Government of Karnataka
Department of Technical Education
Board of Technical Examinations, Bengaluru

Course Title **: Data Communication and Networking**	Course Code : **15EC44T**
Semester : **Fourth**	Course Group : **Core**
Teaching Scheme in Hrs (L:T:P) : **4:0:0**	Credits : **4**
Type of course : **Lecture**	Total Contact Hours: **52**
CIE :**25 Marks**	SEE : **100 Marks**

Prerequisites

Basics concepts of communication, digital electronics and computers.

Course Objectives

1. To understand the basic concepts of data communication, layered model, protocols and inter-working between computer networks and switching components in telecommunication systems.
2. Discuss the nature, uses and implications of internet technology.
3. To understand the functioning of Frame Relay, ATM.
4. An overview of security issues related to data communication in networks.

Course Outcomes

On completion of the course, students will be able to attain the following COs

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Understand the basics of data communication, networking, internet and their importance.	***R/U/A***	1,2,5,6,7,9,10	**7**
CO2	Analyze the services and features of various protocol layers in data networks.	***R/U/A***	1,2,3,4,9,10	**6**
CO3	Differentiate wired and wireless computer networks	***R/U/A***	1,2,3,9,10	**10**
CO4	Analyse TCP/IP and their protocols.	***U/A***	1,2,3,9,10	**10**
CO5	Recognize the different internet devices and their functions.	***R/U/A***	1,2,3,4,9,10	**8**
CO6	Identify the basic security threats of a network.	***R/U/A***	1,2,3,4,5,7,9,10	**7**
	Total sessions including 4 hrs student activity			**52**

Legends: PO-Program Outcome, CO-Course Outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply

Course-PO Attainment Matrix

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Data communication and networking	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**--**	**3**	**3**

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If ≥40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If < 5% of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

Course content and pattern of marks for SEE

Unit No	Unit Name	Hour	Questions For SEE			Marks Weightage	Weightage (%)
			R	U	A		
1	Introduction to data communication and networks	07	05	05	10	20	15
2	Networking protocols and OSI model	07	05	05	10	20	15
3	Computer networks	11	05	10	15	30	20
4	TCP/IP	11	05	10	15	30	20
5	Communication protocols	08	05	10	10	20	15
6	Internet devices and protocols	08	05	05	10	25	15
	Total	**52**	**30**	**45**	**70**	**145**	**100**

Legend: R- Remember, U-Understand A-Application

Course Content

Unit-1: Introduction to data communication and networks 7 Hours

Data communication-data representation, data flow, components. Definition of node, link, branch, network, network criteria. **Physical structures**-types of connection, working of different network topologies, network configuration and their advantages, concepts and comparison of LAN, MAN, WAN. Switching - concepts of circuit switching, packet switching & message switching and their applications.

Unit-2: Networking protocols and OSI model 7 Hours

Protocol layering-Scenarios, principles. Logical connection-connection oriented and connection less. Protocols in computer communications, **OSI reference model** - functions of all layers. **Data link control**- concept of framing, flow control and error control.**MAC protocol**- addressing mechanism. Concept of encapsulation and decapsulation.

Unit-3: Computer Networks **11 Hours**

Local area network-wired LANs features and classification. **Ethernet**- properties, frame format (IEEE 802.3), addressing, simple problems on addressing .**virtual LAN**- working, advantages. **Access method**–CSMA/CD. **Token passing LANS**- properties, token bus maintenance and working. Token ring properties, mechanism. **FDDI** –operation, self healing, **Wireless LANS** - features, Bluetooth architecture (IEEE 802.15). Basic concepts of WIMAX, cellular telephony, satellite networks.

Unit-4: TCP/IP **11 Hours**

TCP/IP-Model, protocols layers, INTERNET Address, logical address, Physical address, UDP/IP Datagram Format, classes of IP address, Dotted Decimal notation of IP address, basics of IPv4 and IPv6,simple problems on addressing. **Address mapping** –static mapping, dynamic mapping**. ARP**- need, methods, need of RARP and ICMP. Definition of fragmentation and reassembly. Features of TCP, relationship between TCP and IP.

Unit-5: Communication protocols **8 Hours**

Concepts of Ports and Sockets. **Domain Name System (DNS) -**name system, name space, working of DNS server. **Email**- architecture, protocols, advantages of IMAP. Basics of FTP, **FTP Connections** - Control and Data transfer Connection**. Frame relay**- Need, Working of frame relay, **ATM**- Architecture, characteristics.

