

**RashtreeyaSikshanaSamithi Trust**

**R.V. College of Engineering**

*(Autonomous Institution Affiliated to VisvesvarayaTechnologicalUniversity, Belagavi)*



**Department of Computer Science and Engineering**

**Master of Technology (M.Tech.)  
in**

**Computer Network Engineering**

**Scheme and Syllabus of  
Autonomous System w.e.f 2016**

## **R. V. College of Engineering, Bengaluru – 59**

*(An Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi)*

### **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**

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

#### **Program Educational Objectives (PEO)**

##### **M. Tech. in Computer Network Engineering (CNE) Program, graduates will be able to:**

- PEO 1.** Apply knowledge acquired in Computer Network Engineering to solve problems encountered in real time application using sustainable solution.
- PEO 2.** Demonstrate technical capability, leadership skills to innovate, communicate and collaborate to pursue career in Computer Network Engineering domain.
- PEO 3.** Engage in research and contribute to the growth of Computer Networks domain.
- PEO 4.** Analyze and solve societal issues related to Computer Network Engineering with focus on professional ethics and lifelong learning.

## **Program Outcomes (PO)**

**The graduates of M. Tech. in Computer Network Engineering (CNE) Program will be able to accomplish/attain:**

- PO 1. Scholarship of Knowledge** - Acquire in-depth knowledge of Computer Network Engineering to discriminate, evaluate, analyze and synthesize existing and new knowledge and to integrate the same for enhancement of knowledge with a global perspective.
- PO 2. Critical Thinking** - Analyze complex problems critically related to Computer Network Engineering domain, apply independent judgment for synthesizing information to make intellectual and/or creative advances with a research perspective.
- PO 3. Problem Solving** - Conceptualize and solve Computer Network Engineering problems effectively and arrive at feasible optimal solution, individually and in teams, to accomplish a common goal considering public health and safety, cultural, societal and environmental factors.
- PO 4. Research Skill** - Extract and analyze information through literature survey for solving problems by applying research methodologies, techniques, tools and design, conduct experiments, analyze and interpret data, demonstrate higher order skills and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in Computer Network Engineering domain.
- PO 5. Usage of modern tools** - Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.
- PO 6. Collaborative and Multidisciplinary work** - Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.
- PO 7. Project Management and Finance** - Demonstrate knowledge and understanding of Computer Network Engineering, management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective

disciplines and multidisciplinary environments after consideration of economic and financial factors.

- PO 8. Communication-** Communicate with Computer Network Engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend, make effective presentations and to write effective reports by adhering to appropriate standards.
- PO 9. Life-long Learning** - Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
- PO 10. Ethical Practices and Social Responsibility** - Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
- PO 11. Independent and Reflective Learning** - Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes with or without depending on external feedback

**Program Specific Criteria for M. Tech. in Computer Network Engineering (CNE)  
Professional Bodies: IEEE-CS, ACM**

The M.Tech program in Computer Network Engineering prepares the students for career in networking domain. The curriculum emphasizes courses on Mathematics and Statistics, Humanities, Ethics and Professional Practice, Information and Network Security, Computer Networks, Distributed Systems, Client Server Communication along with elective courses. The program enables students in problems solving, critical thinking and communication skills with focus on team work.

**Program Specific Outcomes (PSO)**

**The graduates of M. Tech. in Computer Network Engineering (CNE) will be able to:**

- PSO 1.** Design and implement solutions for solving real world problems in wired and wireless computer networks.
- PSO 2.** Acquire skills to operate, design, manage and resolve issues related to large computer networks, telecommunication networks and resource sharing applications.

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FIRST SEMESTER								
Sl. No	Course Code	Course Title	BoS	CREDIT ALLOCATION				Total Credits
				Lecture L	Tutorial T	Practical P	Self Study S	
1	<b>16MEM11R</b>	Research Methodology	IM	3	1	0	0	4
2	<b>16MAT12A</b>	Probability Statistics and Queuing	MA	4	0	0	0	4
3	<b>16MCN13</b>	Advances in Computer Networks	CS	4	0	1	0	5
4	<b>16MCN14</b>	Information and Network Security	CS	4	0	0	1	5
5	<b>16MCN15x</b>	Elective -1	CS	4	0	0	0	4
6	<b>16HSS16</b>	Professional Skill Development	HSS	0	0	2	0	2
		Total		<b>19</b>	<b>1</b>	<b>3</b>	<b>1</b>	<b>24</b>

Elective -1			
<b>16MCN151</b>	Wireless Adhoc and Sensor Networks	<b>16MCN152</b>	Distributed Systems

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SECOND SEMESTER								
Sl. No	Course Code	Course Title	BoS	CREDIT ALLOCATION				Total Credits
				Lecture L	Tutorial T	Practical P	Self Study S	
1	16MEM21P	Project Management	IM	3	1	0	0	4
2	16MCN22	Wireless Communications	CS	4	0	1	0	5
3	16MCN23x	Elective-2	CS	4	0	0	0	4
4	16MCN24x	Elective-3	CS	4	0	0	0	4
5	16MCN25x	Elective-4	CS	4	0	0	0	4
6	16MCN26	Minor Project	CS	0	0	5	0	5
		<b>Total</b>		<b>19</b>	<b>1</b>	<b>6</b>	<b>0</b>	<b>26</b>

Elective-2			
16MCE231/16MCN231	Cloud Computing Technology	16MCN232	Network Programming
Elective-3			
16MCN241	Switching and Routing Techniques	16MCN242	Data Management Essentials
Elective-4			
16MCN251	Analysis of Computer Networks	16MCN252	Optical Network Technology

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THIRD SEMESTER								
Sl. No	Course Code	Course Title	BoS	CREDIT ALLOCATION				Total Credits
				Lecture L	Tutorial T	Practical P	Self Study S	
1	16MCN31	Network Management	CS	4	0	1	0	5
2	16MCN32x	Elective-5	CS	4	0	0	0	4
3	16MCN33x	Elective-6	CS	4	0	0	0	4
4	16MCN34x	Elective-7	CS	4	0	0	0	4
5	16MCN35	Internship/ Industrial Training	CS	0	0	3	0	3
6	16MCN36	Technical Seminar	CS	0	0	2	0	2
		<b>Total</b>		<b>16</b>	<b>0</b>	<b>6</b>	<b>0</b>	<b>22</b>

Elective -5			
16MCN321	Software Defined Systems	16MCN322	Storage Area Network Management
Elective – 6			
16MCN331	Mobile Computing	16MCN332	Internetworking Technologies
Elective-7			
16MCE341/16MCN341	Foundations for Internet of Things	16MCN342	Client Server Programming

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<b>FOURTH SEMESTER</b>								
<b>Sl. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>BoS</b>	<b>CREDIT ALLOCATION</b>				<b>Total Credits</b>
				<b>Lecture L</b>	<b>Tutorial T</b>	<b>Practical P</b>	<b>Self Study S</b>	
1	<b>16MCN41</b>	Major Project	CS	0	0	26	0	26
2	<b>16MCN42</b>	Seminar	CS	0	0	2	0	2
		<b>Total</b>		<b>0</b>	<b>0</b>	<b>28</b>	<b>0</b>	<b>28</b>



