**FMTH0301/Rev.5.3**

**Course Plan**

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| Semester: **6th Semester** | Year: 2022-23 |
| Course Title: **Computer Communication Networks** | Course Code:**17EECC306** |
| Total Contact hrs: **50** | Duration of SEE: 03 |
| ISA Marks: **50** | ESA Marks:**50** |
| Lesson Plan Author: Mr. Shamshuddin K | Date: 10/01/2023 |
| Checked By: Mr. Hemant Kelagadi | Date: 10/01/2023 |

**Course Outcomes (COs):**

At the end of the course the student should be able to:

1. Discuss the principles of the TCP/IP protocol suite and its significance.
2. Identify and explain a data transfer protocol for a given applications.
3. Describe different multiple access control protocols and error control techniques for data transfer.
4. Demonstrate the concepts of packet transfer and analysis using suitable packet analyzing tool.

**Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)**

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| --- | --- |
| Course Title: Computer Communication Networks | Semester: 6th |
| Course Code: 17EECC306 | Year: 2022-23 |

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| **Course Outcomes (CO) / Program Outcomes (PO)** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** |
| 1. Discuss Internet and principles of the TCP/IP protocol suite. | **M** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2. Identify and explain a data transfer protocol for different applications. | **M** | **M** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3. Describe different multiple access control protocols and error control techniques | **M** | **M** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4. Demonstrate the concepts of computer network using suitable open source simulation tool. | **M** | **M** |  |  | **M** |  |  |  | **M** | **M** |  | **M** |  |  | **M** |

Degree of compliance **L**: Low **M**: Medium **H**: High

**Competency addressed in the Course and corresponding Performance Indicators**

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| --- | --- |
| Competency: PO1.3 | Demonstrate competence in engineering fundamentals |
| PI Code: PO1.3.1 | Apply fundamentals of Electrical engineering principles and laws |
| Competency: PO1.4 | Demonstrate competence in electronics and communication engineering knowledge |
| PI Code: PO1.4.1 | Apply principles of electronic device |
| Competency: PO2.1 | Demonstrate an ability to identify and characterize an engineering problem |
| PI Code: PO2.1.3 | Identifies processes/modules of computer based system and parameters to solve a problem |
| Competency: PO5.2 | Demonstrate an ability to select and apply discipline specific tools, techniques and resources |
| PI Code: PO5.2.2 | Demonstrate proficiency in using EDA tools |
| Competency: PO9. | Demonstrate an ability to form a team and define a role for each member. |
| PI Code: PO9.1.1 | Recognize a variety of working and learning preferences; appreciate the value of diversity on a team |
| Competency: PO10. | Demonstrate an ability to comprehend technical literature and document project works |
| PI Code: PO10.1.1 | Read, understand and interpret technical and non-technical information |
| PI Code: PO10.1.2 | Produce clear, well-constructed, and well-supported written engineering documents |
| Competency: PO12.2 | Produce clear, well-constructed, and well-supported written engineering documents |
| PI Code: PO12.2.1 | Identify historic points of technological advance in engineering that required practitioners to seek education in order to stay current. |
| Competency: PO15.1 | Demonstrate an ability to identify the modern techniques for analysis. |
| PI Code: PO15.1.1 | Ability to identify modern techniques for analysis. |

Eg: 1.2.3: Represents program outcome ‘1’, competency ‘2’ and performance indicator ‘3’.

**Course Content**

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| --- | --- | --- |
| Course Code: 17EECC306 | Course Title: Computer Communication Networks | |
| L-T-P: 4-0-0 | Credits: 03 | Contact Hrs: 03 |
| ISA Marks: 50 | ESA Marks: 50 | Total Marks: 100 |
| Teaching Hrs: 50 |  | Exam Duration: 03hrs |