Unit-6: Internet devices and protocols **8 Hours**

Internetworking-need and concept. **Connecting Devices**-discussion on Routers, switches, repeaters, Bridges, Switches and Gateways. **Ways of accessing the internet**- Dial-up access, SLIP, PPP, leased lines, DSL basics, internet access by cable. **Modems**-basics, types, operation, applications. **Network security**-basics of threats and fire wall.

References

1. *Data Communications and Networks*- 2nd edition -Achyut S Godbole- and Atul Kahate Tata McGraw-Hill
2. *Data Communications & Networking* – 5th Edition- B A Forouzan- Tata McGraw-Hill.
3. *Computer Networks*- 4th Edition- Andrew S Tanenbaum- Pearson-Prentice Hall
4. *Computer Networking* - James F. Kurose & Keith W. Ross- PEARSON
5. *Computer Communications and Networking Technologies* - Michael A. Gallo & William M. Hancock- BROOKS&COLE
6. *Computer Networks and Internets* -Douglas E. Comer- PEARSON.
7. *Data and Computer Communications*- Eighth Edition- William Stallings- Pearson Education.
8. Refer the course contents at NPTEL website of IIT Khargapur of course- Communication Networks and Switching.
9. *Network Security Bible*, 2nd edition, Eric Cole, Wiley Publishers.
10. *Data communication and networks* –James Irvine and David Harley- Publishers: Wiley India.

Course Delivery

The course will be delivered through lectures, presentations and support of modern tools. Activities are off-class.

Course Assessment and Evaluation Scheme

Master Scheme

Assessment Method	What		To Whom	Assessment mode /Frequency /timing	Max. Marks	Evidence Collected	Course Outcomes
Direct assessment	CIE	IA	Students	Three tests+	20	Blue Books	1 to 6
				Activity*	05	Activity Sheets	1 to 6
	SEE	End exam		End of the course	100	Answer Scripts at BTE	1 to 6
				Total	125		
Indirect assessment	Student feedback on course		Students	Middle of the Course	Nil	Feedback Forms	1 to 3 Delivery of course
	End of course survey			End of the Course	Nil	Question-naires	1 to 6 Effectiveness of delivery instructions & assessment methods

Legends: CIE-Continuous Internal Evaluation, SEE- Semester End-exam Evaluation

+ Every I.A. test shall be conducted for 20 marks. Average of three tests, by rounding off any fractional part thereof to next higher integer, shall be considered for IA.

***S**tudents should do activity as per the list of suggested activities/ similar activities with prior approval of the teacher. Activity process must be initiated well in advance so that it can be completed well before the end of the term.

Questions for CIE and SEE will be designed to evaluate the various CLs as per the weightage shown in the following table.

Sl. No.	Cognitive Levels (CL)	Weightage (%)
1	Remembering	20
2	Understanding	30
3	Applying	50
	Total	**100**

Continuous Internal Evaluation (CIE) pattern

(i) Student Activity (5 marks)

The following student activities or similar activities can be assigned for assessing CIE/IA marks

Sl. No.	Activity

1	Prepare a report on the Components of Network used in Computer Lab or browsing centre or cellular network stations.
2	Prepare a report on ISDN or web applications.
3	Make a hand-written report on applications on internet devices that are observed in your surroundings.
4	Prepare a report on various standards organization of data communication and networking.

Execution Mode

1. Maximum of 4 students in each batch and one activity per batch.
2. All the above activities need to be distributed evenly to the students.
3. Write qualitative report of 4-6 pages; one report per batch.
4. Activities can be carried out off-class; demonstrations/presentations can be in lab sessions.
5. Teacher is expected to observe and record the progress of students' activities
6. Assessment shall be made based on quality of activity in accordance with the following rubrics table

(ii) Model of rubrics for assessing student activity

Dimension	Scale					Marks (Example)
	1 Unsatisfactory	**2 Developing**	**3 Satisfactory**	**4 Good**	**5 Exemplary**	
1. Research and gathering information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	3
2. Full-fills team roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	2
3. Shares work equality	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	5
4. Listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	3
					Total marks	ceil(13/4)= 4

(iii) CIE/IA Tests (20 Marks)

Three tests have to be conducted, during specified schedule, in accordance with the test pattern given below and their average-marks shall be considered for CIE/IA.

(iv) Format of CIE/IA test question paper

CIE Question Paper								
Institution Name and Code								
Course Co-ordinator/Teacher								
Program Name		***Test No.***		*Units*				
Class/Sem		*Date*		*CL*				
Course Name		*Time*		*COs*				
Course Code		*Max. Marks*		*POs*				
Note to students: Answer all questions								
Question No.	**Question**			Marks	**CL**	**CO**	**PO**	
1								
2								
3								
4								

Legends: PO-Program Outcome, CO-Course outcome, CL-Cognitive Level, R-Remember, U-Understand, A-Apply
Note: Internal choice may be given in each CO at the same cognitive level (CL).