<b>NETWORK MANAGEMENT (Theory and Practice)</b>						
<b>Course Code</b>	:	<b>16MCN31</b>		<b>CIE Marks</b>	:	<b>100+50</b>
<b>Hrs/Week</b>	:	<b>L: T: P: S</b>	<b>4:0:1:0</b>	<b>SEE Marks</b>	:	<b>100+50</b>
<b>Credits</b>	:	<b>5</b>		<b>SEE Duration</b>	:	<b>3+3 Hrs</b>
<b>Course Learning Objectives:</b>						
Graduates shall be able to						
<ol style="list-style-type: none"> <li>1. Learn and explain the need for Network Management.</li> <li>2. Understand the concepts and architecture behind standards used for network management.</li> <li>3. Discover the concepts and terminology associated with SNMP and TMN.</li> <li>4. Describe the management principles, practices and technologies for managing Networks, systems applications &amp; services.</li> </ol>						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Introduction</b>						
Analogy of telephone network management, Data(computer) and telecommunication networks, Distributed Computing environments, TCP/IP based networks: The Internet and Intranets, Communications Protocols and standards, Protocol layers and services, The importance of topology, Centrally Managed Network Issues, Some common network problems, Goals, organization and functions, Goal of Network Management, Network Provisioning, Network operations and the NOC, Network Installation and Maintenance, Network management Perspectives, Future of network management.						
<b>Unit – II</b>						<b>10 Hrs</b>
<b>Basic Foundations: Standards, Models, and Language</b>						
Introduction, Network Management Standards, Network Management Models, Organizational Model, Information model, Management Information Tree (MIT), Managed Object Perspective, Communication Model, Abstract Syntax Notation One: Terminology, symbols and conventions, Objects and Data Types, Object Names, An example of ASN.1 from ISO 8824, Encoding structure, Macros, Functional Model						
<b>Unit – III</b>						<b>10 Hrs</b>
<b>SNMPv1 Network Management: Organization and Information Models</b>						
Managed Network, History of SNMP Management, Internet Organization and Standards, Organizations, Internet Documents, The SNMP Model, The Organization Model, System Overview, Information model, Introduction, The structure of Management Information, Managed Objects, Management information base. SNMP Communication Model, The SNMP Architecture, The Administrative Model, SNMP Protocol Specifications, SNMP Operations, The SNMP MIB Group, Functional Model.						
<b>Unit – IV</b>						<b>10 Hrs</b>
<b>SNMP Management: SNMPv3</b>						
SNMPv3 Key features, Architecture, SNMPv3 applications, SNMPv3 Management Information base, Security, SNMPv3 User based Security Model, Access Control, SNMP Management: RMON, RMON SMI and MIB, ROM1 and ROM2, ATM Remote Monitoring						
<b>Unit-V</b>						<b>10 Hrs</b>
<b>Network Management Applications</b>						
Configuration Management, Network Provisioning, Inventory Management, Network Topology, Fault Management, Fault Detection, Fault Location and Isolation Techniques Performance Management Performance Management, Performance Metrics, Data Monitoring, Problem Isolation, Performance Statistics, Event Correlation Techniques, Rule-						

Based Reasoning, Model-Based Reasoning, Case-Based Reasoning, State Transition Graph Model, Finite State Machine Model. Security Management Policies and Procedures, Security Breaches and the resources needed to prevent them, Firewalls, Cryptography, Authentication and Authorization, Client/Server Authentication Systems, Message Transfer Security, Protection of Networks from Virus Attacks, Accounting Management, Report Management, Policy-Bases Management, Service Level Management.

\*Automation of IT maintenance procedures for IT service management.

**Unit – VI (Lab Component)**

**12 Hrs**

***Implement Programs from 1 to 5 using NS2, Wireshark or equivalent tool.***

1. Explore the following features of Wireshark: Filters, Flow Graphs (TCP), statistics, and protocol hierarchies.
2. Create several example files for your Apache web server to serve. Configure your web server and test your web server by accessing the files. Capture the packets and observe the log file. Login to another computer in the lab, capture and investigate the data exchanged between client and web server.
3. Explore the managed objects such as hard disk, access point, IP and TCP that are defined in MIB files and know their numerical OID, textual descriptor and MIB hierarchy.
4. Explore the ping commands for managing network to identify the routers accessible to your PC within a lab and determine a list of other machines accessible from your PC.
5. Locate a web-based Trace-route site and trace the route from that site to your PC.

***Additional Programs***

1. Design an optimum network for the classroom which can have seating arrangements for 10 students. Each node in the classroom should be well connected to the Internet, Server and Gateway. Simulate the design configuration using simulation tool.
2. Design a topology for the following network components as given in the table below. Simulate the topology, configure all the devices and verify the connectivity between devices.

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/1	192.168.0.1	255.255.255.0	N/A
	S0/0/1	10.1.1.1	255.255.255.252	N/A
R3	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0(DCE)	10.1.1.2	255.255.255.252	N/A
	LAN 0	209.165.200.225	255.255.255.254	N/A
	LAN 1	198.133.219.1	255.255.255.0	N/A
PC-A	NIC	192.168.0.10	255.255.255.0	192.168.0.1
PC-C	NIC	192.168.1.10	255.255.255.0	192.168.1.1

**Course Outcome:**

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

- CO1. Explore and apply various Network Management Protocols to manage practical networks.
- CO2. Identify and describe the different types of network management protocols.
- CO3. Analyze the issues and challenges pertaining to management of emerging network

technologies. CO4. Identify the various components of network and formulate the scheme for managing networks.
<p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Mani Subramanian, "Network Management – Principles &amp; Practice", 2<sup>nd</sup> Edition, Person Education Publication, 2010, <b>ISBN-10:</b> 8131727599, <b>ISBN-13:</b> 978-8131727591</li> <li>2. J. Richard Burke, "Network management Concepts and Practices: a Hands-On Approach", 1<sup>st</sup> Edition, PHI, 2008, <b>ISBN-10:</b> 8131718492, <b>ISBN-13:</b> 978-8131718490</li> <li>3. Stephen B. Morris, "<i>Network management</i>", 1<sup>st</sup> Edition, Pearson Education, 2008, <b>ISBN-10:</b> 0131011138, <b>ISBN-13:</b> 978-0131011137</li> <li>4. *Technical Journal papers, white papers, manuals.</li> </ol>
<p><b>Scheme of Continuous Internal Evaluation (CIE) for Theory</b> CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.</p>
<p><b>Scheme of Continuous Internal Evaluation (CIE) for Practical</b> CIE for the practical courses will be based on the performance of the student in the laboratory, every week. The laboratory records/reports will be evaluated for 40 marks. One test will be conducted for 10 marks. The total marks for CIE (Practical) will be for 50 marks.</p>
<p><b>Scheme of Semester End Examination (SEE) for Theory</b> 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 question from each unit. The total marks for SEE (Theory) will be 100 marks.</p>
<p><b>Scheme of Semester End Examination (SEE) for Practical</b> SEE for the practical courses will be based on conducting the experiments and proper results for 40 marks and 10 marks for viva-voce. The total marks for SEE (Practical) will be 50 marks.</p>

### Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	H	-	L	-	-	-	-	L	-	-	-
<b>CO2</b>	H	H	M	-	M	-	-	-	-	-	-
<b>CO3</b>	-	M	M	-	-	-	-	L	L	-	L
<b>CO4</b>	M	-	-	-	M	-	-	-	L	-	-

	PSO1	PSO2
<b>CO1</b>	M	-
<b>CO2</b>	-	L
<b>CO3</b>	-	-
<b>CO4</b>	M	-

<b>SOFTWARE DEFINED NETWORKS</b> (Elective -5 )						
<b>Course Code</b>	:	<b>16MCN321</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>4</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO):</b> Graduates shall be able to						
<ol style="list-style-type: none"> <li>1. Explore the emerging definitions, protocols, and standards for SDN</li> <li>2. Building SDN frame framework using different components</li> <li>3. Extending the SDN concepts for service virtualization</li> <li>4. Designing different applications using SDN</li> </ol>						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Introduction. Centralized and Distributed Control and Data Planes.</b> 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						
<b>Unit – II</b>						<b>10Hrs</b>
<b>OpenFlow.</b> Introduction - Wire Protocol, Replication, FAWG (Forwarding Abstraction Workgroup), Config and Extensibility, Architecture. Hybrid Approaches - Ships in the Night, Dual Function Switches. <b>SDN Controllers.</b> 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.						
<b>Unit – III</b>						<b>10 Hrs</b>
<b>Network Programmability.</b> 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.						
<b>Unit – IV</b>						<b>10 Hrs</b>
<b>Network Function Virtualization.</b> 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/LineRate, Platform Virtualization. Add OVS, OVN, OPNFV, Openstack						
<b>Unit – V</b>						<b>10 Hrs</b>
<b>Building an SDN Framework.</b> 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 <b>Use Cases for Bandwidth Scheduling, Manipulation, and Calendaring.</b> Introduction. Bandwidth Calendaring - Base Topology and Fundamental 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.	Paul Goransson and Chuck Black, "Software Defined Networks: A Comprehensive Approach", 2 <sup>nd</sup> Edition, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844
2.	Particia A. Morreale and James M. Anderson," Software defined networks: Design and Deployment", 1 <sup>st</sup> Edition, CRC Press, December 2014, ISBN: 9781482238631
3.	FeiHu,"Network Innovation through OpenFlow and SDN: Principles and Design", 1 <sup>st</sup> edition, CRC Press, 2014, ISBN-10: 1466572094.
4.	Thomas D. Nadeau, Ken Gray ,"SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies", 1 <sup>st</sup> Edition, O'Reilly Media, August 2013, ISBN: 978-1-4493-4230-2, ISBN 10:1-4493-4230-2.
* 5	Technical Journal papers, white papers, manuals.

### Scheme of Continuous Internal Evaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Semester End Examination (SEE)

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

### Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	-	L	-		-	-	L	-	-	-
CO2	H	H	M	-	M	-	-	-	-	-	-
CO3	-	M	M	-	L	-	-	L	L	-	L
CO4	-	H	H	-	M	-	-	-	L	-	-

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	M	
<b>CO2</b>	M	
<b>CO3</b>		M
<b>CO4</b>		M

<b>STORAGE AREA NETWORK MANAGEMENT (ELECTIVE -5)</b>					
<b>Course Code</b>	:	<b>16MCN322</b>		<b>CIE Marks</b>	: <b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	: <b>100</b>
<b>Credits</b>	:	<b>4</b>		<b>SEE Duration</b>	: <b>3 Hrs</b>
<b>Course Learning Objectives (CLO):</b>					
Graduates shall be able to:					
<ol style="list-style-type: none"> <li>1. Explore the fundamentals of storage centric and server centric systems in data center infrastructure and its associated elements.</li> <li>2. Compare the metrics used for designing storage area networks along with third platform technologies such as cloud, big-data, social media and mobile computing.</li> <li>3. Illustrate the RAID concepts and evaluate various types of intelligent storage systems and their deployment.</li> <li>4. Use the concepts of backups, mainly remote mirroring for data center.</li> <li>5. Describe the storage area network technology, key processes for managing storage infrastructure.</li> </ol>					
<b>Unit-I</b>					<b>10Hrs</b>
<b>Introduction:</b> Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access.					
<b>Intelligent storage subsystems:</b> Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems. High-end Storage Systems, Mid-range Storage System					
<b>Unit-II</b>					<b>10 Hrs</b>
<b>I/O Techniques:</b> The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage.					
<b>Network Attached Storage:</b> The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.					
<b>File System and NAS:</b> Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fiber Channel and NAS.					
<b>Unit-III</b>					<b>10 Hrs</b>
<b>Storage virtualization:</b> Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.					
<b>Unit-IV</b>					<b>10 Hrs</b>
<b>SAN Architecture and Hardware devices:</b> Overview, Creating a Network for storage; SAN Hardware devices; The fiber channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.					
<b>Software Components of SAN:</b> The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.					
<b>Unit-V</b>					<b>10 Hrs</b>
<b>Management of Storage Network:</b> System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Storage Management Initiative Specification CMIP and DMI, Optional Aspects of the Management of Storage Networks.					



**Course Outcomes:**

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

**CO1:** Identify the need for data center infrastructure and its elements

**CO2:** Analyze the knowledge of key processes for managing a storage infrastructure

**CO3:** Apply various storage networking technologies for their deployment.

**CO4:** Evaluate various types of intelligent storage systems and their deployment.

**Reference Books:**

1	Ulf Troppens, Rainer Erkens and Wolfgang Muller: "Storage Networks Explained", Wiley India 2 <sup>nd</sup> Edition, 2009, ISBN:978-81-265-1832-6
2	Robert Spalding: "Storage Networks The Complete Reference", Tata McGraw Hill, 1 <sup>st</sup> Edition 2003, Reprint 2009, 978-0-07-053292-2.
3	Marc Farley: "Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems", Vol-1, Kindle 1 <sup>st</sup> Edition, 2005, ISBN:10:1-58705-162-1
4	Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 1 <sup>st</sup> Edition 2006, Reprint 2008, ISBN: 978-0-471-03445-2.
5	G.Somasundaram, Alok Shrivastava: "Information Storage and Management", John Wiley, India, 2 <sup>nd</sup> Edition, 2009, ISBN: 978-04-702-9421-5.