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| --- | --- |
| **Content** | **Hours** |
| **Unit - 1** |  |
| **Chapter No. 1. Computer Networks and the Internet**  What is Internet? The Network Edge, the network Core, delay -loss—throughput in packet switched networks. Protocol layers (OSI layers) and their service models, networks under attack. | 08hrs |
| **Chapter No. 2. Application Layer**  Principles of network applications, the web and HTTP,DHCP, file transfer-FTP, electronic mail in the internet, DNS, peer-to-peer applications, socket programming-creating network applications | 12hrs |
| **Unit - 2** |  |
| **Chapter No. 3. Transport Layer**  Introduction and transport-layer services-relationship between transport and network layers - overview of the transport layer in the internet, multiplexing and de multiplexing, connectionless transport: UDP, principles of reliable data transfer, connection oriented transport TCP, TCP congestion control. | 10hrs |
| **Chapter No. 4. Network layer**  Introduction, virtual circuit and datagram networks, what‘s inside router? The Internet protocol (IP): forwarding and addressing in the internet, routing algorithms, routing in the internet, broadcast and multi cast routing. | 10hrs |
| **Unit - 3** |  |
| **Chapter No. 5. The link layer: Links, Access networks, and LANs**  Introduction to the link layer, error-detection and correction techniques, multiple access links and protocols, switched local area networks, link virtualization: A network as a link layer, data center networking, retrospective: A day in the life of a web page request. | 10hrs |

**Text Book (List of books as mentioned in the approved syllabus)**

1. Kurose & Ross, Computer Networking A Top-Down Approach, 6th edition, PEARSON, 2013.

**References**

1. Behrouz A. Forouzan, 1. Data Communications and Networking , 4th Edition, Tata McGra, 2006
2. Larry L. Peterson and Bruce S. Davie, Computer Networks A Systems Approach, : 4th Edition, Elsevier , 2007

**Evaluation Scheme**

**ISA Scheme**

|  |  |
| --- | --- |
| **Assessment** | **Weightage in Marks** |
| Minor Exam-1 | 20 |
| Minor Exam-2 | 20 |
| Activity | 10 |
| **Total** | 50 |

**Course Unitization for Minor Exams and End Semester Assessment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Topics / Chapters** | **Teaching Credits** | **No. of Questions in Minor Exam-1** | **No. of Questions in Minor Exam-2** | **No. of Questions in Activity** | **No. of Questions in ESA** |
| **Unit I** | | | | | |
| 1. Computer Networks and the Internet | 8 | 1.00 | -- | -- | 1.00 |
| 2. Application Layer | 12 | 2.00 | -- | -- | 2.00 |
| **Unit II** | | | | | |
| 3. Transport Layer | 10 | -- | 1.50 | -- | 1.50 |
| 4. The Network Layer | 10 | -- | 1.50 | -- | 1.50 |
| **Unit III** | | | | | |
| 5. The link layer: Links, Access networks, and LANs | 10 | -- | -- | -- | 2.00 |

**Note**

1. Each Question carries 20 marks and may consists of sub-questions.

2. Mixing of sub-questions from different chapters within a unit (only for Unit I and Unit II) is allowed in Minor I, II and ESA

3. Answer 5 full questions of 20 marks each (two full questions from Unit I, II and one full questions from Unit III) out of 8 questions in ESA.

**Course Assessment Plan**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Course Title: Computer Communication Networks Code: 17EECC306 | | | | | |
| Course outcomes (COs) | Weightage in assessment | Assessment Methods | | | |
| ISA 1 | ISA 2 | Assignment | End Semester Exam |
| 1. Discuss Internet and principles of the TCP/IP protocol suite. | 20% | **✓** |  |  | **✓** |
| 2. Identify and explain a data transfer protocol for different applications. | 40% | **✓** | **✓** |  | **✓** |
| 3. Describe different multiple access control protocols and error control techniques | 20% |  |  |  | **✓** |
| 4. Demonstrate the concepts of computer network using Wireshark. | 20% |  |  | **✓** |  |
| Weightage | | 20% | 20% | 10% | 50% |

**Date: Head of school**

**Chapter-wise Plan**

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| --- | --- |
| Course Code and Title: **17EECC306 / Computer Communication Networks** | |
| Chapter Number and Title:  **1. Computer Networks and the Internet** | Planned Hours: **8hrs** |

