

Computer Networks

ENCT 304

Year/Part: III/I

Teaching Schedule				Examination Scheme						Total
L	T	P	Total	Theory			Practical			
				Assessment Marks	Final		Assessment Marks	Final		
					Duration (Hrs)	Marks		Duration (Hrs)	Marks	
3	1	3	7	40	3	60	50	-	-	150

Depth Codes

E-Explanation	C-Circuit	D-Definition	DM-Demonstration
DV-Derivation	DW-Drawing	P-Proof	I-Illustration
NUM-Numerical	PRG-Programming	S-State	ACT-Activity-based Learning
MP- Mini Project	EXP-Experiment	REV-Review / Recap	PS- Problem Solving
QA- Question Answer	Q-Quiz	ST- Surprise Test	MT-Mid Term Test

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
				L	T	P	
1	Introduction						
	1.1 Computer network, importance and applications	D, E	Introduction to computer network and its importance. Applications of computer networks.	0.5			
	1.2 Types of computer networks	E	Types of networks <ul style="list-style-type: none"> ● PAN, LAN, CAN, MAN, WAN ● Wired and wireless networks 	0.5			
	1.3 Network topologies	D, E	Network topologies: Mesh, Star, Bus, Ring and Hybrid topology with their features and applications. Physical and Logical topology.	0.5	0.25		
	1.4 Client/server and P2P networks	D, E	Client/server and P2P network with features and applications.	0.5			
	1.5 Protocols and standards, need of standardization	D, E	Protocols and standards, Need of protocols, Need of standardization	0.25			
	1.6 Layered network architecture, OSI and TCP/IP reference models	E	Layered network architecture, Need of layered model, OSI reference model, and different layers of OSI model with functions of each layer. TCP/IP model, its different layers with functions and protocols at each layer. Comparison of OSI and TCP/IP model with similarities and differences.	2	1		
	1.7 Addressing at different layers	E	Addressing and need of addressing at different layers of network architecture.	0.25	0.25		
	1.8 Networking devices: Repeater, hub, bridge, switch, router, gateway	E	Different networking devices: <ul style="list-style-type: none"> ● Repeater and hub ● Bridge and switch ● Router and gateway With their basic functions and working layer.	0.5			
	Evaluation	QA, Q					

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
				L	T	P	
2	Physical Layer						
	2.1 Network monitoring: Bandwidth, throughput, delay, round-trip-time	D, E	Physical layer and functions of physical layer. Definition and significance of network performance monitoring parameters: Bandwidth, throughput, delay, round-trip-time.	0.5			
	2.2 Multiplexing - FDM, TDM, WDM	D, E	Multiplexing, importance of multiplexing in communication, different types of multiplexing: FDM, TDM, WDM with their features.	1			
	2.3 Switching - circuit switching, packet switching, datagram and virtual circuit switching	D, E	Switching, importance of switching in communication Different types of switching: <ul style="list-style-type: none"> • Circuit switching and packet switching • Datagram and virtual circuit switching Features, merits and demerits of each	1			
	2.4 Transmission media - Guided (twisted pair, coaxial, optical fiber) and unguided media (radio waves, microwaves, infrared)	E	Transmission media and its role in communication. Types of media: <ul style="list-style-type: none"> • Guided: Twisted pair (UTP & STP), Coaxial, and Optical fiber (single mode, multimode - step index, graded index) • Unguided media (radio waves, microwaves-terrestrial and satellite, infrared) Features, merits and demerits of each.	1.5	0.5		
	2.5 Ethernet cable standards (twisted pair and optical fiber)	E	Ethernet cable standards for twisted pair and optical fiber with bandwidth and other typical features.	0.5	0.5		
	2.6 Data encoding: Manchester, NRZ-I, MLT3, 4B/5B	E	Data encoding techniques: Manchester, NRZ-I, MLT3, 4B/5B and their typical uses in Ethernet and Fast-Ethernet with reasons.	0.5	0.5		
	Evaluation	QA, Q					

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
				L	T	P	
3	Data Link Layer						
	3.1 Data link layer functions - Framing, error control, flow control, access control	E	Data link layer and functions of data link layer: Framing, Hop-to-hop delivery, Addressing, Error control, Flow control, Access control.	0.75			
	3.2 Error control codes: Parity, checksum, CRC	E, NUM	Error control codes: Parity, checksum, CRC with their features.	0.5	1		
	3.3 Data link protocols: PPP, HDLC	E	Data link protocols: PPP and HDLC with frame format.	0.5			