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

CIE will consist of TWO Tests, TWO Quizzes and ONE self-study. The test will be for 30 marks each and the quiz for 10 marks each. The self-study will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	<b>H</b>	<b>M</b>	<b>M</b>	-	-	-	-	-	-	<b>M</b>	<b>H</b>
<b>CO2</b>	<b>H</b>	<b>M</b>	<b>L</b>	-	-	-	-	-	<b>L</b>	<b>M</b>	-
<b>CO3</b>	<b>M</b>	<b>M</b>	<b>M</b>	-	-	<b>L</b>	<b>L</b>	-	<b>L</b>	<b>M</b>	<b>L</b>
<b>CO4</b>	<b>M</b>	<b>M</b>	<b>L</b>	-	-	-	<b>L</b>	-	<b>L</b>	<b>M</b>	<b>L</b>



**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	M	M
<b>CO2</b>	H	M
<b>CO3</b>	-	L
<b>CO4</b>	-	-

**MOBILE COMPUTING**

(ELECTIVE - 6)

<b>Course Code</b>	: 16MCN331		<b>CIE Marks</b>	: 100
<b>Hrs/Week</b>	: L:T:P:S	4:0:0:0	<b>SEE Marks</b>	: 100
<b>Credits</b>	: 4		<b>SEE Duration</b>	: 3 Hrs

**Course Learning Objectives (CLO):**

Graduates shall be able to

1. Explore various propagation methods, channel models, capacity calculations, antennas and multiple user techniques used in the mobile communication.
2. Summarize the operation of CDMA, GSM, Mobile IP, WiMax networks
3. Differentiate between various mobile Operating Systems
4. Use various Markup Languages to build web applications
5. Program for CLDC, MIDlet model and security concerns

**Unit – I****10 Hrs**

**Mobile Computing Architecture:** Architecture for Mobile Computing, 3-tier Architecture, Design Considerations for Mobile Computing- Client context manager, Context aware systems  
**Wireless Networks(Cellular):** Global Systems for Mobile Communications, GSM Architecture, Entities, Call routing in GSM, PLMN Interface, GSM Addresses and Identities, Network Aspects in GSM, Mobility Management, CDMA versus GSM, Wireless Data, Third Generation Networks, 3G specific applications- VHE, PCN, USIM,ENUM;

**Unit – II****10 Hrs**

**Mobile Client:** Mobile handset hardware overview, features of Mobile phones, Design Constraints in applications for handheld devices;  
**Mobile IP Network Layer:** Packet delivery and handover management, Location management, Registration, tunneling and encapsulation, Generic Routing Encapsulation (GRE), Route optimization;  
 GPRS Tunneling Protocol, Introduction to GTP headers, PMIP

**Unit – III****10 Hrs**

**Data synchronization in mobile computing systems:** Synchronization, Synchronization software for mobile devices, Synchronization protocols, SyncML, Sync4J, SMIL

**Unit – IV****10 Hrs**

**Mobile devices and server management:** mobile agent, application server, Gateways, Portals, Service discovery, device management, Mobile File systems, security

**Unit – V****10 Hrs**

**\*Next generation networks:** 4G LTE network architecture, Interfaces, Radio resource allocation based on a packet scheduler;  
 GPRS Tunneling Protocol, Introduction to GTP headers, PMIP;  
**Mobile Transport Layer:** Indirect TCP, Snooping TCP, Mobile TCP, Transaction oriented TCP, TCP over LTE and 4G, TCP/IP stack for 5G, Transport protocol for 5G network;  
**Web sockets** for IoT applications, SPDY, Radio level security, IPSec

**Expected Course Outcomes:**

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

**CO1:** Explore the mobile computing architecture and techniques of wireless communication.

**CO2:** Apply the networking concepts in the design and identification of mobile devices

**CO3:** Analyze the capabilities of available Mobile OS for various needs

**CO4:** Develop secure mobile applications using object oriented languages

**Reference Books:**

1.	Asoke K. Talukder, Hasan Ahmed, Roopa R. Yavagal, "Mobile Computing, Technology, Applications and Service Creation", 2 <sup>nd</sup> Edition, Tata McGraw Hill, 2010, ISBN 13: 9780070144576
2.	Raj Kamal: Mobile Computing, Oxford University Press, 2007, ISBN-13: 9780195686777
3.	Jochen Schiller, Mobile Communications, 2 <sup>nd</sup> Edition, Pearson Education, 2009, ISBN: 9788131724262.
4.	Jochen Schiller, Mobile Communications, 2 <sup>nd</sup> Edition, Pearson Education, 2009, ISBN:9788131724262
5.	*Technical Journal papers, white papers, manuals.

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

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination(SEE):**

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO 1</b>	M	L	H	M	H	L	L	L	L	-	-
<b>CO 2</b>	M	M	H	M	M	L	L	L	L	-	-
<b>CO 3</b>	-	-	-	M	M	M	L	L	-	-	-
<b>CO 4</b>	-	-	H	H	H	-	M	-	M	M	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
<b>CO1</b>	L	H
<b>CO2</b>	M	H
<b>CO3</b>	-	-
<b>CO4</b>	M	-

<b>INTERNETWORKING TECHNOLOGIES (ELECTIVE -6)</b>						
<b>Course Code</b>	:	<b>16MCN332</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>4</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives:</b>						
Graduates shall be able to						
<ol style="list-style-type: none"> <li>1. Describe the functionalities of networks; identify major components and their functionalities.</li> <li>2. Familiarize with the TCP/IP protocol suite</li> <li>3. Explore the working of different protocols used in each layer of TCP/IP.</li> <li>4. Study the implementation of TCP/IP protocols.</li> </ol>						
<b>Unit-I</b>						<b>10 Hrs</b>
<b>Introduction and Overview:</b> The motivation for internetworking, internet services						
<b>Review of Underlying Network Technologies:</b> Two approaches to network communication, Wide area and LAN, Ethernet Technology, switched Ethernet.						
<b>Internetworking Concept and Architectural Model:</b> Introduction, Application-Level Interconnection, Network-level interconnection, properties of the internet, Internet architecture, interconnection through IP routers, The User's view						
<b>Unit-II</b>						<b>10Hrs</b>
<b>Mapping Internet Addresses to Physical Addresses(ARP):</b> Introduction, The Address Resolution Problem, Two types of Physical Addresses, Resolution through Direct mapping, Resolution through Dynamic binding, the address resolution cache, ARP cache timeout, ARP refinements, relationship of ARP to other protocols, ARP Implementation, ARP Encapsulation and Identification, ARP protocol format, Automatic ARP cache Revalidation, Reverse Address Resolution(RARP).						
<b>Internet Protocol: Error and Control Messages(ICMP)</b> –The Internet Control Message Protocol, Error Reporting Vs. Error correction, ICMP message delivery, ICMP message format, testing destination reachability and status(ping), Echo request and reply message format, source quench format, route change requests from routers, older ICMP messages no longer needed.						
<b>Routing Architectures:</b> Origin of Routing Tables, forwarding with partial information, original internet architectures and cores, Beyond the Core architecture to Peer backbones, Automatic route propagation, Bellman-Ford routing, reliability and routing protocols.						
<b>Unit-III</b>						<b>10 Hrs</b>
<b>Classless and Subnet Address Extensions:</b> Proxy ARP, subnet addressing, flexibility in subnet address assignment, variable length subnets, implementation of subnets with masks, subnet mask representation, The subnet forwarding algorithm, A Unified forwarding algorithm, maintenance of subnet masks, broadcasting to subnets, Anonymous point-to-point networks, classless addressing and supernetting, CIDR address blocks and Bit masks, address blocks and CIDR notation, CIDR blocks reserved for Private networks.						
<b>Unit-IV</b>						<b>10 Hrs</b>
<b>Routing Between Peers(BGP):</b> Introduction, Routing update protocol scope, determining a practical limit on group size, A fundamental idea: extra hops, autonomous system concept, exterior gateway protocols and reachability, BGP characteristics, BGP functionality and message types, BGP message header, BGP OPEN message, BGP UPDATE message, compressed mask-address pairs, BGP path attributes, BGP KEEPALIVE message, information from the receiver's perspective, the key restriction of exterior gateway protocols, the internet routing architecture, BGP NOTIFICATION message.						
<b>Network Management (SNMP):</b> The level of Management Protocols, Architectural Model,						

