umber of Lecture Hours/Week 4 Exam Marks 60 otal Number of Lecture Hours 50 Exam Hours 03  CREDITS – 04  Idodule – 1  Teachi Hours  pplication Layer: Principles of Network Applications: Network Application rehitectures, Processes Communicating, Transport Services Available to pplications, Transport Services Provided by the Internet, Application-Layer rotocols. The Web and HTTP: Overview of HTTP, Non-persistent and ersistent Connections, HTTP Message Format, User-Server Interaction: ookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & eplies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail lessage Format, Mail Access Protocols, DNS; The Internet's Directory Service: ervices Provided by DNS, Overview of How DNS Works, DNS Records and lessages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash ables.  1: Chap 2  Idodule – 2  ransport Layer: Introduction and Transport-Layer Services: Relationship etween Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egment Structure, UDP Checksum, Principles of Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs	[As per Choice B	•	stem (CBCS) scheme] ic year 2017-2018)		
Teaching total Number of Lecture Hours  CREDITS – 04  Teaching pplication Layer: Principles of Network Applications: Network Application rehitectures, Processes Communicating, Transport Services Available to pplications, Transport Services Provided by the Internet, Application-Layer rotocols. The Web and HTTP: Overview of HTTP, Non-persistent and ersistent Connections, HTTP Message Format, User-Server Interaction: cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & eplies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail lessage Format, Mail Access Protocols, DNS; The Internet's Directory Service: ervices Provided by DNS, Overview of How DNS Works, DNS Records and lessages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash ables.  1: Chap 2  Internet, Multiplexing and Demultiplexing: Connectionless Transport Layer in the eternet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egment Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer: uilding a Reliable Data Transfer, Flow Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion Control: The Causes and the Costs of Congestion Contr	Subject Code			40	
Indule – 1  Indule	Number of Lecture Hours/Week	4	Exam Marks	60	
pplication Layer: Principles of Network Applications: Network Application rehitectures, Processes Communicating, Transport Services Available to pplications, Transport Services Provided by the Internet, Application-Layer rotocols. The Web and HTTP: Overview of HTTP, Non-persistent and ersistent Connections, HTTP Message Format, User-Server Interaction: ookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & eplies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail lessage Format, Mail Access Protocols, DNS; The Internet's Directory Service: ervices Provided by DNS, Overview of How DNS Works, DNS Records and lessages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash ables.  1: Chap 2  Introduction and Transport-Layer Services: Relationship etween Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egment Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congesti	Total Number of Lecture Hours	50	Exam Hours	03	
pplication Layer: Principles of Network Applications: Network Application rehitectures, Processes Communicating, Transport Services Available to pplications, Transport Services Provided by the Internet, Application-Layer rotocools. The Web and HTTP: Overview of HTTP, Non-persistent and ersistent Connections, HTTP Message Format, User-Server Interaction: ookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & eplies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail lessage Format, Mail Access Protocols, DNS; The Internet's Directory Service: ervices Provided by DNS, Overview of How DNS Works, DNS Records and lessages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash ables.  1: Chap 2  Introduction and Transport-Layer Services: Relationship etween Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egement Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Conges		CREDITS -	04	<del></del>	
pplication Layer: Principles of Network Applications: Network Application rchitectures, Processes Communicating, Transport Services Available to pplications, Transport Services Provided by the Internet, Application-Layer rotocols. The Web and HTTP: Overview of HTTP, Non-persistent and ersistent Connections, HTTP Message Format, User-Server Interaction: ookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & eplies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail lessage Format, Mail Access Protocols, DNS; The Internet's Directory Service: ervices Provided by DNS, Overview of How DNS Works, DNS Records and lessages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash ables.  1: Chap 2  Introduction and Transport-Layer Services: Relationship etween Transport and Network Layers, Overview of the Transport Layer in the ternet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egment Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control: The Causes and the Costs of Congestion	Module – 1				
ransport Layer: Introduction and Transport-Layer Services: Relationship etween Transport and Network Layers, Overview of the Transport Layer in the atternet, Multiplexing and Demultiplexing: Connectionless Transport: UDP, UDP egment Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control.  1: Chap 3  Iodule – 3  The Network layer: What's Inside a Router?: Input Processing, Switching, and the Network layer: What's Inside a Router? Routing control plane, IPv6, A rief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, outing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing	Architectures, Processes Commun Applications, Transport Services F Protocols. The Web and HTTP: Persistent Connections, HTTP M Cookies, Web Caching, The Condit Replies, Electronic Mail in the Inte Message Format, Mail Access Proto Services Provided by DNS, Overvi Messages, Peer-to-Peer Application Tables.	Provided by the Overview of Message Formational GET, File Pernet: SMTP, Cocols, DNS; The New of How DN	port Services Available Internet, Application-HTTP, Non-persisten at, User-Server Intera Transfer: FTP Comma comparison with HTTP to Internet's Directory Series Works, DNS Records	Layer at and action: ands & Amail cervice: ds and	
egment Structure, UDP Checksum, Principles of Reliable Data Transfer: uilding a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer rotocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: the TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and imeout, Reliable Data Transfer, Flow Control, TCP Connection Management, rinciples of Congestion Control: The Causes and the Costs of Congestion, pproaches to Congestion Control.  1: Chap 3  Iodule – 3  The Network layer: What's Inside a Router?: Input Processing, Switching, are foray into IP Security, Routing Occur? Routing control plane, IPv6, Arief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing lgorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, outing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing	Transport Layer: Introduction	_	-	_	10 Hour
he Network layer: What's Inside a Router?: Input Processing, Switching, utput Processing, Where Does Queuing Occur? Routing control plane, IPv6,A rief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing lgorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, outing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing	Segment Structure, UDP Checkst Building a Reliable Data Transfer Protocols, Go-Back-N, Selective re The TCP Connection, TCP Segment Timeout, Reliable Data Transfer, F Principles of Congestion Control: Approaches to Congestion Control. T1: Chap 3	um, Principles Protocol, Pipel epeat, Connecti t Structure, Rou Flow Control, To	of Reliable Data Tra lined Reliable Data Tr on-Oriented Transport nd-Trip Time Estimation CP Connection Manage	ansfer: ransfer TCP: on and ement,	
output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A rief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing lgorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, outing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing	Module – 3				
	Output Processing, Where Does Qu Brief foray into IP Security, Routing Algorithm, The Distance-Vector (D' Routing in the Internet, Intra-AS Ro	neuing Occur? Rong Algorithms: 'V) Routing Algorithm Algorithm International Routing in the International Routing in the International Routing Internation	Routing control plane, I The Link-State (LS) Reprithm, Hierarchical Reprinter: RIP, Intra-AS Reprinter: RIP, Intra-RIP, In	Pv6,A outing outing, outing	10 Hour
1: Chap 4: 4.3-4.7				1	