**Learning Outcomes:**

**At the end of the topic the student should be able to:**

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| --- | --- | --- | --- |
| TLO's | CO's | BL | CA Code |
| 1. Describe the basic hardware and software components that makeup the Internet. | 1 | 2 | 1.4.1 |
| 1. Explain the Internet in terms of networking infrastructure. | 1 | 2 | 1.3.1 |
| 1. Describe the service providers to distributed applications. | 1 | 2 | 1.4.1 |
| 1. Explain the performance parameter of computer network | 1 | 2 | 1.3.1 |
| 1. Discuss Internet model and principles protocol suite. | 1 | 2 | 1.4.1 |

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| Lesson Schedule  Class No. - Portion covered per hour |
| 1. What is Internet? |
| 1. The Network Edge |
| 1. The Network Core |
| 1. Delay, Loss, and Throughput in Packet-Switched Networks |
| 1. Protocol Layers and Their Service Models |
| 1. Protocol Layers and Their Service Models |
| 1. Networks Under Attack |
| 1. History of Computer Networking and the Internet |

**Review Questions**

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| --- | --- | --- | --- | --- |
| Sr.No. - Questions | TLO | | BL | PI Code |
| 1. What is the difference between a host and an end system? List several different types of end systems. Is a Web server an end system? | 1 | | 2 | 1.4.1 |
| 1. Why are the standards important for protocols? | 2 | | 2 | 1.4.1 |
| 1. What is the transmission rate of Ethernet LANs? | 3 | | 2 | 1.4.1 |
| 1. Describe the most popular wireless Internet access technologies of today. Compare and contrast them. | 2 | | 2 | 1.4.1 |
| 1. What is the difference between virus and a worm? | 3 | | 2 | 1.4.1 |
| Course Code and Title: **17EECC306 / COMPUTER COMMUNICATION NETWORKS** | | | | |
| Chapter Number and Title:  **2. Application Layer** | | Planned Hours: **12hrs** | | |

**Learning Outcomes:**

**At the end of the topic the student should be able to:**

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| --- | --- | --- | --- |
| TLO's | CO's | BL | CA Code |
| 1. List the network services required by applications. | 2 | 2 | 1.4.1 |
| 1. Identify services provided by each of the protocols at the application layer. | 2 | 3 | 2.1.3 |
| 1. Describe the Client and Servers processes and transport layer interfaces. | 2 | 2 | 1.4.1 |

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| Lesson Schedule  Class No. - Portion covered per hour |
| 1. Principles of Network Applications |
| 1. Principles of Network Applications |
| 1. The Web and HTTP |
| 1. The Web and HTTP |
| 1. File Transfer: FTP |
| 1. File Transfer: FTP |
| 1. Electronic Mail in the Internet |
| 1. Electronic Mail in the Internet |
| 1. DNS—The Internet’s Directory Service |
| 1. DNS—The Internet’s Directory Service |
| 1. Peer-to-Peer Applications |
| 1. Peer-to-Peer Applications |

**Review Questions**

|  |  |  |  |
| --- | --- | --- | --- |
| Sr.No. - Questions | TLO | BL | PI Code |
| 1. List five non-proprietary Internet applications and the application-layer protocols that they use. | 1 | 2 | 1.4.1 |
| 1. What is the difference between network architecture and application architecture? | 1 | 2 | 1.4.1 |
| 1. A company wants to create an app which is used to send and receive email, suggest and explain protocols, which are to be used in building app. | 2 | 3 | 2.1.3 |
| 1. What is meant by a handshaking protocol? | 3 | 2 | 1.4.1 |
| 1. Why it is said that FTP sends control information “Out-of-band” | 4 | 2 | 1.4.1 |

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| Course Code and Title: **17EECC306 / Computer Communication Networks** | |
| Chapter Number and Title:  **3. Transport Layer** | Planned Hours: **10hrs** |