Protocol Framework, The structure of Management Information, Structure and representation of MIB object names, SNMP, SNMP message format, New features in SNMP3.	
<b>Unit–V</b>	<b>09Hrs</b>
<p><b>Private Network Interconnection(NAT, VPN):</b> Private and Hybrid Networks, VPN addressing and Routing, Extending VPN technology to individual hosts, the VPN with private addresses, Network Address Translation(NAT), NAT translation table creation, multi-address NAT, Port-mapped NAT, Interaction between NAT and ICMP, Interaction between NAT and applications.</p> <p><b>Internet Security and Firewall Design:</b> Introduction, IPsec Authentication header, Security association, IPsec Encapsulation security payload, Authentication and Mutable header fields, Required security Algorithms, secure sockets(SSL and TLS), firewalls and internet access, multiple connections and weakest links, firewall implementation and packet filters, security and packet filter specification, the consequence of restricted access for clients, stateful firewalls, content protection and proxies, monitoring and logging.</p> <p>*SNMPV3: A SECURITY ENHANCEMENT FOR SNMP, * Network Virtualization</p>	
<p><b>Course Outcomes:</b> After going through this course the student will be able to:</p> <p><b>CO1:</b> Examine the concepts and techniques that have been used to design and implement the TCP/IP Internet.</p> <p><b>CO2:</b> Analyse the issues that are driving the development of new protocols to broaden and enhance the operation of the Internet.</p> <p><b>CO3:</b> Apply the routing technology for the development of Voice over IP (VoIP) applications.</p> <p><b>CO4:</b> Examine interconnection of networks, IP protocol and its routing.</p>	
<b>Reference Books:</b>	
1	Douglas E. Comer, 'Internetworking with TCP/IP' Volume 1', Third Edition, Prentice Hall, 2013, ISBN-81-203-2998-8.
2	Andrew S.Tananbaum, 'Computer Networks', Fourth Edition, Prentice Hall of India/Pearson Education, 2003, ISBN-13: 978-0130661029.
3	Behrouz A. Forouzan, 'TCP/IP Protocol Suite', Second Edition, Tata McGraw Hill, 2000, ISBN 978-0-07-337604-2—ISBN 0-07-337604-3.
4	William Stallings, 'Data and Computer Communications', Seventh Edition, Prentice Hall of India/Pearson Education, 2003, ISBN-10: 0133506487.
5	* Refereed Journal/ White papers/ Manuals/ Tutorials

### Scheme for Continuous Internal Evaluation (CIE):

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

### Scheme of Semester End Examination (SEE):

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

### Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>CO1</b>	H	L	M	L	L	-	-	L	L	M	-
<b>CO2</b>	M	L	M	L	L	L	-	-	L	L	-
<b>CO3</b>	M	M	L	M	L	L	L	-	L	L	L
<b>CO4</b>	M	M	M	L	L	-	-	-	L	L	L

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	L	M
<b>CO2</b>	M	-
<b>CO3</b>	-	M
<b>CO4</b>	-	M

<b>FOUNDATIONS FOR INTERNET OF THINGS (ELECTIVE - 7)</b>					
<b>Course Code</b>	<b>:</b>	<b>16MCE341/16MCN341</b>		<b>CIE Marks</b>	<b>:</b> <b>100</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	<b>:</b> <b>100</b>
<b>Credits</b>	<b>:</b>	<b>4</b>		<b>SEE Duration</b>	<b>:</b> <b>3 Hrs</b>
<b>Course Learning Objectives (CLO):</b>					
Graduates shall be able to					
<ol style="list-style-type: none"> <li>1. Acquire knowledge on basic issues, policy and challenges in IoT</li> <li>2. Illustrate mechanism and key technologies in IoT for different applications</li> <li>3. Use appropriate technologies for efficient communication across smart devices</li> <li>4. Explore connectivity mechanisms and application protocols in IoT</li> </ol>					
<b>Unit – I</b>					<b>10Hrs</b>
<b>OVERVIEW AND MOTIVATIONS</b> , Examples of Applications, IPV6 Role, Areas of Development and Standardization, Scope of the Present Investigation. Internet of Things Definitions and frameworks-IoT Definitions, IoT Frameworks, Basic Nodal Capabilities. Internet of Things Application Examples Overview, Smart Metering/Advanced Metering Infrastructure-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad Other Applications.					
<b>Unit – II</b>					<b>10 Hrs</b>
<b>FUNDAMENTAL IOT MECHANISM AND KEY TECHNOLOGIES</b> -Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer, ETSI M2M, Third Generation Partnership Project Service Requirements for Machine-Type Communications, CENELEC, IETF IPv6 Over Lowpower WPAN, Zigbee IP(ZIP), IPSO					
<b>Unit – III</b>					<b>08 Hrs</b>
<b>LAYER ½ CONNECTIVITY:</b> Wireless Technologies for the IoT-WPAN Technologies for IoT/M2M, Cellular and Mobile Network Technologies for IoT/M2M, Layer 3 Connectivity: IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6.					
<b>Unit – IV</b>					<b>10Hrs</b>
<b>Application Protocols</b> - Common Protocol, Web service protocols, MQ telemetry transport for sensor networks (MQTT-S), ZigBee compact application protocol (CAP), Service discovery, Simple Network Management Protocol (SNMP), Real-time transport and sessions, Industry-specific protocols.					
<b>Unit – V</b>					<b>12 Hrs</b>
<b>Wireless Embedded Internet</b> -6LoWPAN, 6LoWPAN history and standardization, Relation of 6LoWPAN to other trends, Applications of 6LoWPAN, Example: facility management, The 6LoWPAN Architecture, 6LoWPAN Introduction, The protocol stack, Link layers for 6LoWPAN, Addressing, Header format, Bootstrapping, Mesh topologies, Internet integration * <b>6LoWPAN-based Wireless Home Automation:</b> Link Layer Coexistence, Routing Consideration, Security, Power Consumption, System Development, 6LoWPAN Home Automation Network, Home Gateway, Home Node, Evaluation and Management, Secure System,					



Energy Management.

