Services, Routing Mechanisms, Zoning. Gigabit Transport Technology, Inter- switch links

Unit – III **09Hrs**

Storage Virtualization and Basic Software for Storage Networking:

Storage Virtualization, Implementation Considerations, Storage Virtualization in Server, Storage Devices, Network, Symmetric and Asymmetric Storage Virtualizaion in the Network. Software for SANs, Shared Access Data Managers, Computer System I/O Performance, Volumes: Resilience, Performance and flexibility, File Systems and Application Performance

Unit – IV **09Hrs**

Advanced Software for storage Networking:

Data Replication, Different types of data replication, Synchronous and Asynchronous Replication, Using data Replication, Clusters, Data Center Clusters, Cluster Data Models, Cluster File Systems, Disaster Recovery and Global Clusters, Clusters and Storage Area Networks, Backup Management for SANs, Enterprise Data Protection and Backup Architecture.

Unit-V **10Hrs**

Application and Management of Storage Networks:

Application of Storage Networks, Storage Sharing, Availability of Data, Adaptability and Scalability of IT Systems, Capacity Planning, NAS Case Study: The International Image Processing, SAN Case study: The Import Auto Industry, SAN/NAS Management Case Study: The Southwestern CD Company

Course Outcomes:

At the end of this course graduates will be able to:

CO1: Identify the different storage Technologies and protocols used for storage networks.
CO2: Design and architect the storage solution for different application scenarios.
CO3: Analyse the issues of different data storage techniques and data access methods in SAN.
CO4: Examine the software technologies used to build the storage area networks.

Reference Books:	
1.	Ulf Troppens, Wolfgang Muller-Freidt, Rainer Wolafka, Storage Networks Explained John Wiley Publishers, 2nd Edition, 2009, ISBN:978-81-265-1832-6.
2.	Robert Spalding, Storage Networks:The complete Reference,TataMcGraw,Edition-1, 2003,ISBN:0-07-053292-3.
3.	Richard Barker Paul Massiglia, Storage Area Network Essentials-A Complete Guide to Understanding and Implementing SANs, by, John Wiley Publisher,2008. ISBN:978-0471034452.
4.	IEEE/ACM/Elsevier/SpringerTransactions:Networking/Communicationand Information Networks / Cloud Computing / Network and Computer Applications / Transactions on Storage.

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 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.

CYBER SECURITY (Elective- E3)						
Course Code	**:**	**18MCE3E3**		**CIE Marks**	**:**	100
Credits	**:**	**L:T:P 4:0:0**		**SEE Marks**	**:**	100
Hours	**:**	**48L**		**SEE Duration**	**:**	**3 Hrs**

Course Learning Objectives (CLO):

Graduates shall be able to:

1. Understand fundamentals of cyber security
2. Analyze the nature and effect attacker techniques
3. Compare different types of exploitations
4. Apply methods to handle Malicious code efficiently
5. Develop Defense and analysis techniques

Unit–I	**9 Hrs**

Cyber Security Fundamentals: Network 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	**10 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	**10 Hrs**

Malicious Code: Self-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	**10 Hrs**

Defense and Analysis Techniques: Memory Forensics ,Why Memory Forensics Is Important ,Capabilities of Memory Forensics ,Memory Analysis Frameworks, Dumping Physical Memory ,Installing and Using Volatility, Finding Hidden Processes, Volatility Analyst Pack, Honeypots, Malicious Code Naming, Automated Malicious Code Analysis Systems, Passive Analysis ,Active Analysis ,Physical or Virtual Machines.

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 defense mechanism to handle attacks.

Reference Books:	
1	James Graham, Richard Howard, Ryan Olson- "Cyber Security Essentials" CRC Press, 2011 by Taylor and Francis Group. ISBN13: 978-1-4398-5126-5.
2	James A. Lewis, "Cyber security: turning national solutions into international cooperation" Volume 25, Number 4, 2003 by center for strategic and international studies, ISBN: 0-89206-426-9.
3	Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin "Cyber security: The Essential Body of Knowledge" 2012 by cengage learning, ISBN13:978-1-4354-8169-5.
4	* S. T. Zargar, J. Joshi and D. Tipper, "A Survey of Defense Mechanisms Against Distributed Denial of Service (DDoS) Flooding Attacks," in IEEE Communications Surveys & Tutorials, vol. 15, no. 4, pp. 2046-2069, Fourth Quarter 2013.doi: 10.1109/SURV.2013.031413.00127

Scheme of Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and assignments. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50 marks. A minimum of two assignments are given with a combination of two components among 1) solving innovative problems 2) seminar/new developments in the related course 3) Laboratory/field work 4) mini project.

Total CIE is 20+50+30=100 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.

INTERNSHIP						
Course Code	**:**	**18MCN32**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P 0:0:5**		**SEE Marks**	**:**	**100**
Hours/week	**:**	**10**		**SEE Duration**	**:**	**3 Hrs**

GUIDELINES FOR INTERNSHIP

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the process of applying engineering knowledge to produce product and provide services.

(2) Explain the importance of management and resource utilization

(3) Comprehend the importance of team work, protection of environment and sustainable solutions.

(4) Imbibe values, professional ethics for lifelong learning.