(v) Model question paper for CIE

CIE Question Paper							
Institution Name and Code							
Course Co-ordinator/Teacher							
Program Name	Electronics and Communication	***Test No.***	1	*Units*	1 & 2		
Class/Sem	4th Sem	*Date*	1/1/2017	*CL*	R/U/A		
Course Name	Data Communication and Networking	*Time*	10-11AM	*COs*	1 & 2		
Course Code	15EC44T	*Max. Marks*	20	*POs*	1, 2 & 3		
Note to students: Answer all questions							
No.	**Question**		Marks	**CL**	**CO**	**PO**	
1	Define network. explain the parameters to meet network criteria		05	U/A	1	1,2,3	
2	List the characteristics that data communication system depends upon.		05	R/A	1	1,2	
3	Discuss the principles of protocol layering.		05	R	2	1,2	
4	Explain different layers and their roles in protocols of computer communication.		05	A	2	1,2	

Semester end-exam evaluation (SEE)

(i) End-exam question-paper pattern

.Unit No.	Unit Name	Study Duration (Hrs.)	No. Questions for End-exam	
			5 marks Part - A	10 marks Part - B
1	Introduction To Data Communication And Networks	07	01	01
2	Networking Protocols And OSI Model	07	02	01
3	Computer Networks	11	02	02
4	TCP/IP	11	02	02
5	Communication protocols	08	01	02
6	Internetworking devices and Internet	08	01	02
	Total	**52**	**09 (45 Marks)**	**10 (100 Marks)**

(ii) Model question paper

Course Title **: Data Communication and Networking**

Course Code **: 15EC44T** Time **: 3 Hrs**

Semester **: Fourth** Max. Marks**: 100**

Instructions*: 1. Answer any **SIX** question from **Part A** (5x6=30 Marks)*

*2. Answer any **SEVEN** full questions from **Part B** (7x10=70 Marks)*

Part A

1. Name the basic network topologies and cite an advantage of each type.
2. Explain MAC addressing mechanism
3. Show how the address 47:20:1B:2E:08:EE is sent out online.
4. List the features of wireless LANs?
5. Define mapping. Explain static mapping and dynamic mapping. (5)
6. Differentiate between port and socket.
7. Define address resolution .explain the different methods for obtaining the physical address based on IP address.
8. Draw a conceptual view of Internet domain name space.
9. Discuss the motives for internetworking.

Part B

1. a) Explain the components of data communication system.
   b) Name are the factors that determine whether the communication system is LAN or WAN? .
2. Explain the different layers in OSI model.
3. a) Explain the need of protocol layering.
   b) Differentiate between encapsulation and decapsulation.
4. a)Compare static and dynamic LANs? Why are static LANs not as popular as dynamic LANs?
   b) Define and explain CSMA/CD.
5. a) Describe the main fields in Ethernet frame header.

b) Explain why FDDI is called a self healing type of network?

6. a) Explain the mapping of TCP/IP protocols with the OSI model.(7)
   b) Explain the need of ICMP.
7. a) Explain the features of TCP.
   b) Compare ARP and RARP.
8. a) Explain the working of DNS server.(7)
   b) Explain the need for additional suffixes such as com, edu and gov?
9. Define spooling .discuss email architecture in brief along with its main components.
10. a)Describe how does router facilitate interconnection between two or more networks.
    b) Discuss the external and internal threats.

Institutional Activities

The following are suggested institutional activities, to be carried out at least one during the semester. The course teacher/coordinator is expected to maintain the relevant record (Containing, Activity name, Resource persons and their details, duration, venue, student feedback, etc) pertaining to Institutional activities.

Sl. No.	Activity
1	Organize Seminar, workshop or Lecture from experts on the modern trends in data communications and networking or modern network tools
2	Organize software workshop from experts on wire shark and analyse TCP/IP.

Model Question Bank

Note: The questions in the question bank are indicative but not exhaustive. Sub-questions on different CLs may be combined to frame 10-marks questions or 10-marks questions given here can be splitted into 5-marks questions if necessary keeping weightage of CLs approximately intact and adhering to SEE end-exam pattern.

Unit-1: Introduction to Data Communication and Networks

05 Marks

Remember

1. Name the basic network topologies and cite an advantage of each type.
2. List the characteristics that data communication system depends upon.
3. List the classification of standards organizations.