**Course Outcomes:**

After going through this course the student will be able to

CO1: Acquire knowledge of different applications of IOT in real time scenarios

CO2: Apply key technology for efficient communication and connectivity

CO3: Analyze different applications and its role in IoT

CO4: Design applications for efficient resource utilization using key technologies

**Reference Books:**

1.	Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", student edition, Wiley, 2013. ISBN: 978-1-118-47347-4.
2.	Zach Shelby Sensinode, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", 1 <sup>st</sup> Edition, John Wiley & Sons Ltd, 2009, ISBN 9780470747995
3.	Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands on Approach", 1 <sup>st</sup> Edition, Universities Press., 2015, ISBN: 978-81-7371-954-7
4.	Michael Miller, "The Internet of Things", First Edition, Pearson, 2015. ISBN-13: 978-0-7897-5400-4
5.	Claire Rowland, Elizabeth Goodman, "Designing Connected Products", First Edition, O'Reilly, 2015. ISBN=0636920031109
6.	*Technical Journal Papers, White papers, Manuals.

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

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	L	L	M	-	-	-	L	L	L
CO2	L	L	L	M	M	-	-	-	L	L	L
CO3	M	M	M	M	M	-	L	L	L	M	L
CO4	M	H	M	M	H	-	L	L	M	M	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	L	-
CO2	M	L

<b>CO3</b>	M	L
<b>CO4</b>	M	M

<b>CLIENT SERVER PROGRAMMING</b> (Elective - 7)						
<b>Course Code</b>	:	<b>16MCN342</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>4:0:0:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>4</b>		<b>SEE Duration</b>	:	<b>3 Hrs</b>
<b>Course Learning Objectives (CLO):</b>						
Graduates shall be able to						
<ol style="list-style-type: none"> <li>1. Explore the various Client-Server architecture and their applications.</li> <li>2. Demonstrate Socket programming concepts in client server programming.</li> <li>3. Explore various application protocols in Client Server communications.</li> <li>4. Investigate the next generation IP.</li> </ol>						
<b>Unit – I</b>						<b>10 Hrs</b>
<b>Client-Server Model of Interaction:</b> Introduction, The Client-Server Model, A Simple Example: UDP Echo Server, Time And Date Service, The Complexity of Servers, Broadcasting A Request, Alternatives To The Client-Server Model.						
<b>The Socket Interface:</b> Introduction, The UNIX I/O Paradigm And Network, Adding Network I/O to UNIX, The Socket Abstraction, Creating A Socket, Socket Inheritance And Termination, Specifying A Local Address, Connecting Sockets To Destination Addresses, Sending Data Through A Socket, Receiving Data Through A Socket, Obtaining Local And Remote Socket Addresses						
<b>Unit – II</b>						<b>10 Hrs</b>
<b>The Socket Interface:</b> Obtaining And Setting Socket Options, Specifying A Queue Length For A Server, How A Server Accepts Connections, Servers That Handle Multiple Services, Obtaining And Setting Host Names, Obtaining And Setting The Internal Host Domain, Socket Library Calls, Network Byte Order Conversion Routines, IP Address Manipulation Routines, Accessing The Domain Name System, Obtaining Information About Hosts, Obtaining Information About Networks, Obtaining Information About Protocols, Obtaining Information About Network Services, An Example Client, An Example Server.						
<b>Unit – III</b>						<b>10Hrs</b>
<b>Applications I:</b> Remote Login(TELNET, SSH), File Transfer and Access(FTP, TFTP, NFS), Electronic Mail(SMTP)						
Remote Interactive Computing, TELNET Protocol, Accommodating Heterogeneity, Passing Commands That Control The Remote Side, Forcing The Server To Read A Control Function, TELNET Options, TELNET Option Negotiation, Secure Shell (SSH), Other Remote Access Technologies.						
Remote File Access, Transfer and Storage Networks, On-line Shared Access, Sharing By File Transfer, FTP: The Major TCP/IP File Transfer Protocol, FTP Features, FTP Process Model, TCP Port Numbers and Data Connections, The User's View Of FTP, Anonymous FTP, Secure File Transfer(SSL-FTP, Scp, Sftp), TFTP, NFS, Implementation of NFS(RPC and XDR).						
Simple Mail Transfer Protocol (SMTP), Mail Retrieval And Mailbox Manipulation Protocols.						
<b>Unit – IV</b>						<b>10Hrs</b>
<b>Applications II:</b> World Wide Web (HTTP), Voice And Video Over IP (RTP)						
Importance Of The Web, Architectural Components, Uniform Resource Locators, An Example						

Document, Hypertext Transfer Protocol, HTTP GET Request, Error Messages, Persistent Connections And Lengths, Data Length And Program Output, Length Encoding And Headers, Negotiation, Conditional Requests, Proxy Servers and Caching, Caching, other HTTP functionality, HTTP, Security and E-Commerce.

Digitizing and Encoding, Audio And Video Transmission And Reproduction, Jitter And Playback Delay, Real-Time Transport Protocol (RTP), Streams, Mixing, And Multicasting, RTP Encapsulation, RTP Control Protocol (RTCP), RTCP Operation, IP Telephony And Signaling, Quality of service controversy, QOS, Utilization and Capacity, IntServ Resource Reservation(RSVP), IntServ Enforcement(COPS), DiffServ and Per-Hop Behavior, Traffic Scheduling, Traffic Policing.

**Unit – V**

**10 Hrs**

**A Next Generation IP(IPV6):** Need for IPV6, Beyond IPV4, The Road To A New Version Of IP, The Name Of The Next IP, Features Of IPv6, General Form Of An IPv6 Datagram, IPv6 Base Header Format, IPv6 Extension Headers, Parsing An IPv6 Datagram, IPv6 Fragmentation And Reassembly The Consequence Of End-To-End Fragmentation, IPv6 Source Routing, IPv6 Options, Size Of The IPv6 Address Space, IPv6 Colon Hexadecimal Notation, Three Basic IPv6 Address Types, The Duality Of Broadcast And Multicast, An Engineering Choice And Simulated Broadcast, Proposed IPv6 Address Space Assignment, Embedded IPv4 Addresses And Transition, Unspecified And Loopback Addresses, Unicast Address Structure, Interface Identifiers, local Addresses, Autoconfiguration and Renumbering.

\*Web sockets, Data presentation using RPC (Corba), XML, JSON, AJAX, Google ProtoBuff, Data marshaling and unmarshaling, Latest Web application architecture SOAP, REST.

**Course Outcomes:**

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

CO1: Explore the Client-Server Models, Socket interface and various application protocols.