1) The duration of the internship shall be for a period of 8 weeks on full time basis between II semester final exams and beginning 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 or the M.Tech program 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 make a presentation on their internship activities in front of the departmental committee and only upon approval of the presentation should the student proceed to prepare and submit the hard copy of the internship final report. However interim or periodic reports and reports as required by the industry / organization can be submitted as per the format acceptable to the respective industry /organizations.
6) The reports shall be printed on bond paper – 80GSM, back to back print, with soft binding – A4 size with 1.5 spacing and times new roman font size 12.
7) The broad format of the internship final report shall be as follows
    - Cover Page
    - Certificate from College
    - Certificate from Industry / Organization
    - Acknowledgement
    - Synopsis
    - Table of Contents
    - Chapter 1 - Profile of the Organization – Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices,
    - Chapter 2 - Activities of the Department -
    - Chapter 3 – Tasks Performed – summaries the tasks performed during 8 week period
    - Chapter 4 – Reflections – Highlight specific technical and soft skills that you acquired during internship
    - References & Annexure

Course Outcomes:

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

CO1: Apply engineering and management principles
CO2: Analyze real-time problems and suggest alternate solutions
CO3: Communicate effectively and work in teams
CO4: Imbibe the practice of professional ethics and need for lifelong learning.

Scheme of Continuous Internal Evaluation (CIE):

A committee comprising of the Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide would review the presentation and the progress reports in two phases. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (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.

(1) Explanation of the application of engineering knowledge in industries 35%
(2) Ability to comprehend the functioning of the organization/ departments 20%
(3) Importance of resource management, environment and sustainability 25%
(4) Presentation Skills and Report 20%

Dissertation Phase 1						
Course Code	**:**	**18MCN33**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P 0:0:5**		**SEE Marks**	**:**	**100**
Hours	**:**	**10**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be carried out by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this 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, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life-long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase	Activity	Weightage
4th week	Topic approval along with Synopsis	20%
8th week	Literature survey with Problem Statement	20%
12th week	Motivation and Objectives	20%
15th week	Preliminary report for the approval of selected topic along with methodology.	40%

CIE Evaluation shall be done with marks distribution as follows:

- Selection of the topic 10%
- Literature review and framing of objectives 25%
- Defining the brief methodology along with the algorithm development/experimental setup 25%
- Presentation 20%
- Report writing 20%

Scheme for Semester End Evaluation (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.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Presentation 25%
4. Report 20%
5. Viva Voce 30%

SEMESTER IV						
Dissertation Phase II						
Course Code	**:**	**18MCN41**		**CIE Marks**	**:**	**100**
Credits	**:**	**L:T:P 0:0:20**		**SEE Marks**	**:**	**100**
Hours/Week	**:**	**40**		**SEE Duration**	**:**	**3 Hours**

Course Learning Objectives:

The students shall be able to

1. Understand the method of applying engineering knowledge to solve specific problems.
2. Apply engineering and management principles while executing the project
3. Demonstrate good verbal presentation and technical report writing skills.
4. Identify and solve complex engineering problems using professionally prescribed standards.

GUIDELINES

1. Major project will have to be done by only one student in his/her area of interest.
2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.
3. Allocation of the guides preferably in accordance with the expertise of the faculty.
4. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.
5. The standard duration of the project is for 16 weeks, however if the guide and the evaluation committee of the department, after the assessment feel that the work is insufficient and it has to be extended, then the student will have to continue as per the directions of the guide and the committee.
6. It is mandatory for the student to present his/her work in one of the international conferences or publish the research finding in a reputed unpaid journal with impact factor.

Course Outcomes:

After going through this 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, societal concerns
CO4: Synthesize self-learning, sustainable solutions and demonstrate life long learning

Scheme of Continuous Internal Examination (CIE)

Evaluation will be carried out in THREE Phases. The evaluation committee will comprise of: guide, two senior faculty members, one industry member and Head of the Department.

Phase II	Activity	Weightage
5th week	Review and refinement of Objectives and methodology.	20%
10th week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
15th week	Oral presentation, demonstration and submission of project report. Outcome and publication	40%

CIE Evaluation shall be done with marks distribution as follows:

- Review of formulation of objectives and methodology 10%
- Design and simulation/ algorithm development/experimental setup 25%
- Conducting experiments / implementation / testing / analysis 25%
- Demonstration & Presentation 20%

- Report writing 20%

Scheme for Semester End Evaluation (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.

1. Brief write-up about the project 5%
2. Formulation of Project Objectives & Methodology 20%
3. Experiments / Analysis Performed; Results & Discussion 25%
4. Report 20%
5. Viva Voce 30%

TECHNICAL SEMINAR						
Course Code	**:**	**18MCN42**		**CIE Marks**	**:**	**50**
Credits	**:**	**L:T:P 0:0:2**		**SEE Marks**		**50**
Hours/Week	**:**	**4**		**SEE Duration**		**30 min**

Course Learning Objectives (CLO):

The students shall be able to:

(1) Understand the technological developments in their chosen field of interest
(2) Explain the scope of work and challenges in the domain area
(3) Analyze these engineering developments in the context of sustainability and societal concerns.
(4) Improve his/her presentation skills and technical report writing skills

GUIDELINES

1) The presentation will have to be done by individual students.
2) The topic of the seminar must be in one of the thrust areas with in-depth review and analysis on a current topic that is relevant to industry or on-going research.
3) The topic could be an extension or complementary to the project
4) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.
5) Each student must submit both hard and soft copies of the presentation.

Course Outcomes:

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

CO1: Identify topics that are relevant to the present context of the world
CO2: Perform survey and review relevant information to the field of study.
CO3: Enhance presentation skills and report writing skills.
CO4: Develop alternative solutions which are sustainable

Scheme of Continuous Internal Evaluation (CIE): Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of Head of the Department / Associate Dean, Associate Professor, Assistant Professor and Guide. The evaluation criteria shall be as per the rubrics given below:

Scheme for Semester End Evaluation (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.

Rubrics for Evaluation:

1) Topic – Technical Relevance, Sustainability and Societal Concerns 15%
2) Review of literature 25%
3) Presentation Skills 35%
4) Report 25%