Understand

1. Define network .explain the parameters to meet network criteria
2. Define switching ,node, branch
3. Write a short note on standards.

Application

1. Compare LAN, WAN and MAN.
2. Differentiate between LAN and WAN.
3. List advantages of multi point connection over point to point one.
4. List are the factors that determine whether the a communication system is LAN or WAN?
5. Differentiate between ring and bus topology.

10 Marks

Understand

1. Briefly explain different forms of data.
2. Explain the different network topologies.
3. Explain the components of data communication system.
4. Explain the different switching techniques.

UNIT-2: Networking protocols and OSI model

05 Marks

Remember

1. Define frame. Write a note on error control and flow control.

Understand

1. Explain the need of protocol layering.
2. Explain MAC addressing mechanism.
3. Discuss the principles of protocol layering.
4. Differentiate between connection oriented and connection less.

Application

1. Discuss the role of network layer in OSI model.

10 Marks

Understand

1. Explain the different layers in OSI model.
2. Explain different layers and their roles in protocols of computer communication.
3. Explain the role played by presentation layer in handling data.
4. Differentiate between Encapsulation and encapsulation.

UNIT-3: Computer Networks

05 Marks

Remember

1. List the advantages of virtual LANs.
2. List the applications of satellite networks.
3. List the features of wireless LANs?

Understand

1. Write a note on WIMAX.
2. Explain the difference between a fixed WIMAX and mobile WIMAX.
3. Compare static and dynamic LANs

Application

1. Discuss the properties of Ethernet network.
2. Describe the purpose of transceiver and network interface card.
3. Show how the address 47:20:1B:2E:08:EE is sent out online.
4. Explain why are static LANs not as popular as dynamic LANs?
5. FDDI is called a self healing type of network, justify.
6. Write the hex decimal equivalent of the following address?

   01011010 10000001 01010101 00010001 10101010 00011111

10 Marks

Understand

1. Explain the block diagram of cellular system.
2. Explain the architecture of Bluetooth
3. Describe the working of CSMA/CD
4. Explain the working of virtual LAN.

Application

1. Describe the main fields in Ethernet frame header.
1. Explain the working of a Token ring network. Demonstrate how is it different from Ethernet?

UNIT-4 TCP/IP

05 Marks

Remember

1. Define mapping. Explain static mapping and dynamic mapping.
2. Define address resolution .explain the different methods for obtaining the physical address based on IP address.

Understand

1. Explain how an IP address is designed to a host.
2. Explain the need of ICMP.
3. Explain fragmentation.
4. Compare ARP and RARP.
5. Differentiate between IPv4and IPv6.
6. Differentiate between TCP and UDP.
7. Differentiate between port and socket.

Application

1. Discuss the idea of port.
2. Describe the various fields in the IP datagram header.
3. Describe the three parts of an IP address.
4. Explain the purpose of Dotted Decimal notation of IP address.
5. Briefly discuss when to use TCP and when to use UDP.

10 Marks

Understand

1. Explain layered model of TCP/IP.
2. Explain the mapping of TCP/IP protocols with the OSI model.
3. Explain the features of TCP.

Application

1. Describe the various fields in UDP format.
2. Describe the various fields in TCP format.

UNIT-5 Communication protocols

05 Marks

Remember

1. Name the ATM layer and their functions.
2. Draw a conceptual view of Internet domain name space.
3. Define DNS and describe why it is required?

Understand

1. Explain the significance of a DNS server.
2. Differentiate IMAP with POP.
3. Explain the need of frame relay network.

Application

1. Discuss the FTP connection mechanism between the client and the server.
2. Discuss POP and SMTP.
3. Explain the need for additional suffixes such as com, edu and gov?
4. What is the purpose of FTP?
5. What are the specific purposes of the control connection?
6. Describe the characteristics of ATM.

10 Marks

Remember

1. Define spooling .discuss email architecture in brief along with its main components.

Understand

1. Explain the working of DNS server.
2. Briefly explain the working of frame relay .

UNIT-6 Internetworking devices and internet

05 Marks

Remember

Understand

1. Explain universal service
2. Explain how does router facilitate interconnection between two or more networks
3. Explain is bridge and its functions
4. Explain working of router
5. Explain the working a gateway work
6. Compare SLIP and PPP with definitions
7. Explain leased line and its purposes
8. Explain firewall.

Application

1. Discuss the motives for internetworking.
2. Summarize of internetworking devices.

10 Marks

Application

1. Discuss the different type's modems.
2. Discuss the external and internal threats.

End