CO2: Investigate the issues in various application protocols.

CO3: Design Client and Server Models for File access & transfer and Web applications to provide reliable communication.

CO4: Implement appropriate Client-Server software for various real world applications.

**Reference Books:**

- |     |   |
|-----|---|
| 1.  | Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP: Vol. 3 , Client-Server Programming and Applications (BSD Socket Version with ANSI C), Prentice Hall India Learning Private Limited; 2 <sup>nd</sup> edition (2004), ISBN-10: 8120325532, ISBN-13: 978-8120325531. |
| 2.  | W.Richard Stevens, Bill Ferner, Andrew M. Rudoff; Unix Network Programming- The sockets networking API Vol 1, PHI, 3 <sup>rd</sup> edition, 2004, ISBN- 978-81-203-2823-5   |
| 3.  | Stephen A. Rago; Unix System V Network Programming; Addison-Wesley, 3 <sup>rd</sup> Edition 1993, , Digitized 19 Nov 2009, ISBN- 978-80-201-5631-84 .   |
| 4.  | Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP: Vol. 3 , Client-Server Programming and Applications (BSD Socket Version with ANSI C), Prentice Hall India Learning Private Limited; 2 <sup>nd</sup> edition (2004), ISBN- 978-8120325531.                         |
| *5. | Technical Journal Papers, White papers, Manuals.  |

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CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

**Scheme of Semester End Examination (SEE)**

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 question from each unit. The total marks for SEE (Theory) will be 100 marks.

**Mapping of COs with POs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	H	L	L	L	M	-	-	L	M	L	L
<b>CO2</b>	H	H	L	M	-	-	L	-	M	-	L
<b>CO3</b>	-	M	H	L	-	M	L	L	M	-	L
<b>CO4</b>	-	L	H	-	H	H	L	L	M	M	L

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
<b>CO1</b>	L	H
<b>CO2</b>	M	M
<b>CO3</b>	H	-
<b>CO4</b>	H	-

<b>INTERNSHIP / INDUSTRIAL TRAINING</b>						
<b>Course Code</b>	:	<b>16MCN35</b>		<b>CIE Marks</b>	:	<b>100</b>
<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>0:0:6:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>3</b>		<b>SEE Duration</b>	:	<b>30 min</b>
<b>GUIDELINES FOR INTERNSHIP</b>						
<b>Course Learning Objectives (CLO):</b>						
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 use ICT tools such as skype to report their progress and submission of periodic progress reports to the faculty members.
- 5) Every student has to write and submit his/her own internship report to the designated faculty.
- 6) 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.
- 7) 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.
- 8) 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% |

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

**GUIDELINES FOR INDUSTRIAL TRAINING****Course Learning Objectives (CLO):**

The students shall be able to:

- (1) Understand the process of applying engineering knowledge to industrial products & processes
- (2) Explain the importance of skilling, training and resource management.
- (3) Comprehend the importance of team work, communication and sustainable solutions.
- (4) Imbibe values, professional ethics for life long learning

- 1) The duration of industrial training must be for a minimum of 1 week and maximum of 8 weeks on full time basis.
- 2) Industrial Training in which students pays a fee to the organization / industry will not be considered.
- 3) He/she can undergo training in one or more industry /organization.
- 4) The student must submit letters from the industry clearly specifying his / her name and the duration of the training provided by the company with authorized signatures.
- 5) Industrial training must be related to the field of specialization or the M.Tech program in which the student has enrolled.
- 6) Students undergoing industrial training are advised to use ICT tools such as skype to report their progress and submission of periodic progress reports to the faculty members.
- 7) Every student has to write and submit his/her own industrial training report to the designated faculty.

- 8) Students have to make a presentation on their industrial training 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 final report.
- 9) 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.
- 10) The broad format of the industrial training report shall be as follows
- Cover Page
  - Certificate from College
  - Training Certificate from Industry / Organization
  - Acknowledgement
  - Executive Summary
  - Table of Contents
  - Chapter 1 - Profile of the Organization –Organizational structure, Products, Services, Business Partners, Financials, Manpower, Societal Concerns, Professional Practices
  - Chapter 2 – Details of the Training Modules
  - Chapter 3 – Reflections – Highlight specific technical and soft skills that you acquired

References & Annexure

#### Course Outcomes:

After going through the industrial training the student will be able to:

CO1: Understand the process of applying engineering knowledge to solve industrial problems

CO2: Develop skills through training relevant to industrial requirement

CO3: Communicate effectively and work in teams

CO4: Imbibe ethical practices and develop it as life skill.

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

A committee comprising of 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 on the application of engineering knowledge          | 25% |
| (2) Ability to comprehend the importance of skilling and training    | 25% |
| (3) Importance of communication, professional ethics, sustainability | 20% |
| (4) Oral Presentation and Report                                     | 30% |

#### Mapping of Course Outcomes (CO) to Program Outcomes (PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		



CO4					L		H			M	H
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### Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

### GUIDELINES FOR INDUSTRIAL VISITS

#### Course Learning Objectives (CLO):

The students shall be able to:

- (1) Understand the role of industries and service organization in meeting the demands of the society.
- (2) Explain the working of different industries and organizations with an engineering perspective
- (3) Comprehend the importance of team work, communication and sustainable solutions.
- (4) Imbibe values, professional ethics for lifelong learning.

- 1) Student must visit a minimum of THREE organizations/industry. The duration of the visit per organization must be for ONE full day, during which he/she must comprehend the importance of organization structure, function of various departments, application of engineering knowledge, resource management, and importance to environment and safety, professional ethics.
- 2) It is mandatory to visit ONE private multi-national company or public sector industry / organization, ONE medium-small enterprise and ONE rural based or NG organization.
- 3) The student must submit letter from the industry clearly specifying his / her name and the date of visit to the industry with authorized signatures.
- 4) Industrial visit must be related to the field of specialization or the M.Tech program in which the student has enrolled.
- 5) Every student has to write and submit his/her own report on each industrial visit and submit the report to the designated faculty advisor for evaluation.
- 6) A photograph outside the industry with the name and logo of the industry in the background along with the students and faculty members could be included in the report.
- 7) Students have to make a presentation on their industrial visit 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 final report.
- 8) 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.
- 9) The broad format of the industrial visit report shall be as follows
  - Cover Page
  - Certificate from College
  - Acknowledgement
  - Synopsis / Executive Summary

- Table of Contents
- Chapter 1 - Profile of the PSU or MNC – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
- Chapter 2 – Profile of the SME – must include Organizational structure, Products, Services, Financials, Manpower, Societal Concerns, Professional Practices
- Chapter 3 - Profile of the NGO – must include Organizational structure, services, Manpower, Societal Concerns, Professional Practices
- Chapter 4 – Comparative Analysis of PSU/MNC – SME – NGO
- References & Annexure (Permission letters from the organizations for the visit & photographs)

**Course Outcomes:**

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

- CO1: Classify the role of different industries and organization in addressing the needs of the society.
- CO2: Explain the process of applying engineering knowledge in industries and organizations.
- CO3: Describe the importance of communication and team work
- CO4: Recognize the importance of practicing professional ethics and need for life skills.