Internet to Cellular subscribers, On to 4G:LTE, Mobility management: Principles,

Addressing, Routing to a mobile node, Mobile IP, Managing mobility in cellular Networks, Routing calls to a Mobile user, Handoffs in GSM, Wireless and Mobility: Impact on Higher-layer protocols.

T1: Chap: 6: 6.4-6.8

### Module – 5

**Multimedia Networking:** Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks, case study: You Tube.

10 Hours

**Network Support for Multimedia:** Quality-of-Service (QoS) Guarantees: Resource Reservation and Call Admission

**T1: Chap: 7** 

# **Course outcomes:** The students should be able to:

- Explain principles of application layer protocols
- Outline transport layer services and infer UDP and TCP protocols
- Classify routers, IP and Routing Algorithms in network layer
- Explain the Wireless and Mobile Networks covering IEEE 802.11 Standard
- Define Multimedia Networking and Network Management

## **Question paper pattern:**

The question paper will have TEN questions.

There will be TWO questions from each module.

Each question will have questions covering all the topics under a module.

The students will have to answer FIVE full questions, selecting ONE full question from each module.

#### **Text Books:**

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson, 2017.

# **Reference Books:**

- 1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
- 2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
- 3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
- 4. Mayank Dave, Computer Networks, Second edition, Cengage Learning