**Learning Outcomes:**

**At the end of the topic the student should be able to:**

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| TLO's | CO's | BL | CA Code |
| 1. Explain the services provided by transport layer to upper layers | 2 | 2 | 1.4.1 |
| 1. State the limitations of UDP | 2 | 2 | 1.4.1 |
| 1. Identify application which needs connection-oriented service and reliable communication. | 2 | 3 | 2.1.3 |
| 1. Describe the QOS parameters of transport layer | 2 | 2 | 1.4.1 |

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| Lesson Schedule  Class No. - Portion covered per hour |
| 1. Introduction and Transport-Layer Services |
| 1. Multiplexing and Demultiplexing |
| 1. Connectionless Transport: UDP |
| 1. Principles of Reliable Data Transfer |
| 1. Principles of Reliable Data Transfer |
| 1. Connection-Oriented Transport: TCP |
| 1. Connection-Oriented Transport: TCP |
| 1. Principles of Congestion Control |
| 1. Principles of Congestion Control |
| 1. TCP Congestion Control |

**Review Questions**

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| Sr.No. - Questions | TLO | BL | PI Code |
| 1. Identify and explain a protocol so that voice and video traffic can be sent over Internet simultaneously? | 3 | 3 | 2.1.3 |
| 1. In our rdt protocols, why did we need to introduce sequence numbers? | 1 | 2 | 1.4.1 |
| 1. Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110. How much data is in the first segment? | 3 | 3 | 2.1.3 |
| 1. Consider congestion control in TCP. When the timer expires at the sender, What will be the value of ssthresh? | 4 | 2 | 1.4.1 |
| 1. Suppose that the UDP receiver computes the Internet checksum for the received UDP segment and finds that it matches the value carried in the checksum field. Can the receiver be absolutely certain that no bit errors have occurred? Explain. | 2 | 2 | 1.4.1 |

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| Course Code and Title: **17EECC306 / Computer Communication Networks** | |
| Chapter Number and Title:  **4. Network layer** | Planned Hours: **10hrs** |

**Learning Outcomes:**

**At the end of the topic the student should be able to:**

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| TLO's | CO's | BL | CA Code |
| 1. Explain different classes of IP addresses | 2 | 2 | 1.4.1 |
| 1. Describe the structure of router. | 2 | 2 | 1.4.1 |
| 1. State the key features of IPv6 | 2 | 2 | 1.4.1 |
| 1. Suggest routing algorithms based application requirement | 2 | 3 | 2.1.3 |

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| Lesson Schedule  Class No. - Portion covered per hour |
| 1. Introduction |
| 1. Virtual Circuit and Datagram Networks |
| 1. What’s Inside a Router? |
| 1. The Internet Protocol (IP) - IPv4 |
| 1. The Internet Protocol (IP) – Ipv6 |
| 1. Routing Algorithms |
| 1. Routing Algorithms |
| 1. Routing in the Internet |
| 1. Routing in the Internet |
| 1. Broadcast and Multicast Routing |

**Review Questions**

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| Sr.No. - Questions | TLO | BL | PI Code |
| 1. What is the difference between routing and forwarding? | 2 | 2 | 1.4.1 |
| 1. Describe how packet loss can occur at output ports. Can this loss be prevented by increasing the switch fabric speed? | 2 | 2 | 1.4.1 |
| 1. Suppose there are three routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? How many forwarding tables will be indexed to move the datagram from the source to the destination? | 4 | 3 | 2.1.3 |
| 1. Compare and contrast the IPv4 and the IPv6 header fields. Do they have any fields in common? | 3 | 2 | 1.4.1 |
| 1. Compare and contrast link-state and distance-vector routing algorithms. | 4 | 2 | 1.4.1 |
| 1. Compare and contrast the advertisements used by RIP and OSPF | 4 | 2 | 1.4.1 |
| 1. What are the roles played by the IGMP protocol and a wide-area multicast routing protocol? | 1 | 2 | 1.4.1 |

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| Course Code and Title: **17EECC306 / Computer Communication Networks** | |
| Chapter Number and Title:**5.The link layer: Links, Access networks, and LANs** | Planned Hours: **10 hrs** |