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

A committee comprising of 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  | 25% |
| (2) Ability to comprehend the functioning of the organization/ departments | 30% |
| (3) Importance of resource management, environment and sustainability      | 20% |
| (4) Presentation Skills and Report   | 25% |

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	H	M		M				L	
CO2				H	M	M		L			
CO3					L		M	H	H		
CO4					L		H			M	H

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	
CO2	L	L
CO3		M
CO4	M	H

**TECHNICAL SEMINAR**

<b>Course Code</b>	<b>:</b>	<b>16MCN36</b>		<b>CIE Marks</b>	<b>:</b>	<b>50</b>
<b>Hrs/Week</b>	<b>:</b>	<b>L:T:P:S</b>	<b>0:0:4:0</b>	<b>SEE Marks</b>		<b>50</b>
<b>Credits</b>	<b>:</b>	<b>2</b>		<b>SEE Duration</b>		<b>30 min</b>

**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% |

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		H	M	M	L	H	H	--	---	---	M
CO2	L	M								H	

<b>CO3</b>							L	M	H		
<b>CO4</b>		L	M		H	H					H

### Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)

	PSO1	PSO2
<b>CO1</b>	H	L
<b>CO2</b>	M	H
<b>CO3</b>	M	L
<b>CO4</b>	H	L

## IV SEMESTER

MAJOR PROJECT						
<b>Course Code</b>	:	<b>16MCN41</b>		<b>CIE Marks</b>	:	<b>100</b>

<b>Hrs/Week</b>	:	<b>L:T:P:S</b>	<b>0:0:52:0</b>	<b>SEE Marks</b>	:	<b>100</b>
<b>Credits</b>	:	<b>26</b>		<b>SEE Duration</b>	:	<b>3 Hours</b>
<b>Course Learning Objectives:</b>						
The students shall be able to						
<ol style="list-style-type: none"> <li>1. Understand the method of applying engineering knowledge to solve specific problems.</li> <li>2. Apply engineering and management principles while executing the project</li> <li>3. Demonstrate good verbal presentation and technical report writing skills.</li> <li>4. Identify and solve complex engineering problems using professionally prescribed standards.</li> </ol>						
<b>GUIDELINES</b>						
<ol style="list-style-type: none"> <li>1. Major project will have to be done by only one student in his/her area of interest.</li> <li>2. Each student has to select a contemporary topic that will use the technical knowledge of their program of specialization.</li> <li>3. Allocation of the guides preferably in accordance with the expertise of the faculty.</li> <li>4. The number of projects that a faculty can guide would be limited to three.</li> <li>5. The project can be carried out on-campus or in an industry or an organization with prior approval from the Head of the Department.</li> <li>6. 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.</li> <li>7. 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.</li> </ol>						
<b>Course Outcomes:</b>						
After going through this course the students will be able to						
<b>CO1:</b> Conceptualize, design and implement solutions for specific problems.						
<b>CO2:</b> Communicate the solutions through presentations and technical reports.						
<b>CO3:</b> Apply project and resource managements skills, professional ethics, societal concerns						
<b>CO4:</b> Synthesize self-learning, sustainable solutions and demonstrate lifelong 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

<b>Phase</b>	<b>Activity</b>	<b>Weightage</b>
<b>I</b> 5 <sup>th</sup> week	Synopsis, Preliminary report for the approval of selected topic along with literature survey, objectives and methodology.	20%
<b>II</b> 10 <sup>th</sup> week	Mid-term progress review shall check the compliance with the objectives and methodology presented in Phase I, review the work performed.	40%
<b>III</b> 15 <sup>th</sup> week	Oral presentation, demonstration and submission of project report. After this presentation, the student will have one week time to correct / modify his report to address the issues raised by the committee members.	40%

**CIE Evaluation shall be done with marks distribution as follows:**

- Selection of the topic & formulation of objectives 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%

**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	M	L	M	L				
CO2				L				M	H		
CO3					L	M	M			H	
CO4					L	M	H	M			H

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	PSO1	PSO2
CO1	H	L
CO2	L	H
CO3	M	H
CO4	H	H

SEMINAR						
Course Code	:	16MCN42		CIE Marks	:	50
Hrs/Week	:	L:T:P:S	0:0:4:0	SEE Marks		50

<b>Credits</b>	:	<b>2</b>	<b>SEE Duration</b>	<b>30 min</b>
<b>Course Learning Objectives (CLO):</b>				
The students shall be able to:				
<ol style="list-style-type: none"> <li>1) Understand the technological developments in their chosen field of interest</li> <li>2) Explain the scope of work and challenges in the domain area</li> <li>3) Analyze these engineering developments in the context of sustainability, societal concerns and project management.</li> <li>4) Improve his/her verbal presentation and report writing skills</li> </ol>				
<b>GUIDELINES</b>				
<ol style="list-style-type: none"> <li>1) The presentation will have to be done by individual students.</li> <li>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.</li> <li>3) The topic could be an extension or complementary to the project topic.</li> <li>4) Topics could be in multidisciplinary areas and strongly address the technical design issues.</li> <li>5) The student must be able to highlight or relate these technological developments with sustainability and societal relevance.</li> <li>6) The students must mandatorily address legal, ethical issues as related to the topic of study.</li> <li>7) The student shall make an attempt to perform financial / cost analysis or apply project management tools as related to his/her topic of study.</li> <li>8) Each student must submit both hard and soft copies of the presentation.</li> </ol>				
<b>Course Outcomes:</b>				
After going through this course the student will be able to:				
CO1: Identify topics that are relevant in the present context of the world and relate it to sustainability and societal relevance.				
CO2: Perform literature/market/product survey and analyse information to the field of study.				
CO3: Enhance presentation and report writing skills.				
CO4: Develop creative thinking abilities.				

**Scheme of Continuous Internal Evaluation (CIE):** Evaluation would be carried out in TWO phases. The evaluation committee shall comprise of TWO senior faculty members. 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:**

- |   |     |
|---|-----|
| • Topic – Technical Relevance, Sustainability and Societal Concerns | 15% |
| • Literature Review   | 25% |
| • Presentation Skills   | 35% |
| • Report  | 25% |



**Mapping of Course Outcomes (CO) to Program Outcomes (PO)**

	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>
<b>CO1</b>		H	M	M	L	H	H	--	---	---	M
<b>CO2</b>	L	M								H	
<b>CO3</b>							L	M	H		
<b>CO4</b>		L	M		H	H					H

**Mapping of Course Outcomes (CO) to Program Specific Outcomes (PSO)**

	<b>PSO1</b>	<b>PSO2</b>
<b>CO1</b>	H	L
<b>CO2</b>	M	H
<b>CO3</b>	M	L
<b>CO4</b>	H	L