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	3.4 Logical link control (LLC) and media access control (MAC) sublayers	D, E	Sublayers of data link layer, Functions of LLC and MAC.	0.25			
	3.5 Random access protocols: ALOHA, CSMA, CSMA/CD, CSMA/CA	E	Why channelization techniques are not-suitable for computer networks? Dynamic channel allocation. Random access protocols. Overview of ALOHA protocol. Features and working of CSMA, CSMA/CD and CSMA/CA protocols.	1.5	0.5		
	3.6 Token based protocols: Token bus, token ring, FDDI	E	Problems with random access protocols and the features of token based protocols. Basic working, Overview of token based protocols: Token bus, token ring, FDDI	0.5			
	3.7 Ethernet (IEEE 802.3) and its evolution, bridged and switched Ethernet	E	Ethernet and IEEE 802.3, Access technique in Ethernet, Frame format of Ethernet and function of each field, Evolution of Ethernet from 10 Mbps to several Gbps. Switched Ethernet, Full-duplex Ethernet, Ethernet extension using repeater/hub and bridge/switch.	1.5	0.5		
	3.8 WLAN (Wi-Fi) and IEEE 802.11	E	WLAN and IEEE 802.11, Evolution of WLAN, WLAN standards, Access technique in WLAN, Frame format of WLAN and function of each field, NAV, RTS & CTS, Hidden station and exposed station problems.	1.5	0.5		
	3.9 VLAN and its importance	E	VLAN and its importance, extension of VLAN across multiple switches, Inter-VLAN communication	0.5			
	3.10 Virtual circuit switching: ATM, MPLS	E	Features of virtual circuit switching, basic working of protocols: ATM, MPLS	0.5			
	Evaluation	QA, Q					

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
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4	Network Layer						
	4.1 Network layer functions and services	E	Network layer, function of network layer, services provided by network layer.	0.5			
	4.2 Connection oriented and connectionless network services	D, E	Connection oriented and connectionless services from network layer.	0.25			
	4.3 Logical addressing and its importance	E	Logical addressing (IP addressing), need of logical addressing and its importance.	0.25			
	4.4 IPv4 addressing and classes, private and public IP address, sub-netting and super-netting, VLSM, CIDR	E, NUM	IPv4 addressing, Classes of IPv4 addresses, Private and Public IP address. Subnetting and need of subnetting. Subnetting with FLSM and VLSM Supernetting and CIDR.	2	3		
	4.5 Unicast, multicast and broadcast addresses	D, E	Unicast, Multicast and Broadcast addresses and their uses.	0.25			

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
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	4.6 Routing and types of routing: Static and dynamic, unicast and multicast, interior and exterior, distance vector and link state	D, E	Autonomous system, types and AS-number Routing, Need of routing, Principal of optimality in routing, Parameters of routing algorithms. Flooding. Types of routing: Static and dynamic, unicast and multicast, interior and exterior, distance vector and link state. Distance vector routing - features and issues Link state routing - features and issues	1.25	0.5		
	4.7 Routing protocols: RIP, OSPF, EIGRP, BGP	E	Dynamic routing protocols and their need RIP, its features and working, RIPv2 OSPF, its features and working, multi-area OSPF, ABR. EIGRP and its features. Path vector routing, BGP and its basic features	2	0.5		
	4.8 Network address translation (NAT)	D, E	Network address translation (NAT) and its importance. Static and dynamic NAT, NAT and its need. SNAT and DNAT with their applications.	1	0.5		
	4.9 IPv6 addressing, need and features of IPv6	E	IPv6 addressing, need of IPv6, features of IPv6. IPv6 address format. IPv6 address types: Unicast, Multicast and Anycast	0.5	0.5		
	4.10 Protocols: IPv4, ARP, ICMP, IPv6, ICMPv6	E	Packet format and function of each field of header of protocols: IPv4 and ARP Need of ICMP, packet format of ICMP. Debugging tools using ICMP. Packet format and function of each field of IPv6 header, Concept of IPv6 extension headers. ICMPv6 with packet format and uses, MLD and NDP.	2	0.5		
	4.11 Transition from IPv4 to IPv6 and strategies	E	Transition from IPv4 to IPv6 and different strategies for transition: Dual stack, Tunneling, Header translation	1			
	4.12 Traffic shaping and congestion control mechanisms	E	Network congestion and its impact. Different mechanisms for congestion control. Traffic shaping algorithms.	1			
	Evaluation	QA, Q					

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
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5	Transport Layer						
	5.1 Transport layer functions and services	E	Transport layer and its functions. Services provided by the transport layer.	0.5			