**Learning Outcomes:**

**At the end of the topic the student should be able to:**

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| TLO's | CO's | BL | CA Code |
| 1. Apply the error detection and correction techniques for a frame | 3 | 3 | 1.4.1 |
| 1. Suggest different multiple access protocols based on application | 3 | 3 | 2.1.3 |
| 1. Explain IEEE standards 802.3. | 3 | 2 | 1.4.1 |
| 1. Describe MPLS technique to virtualized link | 3 | 2 | 1.4.1 |
| 1. different techniques which needs Data center networking | 3 | 2 | 1.4.1 |

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| Lesson Schedule  Class No. - Portion covered per hour |
| 1. Introduction to the Link Layer |
| 1. Error-Detection and -Correction Techniques |
| 1. Error-Detection and -Correction Techniques |
| 1. Multiple Access Links and Protocols |
| 1. Multiple Access Links and Protocols |
| 1. Switched Local Area Networks |
| 1. Switched Local Area Networks |
| 1. Link Virtualization: A Network as a Link Layer |
| 1. Data Center Networking |
| 1. Retrospective: A Day in the Life of a Web Page Request |

**Review Questions**

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| Sr.No. - Questions | TLO | BL | PI Code |
| 1. Identify and explain a technique which can be used to virtualized link. | 4 | 2 | 2.1.3 |
| 1. Describe polling and token-passing protocols using the analogy of cocktail party interactions. | 2 | 2 | 1.4.1 |
| 1. Why is an ARP query sent within a broadcast frame? Why is an ARP response sent within a frame with a specific destination MAC address? | 1 | 2 | 1.4.1 |
| 1. Compare the frame structures for 10BASE-T, 100BASE-T, and Gigabit Ethernet. How do they differ? | 3 | 2 | 1.4.1 |
| 1. A company developed an app which send and receive messages over internet, suggest a technique which can be used to detect and correct error of the message received and explain with an example. | 1 | 3 | 1.4.1 |

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| **Model Question Paper for Minor Examination - I (ISA)** | | | | | | | | | |
| **Course Code:** | | | **17EECC306** | **Course Title: Computer Communication Networks** | | | | | |
| **Duration** | | | **1 hour 15 min** |  | | | | | |
| **Max. Marks** | | | **40** |  | | | | | |
|  | Note: Answer any two full questions. | | | | | | | | |
|  |  | | | | | | | | |
| Q.No | | Questions | | | Marks | CO | BL | PO | PI Code |
| 1a | | List the various functions of different network layout of the OSI model. | | | 10 | 1 | 2 | 1 | 1.4.1 |
| 1b | | Explain the twisted pair medium and its applications in LAN. | | | 10 | 1 | 2 | 1 | 1.4.1 |
| 2a | | A company wants to create an app which is used to send and receive email, suggest and explain protocols, which are to be used in building app. | | | 10 | 2 | 3 | 2 | 2.1.3 |
| 2b | | Describe different transmission media used in computer communication. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 3a | | With the help of timing of events diagram explain circuit switching and packet switching. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 3b | | Suppose Host A sends two TCP segments back to back to Host B over a TCP connection. The first segment has sequence number 90; the second has sequence number 110. How much data is in the first segment? | | | 10 | 2 | 3 | 2 | 2.1.3 |

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| **Model Question Paper for Minor Examination - II (ISA)** | | | | | | | | | |
| **Course Code:** | | | **17EECC306** | **Course Title: Computer Communication Networks** | | | | | |
| **Duration** | | | **1 hour 15 min** |  | | | | | |
| **Max. Marks** | | | **40** |  | | | | | |
|  | Note: Answer any two full questions. | | | | | | | | |
|  |  | | | | | | | | |
| Q.No | | Questions | | | Marks | CO | BL | PO | PI Code |
| 1a | | What is ALOHA? Derive the expression for throughput in ALOHA? How is it improved in slotted ALOHA? | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 1b | | What are the principles of congestion control algorithms? Explain. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 2a | | Suppose there are three routers between a source host and a destination host. Ignoring fragmentation, an IP datagram sent from the source host to the destination host will travel over how many interfaces? How many forwarding tables will be indexed to move the datagram from the source to the destination? | | | 10 | 2 | 2 | 2 | 2.1.3 |
| 2b | | Bring out differences between adaptive and non-adaptive routing algorithms. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 3a | | What do you understand by internetworking? Discuss the functions of repeaters bridges and gateways in internetworking. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 3b | | A university has decided to set up a new lab facility to its students, if the CIDR IP address allocated to a company by ISP is 192.168.55.32/28 Find the first, last address and number of PC that can be connected to network using these IP addresses, | | | 10 | 2 | 3 | 2 | 2.1.3 |