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	5.2 Elements of transport layer protocols: process-to-process communication, addressing, multiplexing and de-multiplexing, segmentation and reassembly, error control, flow control	E	Elements of transport layer protocols: <ul style="list-style-type: none"> • End process-to-process communication • Addressing • Multiplexing and de-multiplexing • Segmentation and reassembly • Error control • Flow control • Connectionless and connection oriented services 	0.5			
	5.3 Transport protocols: TCP and UDP	E	Protocol format and function of each field of header of transport layer protocols: TCP and UDP	2.5	1		
	5.4 TCP services: connection setup and release, reliable, stream oriented, flow-control, error-control	E	TCP services Connection setup, Data-transfer and Connection release. Reliable, stream oriented service with flow-control and error-control. TCP sliding window.	1	1		
	5.5 Introduction to socket and socket programming	E	Introduction to socket and the basic concept of socket programming.	0.5			
	Evaluation	QA, Q					

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6	Upper Layers and Network Design						
	6.1 Functions and services of session, presentation and application layers	E	Functions and services of session, presentation and application layers	0.5			
	6.2 Introduction to upper layer protocols: DHCP, HTTP, HTTPS, FTP, SMTP, POP, IMAP	E	Introduction to upper layer protocols: DHCP, HTTP, HTTPS, FTP, SMTP, POP and IMAP with their basic functions.	1.5	0.5		
	6.3 DNS, its function and DNS queries	E	DNS and its importance. DNS hierarchies, DNS queries: Recursive and Iterative	1.5	0.5		
	6.4 Network management tools and protocols (SNMP)	E	Overview of network management tools and protocols (SNMP) with their applications.	0.5			
	6.5 Basics of web, e-mail, DNS and proxy server configurations	E	Basic idea of web, e-mail, DNS and proxy server configurations	0.5	0.5		
	6.6 VoIP, FoIP and IP interconnection	E	Overview of VoIP, FoIP and IP interconnection	0.5			
	6.7 Network design and configuration guidelines	E	Basic network design and configuration guidelines	1	0.5		
	Evaluation	QA, Q					

Unit	Topic/Subtopic	Depth Code	Description of Depth	Actual plan			Week
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7	Advanced Topics						
	7.1 Introduction to software-defined networking (SDN), basic architecture, importance and applications	E	Introduction to software-defined networking (SDN), basic architecture, importance and applications.	1.5			
	7.2 Network security and its importance	E	Introduction to network security and its importance, Introduction to Symmetric and Asymmetric encryption techniques	1			
	7.3 Overview of content delivery networks (CDNs), named data networking (NDN), intent based networking (IBN)	E	Overview of content delivery networks (CDNs), named data networking (NDN), intent based networking (IBN).	0.75			
	7.4 Quantum network, network virtualization and recent trends in networking	E	Introduction to quantum network Overview of network virtualization Recent trends in networking.	0.75			
	Evaluation	QA, Q					

References:

1. Forouzan, B. A. (2012). Data communications and networking. McGraw-Hill.
2. Kurose, J. F., Ross, K. W. (2017). Computer networking: A top-down approach. Pearson.
3. Tanenbaum, A.S., Feamster, N. (2021). Computer networks. Pearson.
4. Stevens, W.R., Fall, K.R. (2011). TCP/IP illustrated: The protocols. Addison-Wesley.
5. RFCs and online resources for protocol specifications.

Final Exam - Model Question
Computer Networks
ENCT 304

Year/Part: III/I

QN	Question	Marks	Unit
1.	Why layered models are used in network architecture? Explain the functions of each layer of TCP/IP model with example protocols at each layer.	[2+4]	1
2.	What are the importance of switching and multiplexing? Explain different techniques of multiplexing with typical applications of each.	[3+3]	2
3.	What is collision? What are the problems due to collision? How the possibilities of collision be reduced in IEEE 802.3 and IEEE 802.11 protocols?	[1+1+4]	3
4.	What is a virtual LAN? Why is it called as virtual? Explain how the frames can be delivered from on computer to another computer connected in different switches but within the same VLAN.	[1+1+4]	3
5.	Suppose your company has obtained the IP addresses of 175.25.64.0/23 from your ISP. You have to divide this address for different departments A, B, C, D, E and F having 60, 70, 40, 10, 80 and 20 numbers of hosts respectively. In addition to this there are three networks G, H and I for point-to-point connection between routers. Allocate the IP address range for each of the sub-networks with their network address, broadcast address and subnet mask. Also list out the remaining range of IP addresses (if any).	[6]	4
6.	Why is co-existence of IPv4 and IPv6 necessary? Explain the different strategies for transition from IPv4 to IPv6.	[2+4]	4
7.	What are the services provided by the transport layer? Explain connection establish and connection release of TCP for data transfer with suitable diagrams.	[2+4]	5
8.	What is the importance of DNS? How can a DNS request from a client computer be resolved from authoritative server? Explain with suitable diagrams.	[2+4]	6
9.	What is SDN? Explain its architecture with necessary diagrams.	[2+4]	7
10.	Write short notes on: (any two) a) OSPF b) ICMP c) SNMP	[2×3]	4 & 6

Note: Number of questions and distribution of marks are indicative only.