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| **Model Question Paper for End Semester Assessment (ESA)** | | | | | | | | | |
| **Course Code:** | | | **17EECC306** | **Course Title: Computer Communication Networks** | | | | | |
| **Duration** | | | **3 hours** |  | | | | | |
| **Max. Marks** | | | **100** |  | | | | | |
|  | Note: 1. Answer any 2 questions from Unit 1 and 2 and any 1 question from Unit 3.  2. Each question carries equal marks. | | | | | | | | |
|  | UNIT I | | | | | | | | |
| Q.No | | Questions | | | Marks | CO | BL | PO | PI Code |
| 1a | | Identify and describe different transmission media which can be used in computer communication to obtain a transmission rate of 100mbps. | | | 08 | 1 | 3 | 2 | 2.1.3 |
| 1b | | Compare Packet switching and Circuit switching. | | | 06 | 1 | 2 | 1 | 1.4.1 |
| 1c | | Explain different types of delay used to measure the performance of a computer networks. | | | 06 | 1 | 2 | 1 | 1.4.1 |
| 2a | | Describe the 5 layer internet protocol stack model. | | | 08 | 2 | 2 | 1 | 1.4.1 |
| 2b | | Explain the File transfer protocol with a neat diagram. | | | 06 | 2 | 2 | 1 | 1.4.1 |
| 2c | | How electronic mail is sent over internet and identify different protocols needed, explain their significance. | | | 06 | 2 | 3 | 2 | 2.1.3 |
| 3a | | With a neat diagram request and response frame format explain http protocol. | | | 08 | 2 | 2 | 1 | 1.4.1 |
| 3b | | What is DNS? Describe the need for the DNS in computer network. | | | 06 | 2 | 2 | 1 | 1.4.1 |
| 3c | | Compare client server architecture and peer to peer architecture. | | | 06 | 2 | 3 | 1 | 1.4.1 |
| UNIT II | | | | | | | | | |
| Q.No | | Questions | | | Marks | CO | BL | PO | PI Code |
| 4a | | Explain how a connection is setup at the transport layer. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 4b | | Discuss various services offered to upper layers by transport layer. | | | 10 | 2 | 3 | 1 | 1.4.1 |
| 5a | | An internet application providing company wants to choose a protocol for its application which sends information using web pages. Suggest and explain a suitable transport layer protocol. | | | 10 | 2 | 3 | 2 | 2.1.3 |
| 5b | | What are the services provided by network layer to transport layer. | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 6a | | What is congestion control? How it’s different from flow control? | | | 10 | 2 | 2 | 1 | 1.4.1 |
| 6b | | A university has decided to set up a new lab facility to its students, if the CIDR IP address allocated to a company by ISP is 192.168.55.32/28 Find the first, last address and number of PC that can be connected to network using these IP addresses, | | | 10 | 2 | 3 | 2 | 2.1.3 |
| UNIT III | | | | | | | | | |
| 7a | | Describe the pure ALOHA system with relevant diagrams | | | 10 | 3 | 2 | 1 | 1.4.1 |
| 7b | | Explain the concepts CSMA with different persistent a) p-persistent b) Non-persistent c) 1-persistent. | | | 10 | 3 | 2 | 1 | 1.4.1 |
| 8a | | Describe all the fields of Ethernet frame format. | | | 10 | 3 | 2 | 1 | 1.4.1 |
| 8b | | With a neat flow diagram explain n-bit sliding window protocol. | | | 10 | 3 | 2 | 1 | 1.4.1 |