



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Diploma Engineering

Level: Diploma

Branch: Computer Engineering / Computer Science and Engineering

Subject Code : DI04000301

Subject Name : Advance Computer Network

W.E. F. Academic Year:	2025-26
Semester:	4 th
Category of the Course:	Professional Elective - I

Prerequisite:	Students should possess basic knowledge of computer networks, including OSI and TCP/IP models, IP addressing, and sub netting, as covered in the Computer Network subject.
Rationale:	In today's connected world, computer networks are the foundation of communication and information sharing among people, businesses, and organizations. As technology grows and the need for fast, reliable communication increases, skilled professionals are required to design, set up, and manage these networks. This course on Advanced Computer Networks helps students understand different networking concepts and protocols. It covers topics like IPv4 and IPv6, routing protocols such as RIP, OSPF, and BGP, and transport layer protocols like TCP and UDP. Students will also learn about application layer protocols such as HTTP, SMTP, POP3, IMAP4, and DNS. Through practical exercises, students will gain hands-on experience in configuring networks, troubleshooting issues, and analyzing network traffic. By the end of the course, they will have the skills and knowledge needed to design, implement, and manage advanced computer networks and understand how different layers and protocols work together.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT Level
01	Describe IPv4 addressing, packet forwarding, and ICMP tools for network communication.	Understand
02	Apply routing algorithms and RIP, OSPF, BGP protocols for unicast routing configuration.	Apply
03	Analyze and use transport layer protocols TCP and UDP to establish reliable and connectionless communication.	Understand
04	Implement and test application layer protocols HTTP, FTP, DNS, and Email in a simulated networking environment.	Apply
05	Interpret IPv6 addressing, packet structure, and transition techniques to ensure compatibility with IPv4 networks.	Understand

**Revised Bloom's Taxonomy (RBT)*



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Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+ (PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial / Practical		
				ESE (E)	PA (M)	PA (I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weightage
1.	Network Layer <ul style="list-style-type: none"> Introduction - Network Layer Protocol (IP) IPv4 Addresses <ul style="list-style-type: none"> Address space Classful addressing Classless addressing Forwarding of IP Packets based on destination address Network Address Translation (NAT) – Static NAT, Dynamic NAT Internet Protocol <ul style="list-style-type: none"> Datagram Format Fragmentation Options ICMPv4 <ul style="list-style-type: none"> Error reporting Messages and Query messages ICMP checksum Debugging tools - Ping, Trace route 	10	25
2.	Unicast Routing <ul style="list-style-type: none"> Introduction <ul style="list-style-type: none"> Cost/Metric Static and Dynamic Routing Tables Intra-and Inter-domain Routing Routing Algorithms - Distance vector routing, Link-state routing, Path-vector routing Unicast Routing Protocols <ul style="list-style-type: none"> Routing Information Protocol (RIP) 	10	20



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	Open Shortest Path First (OSPF) Border Gateway Protocol (BGP)		
3.	Transport Layer <ul style="list-style-type: none"> • Introduction - Services, Port number • User Datagram Protocol <ul style="list-style-type: none"> User Datagram UDP Services UDP Applications • Transmission Control Protocol- <ul style="list-style-type: none"> TCP Services TCP Features TCP Segment TCP Connections, State Transition Diagram 	07	15
4.	Application Layer <ul style="list-style-type: none"> • Introduction - Client-Server Architecture, Peer to Peer Architecture • World Wide Web and HTTP <ul style="list-style-type: none"> Architecture Web Documents HTTP • File Transfer Protocol <ul style="list-style-type: none"> Connections: - Control, Data File Transfer • Electronic Mail <ul style="list-style-type: none"> Architecture (SMTP, POP, IMAP, Introduction of MIME) Web-Based Mail • Domain Name System <ul style="list-style-type: none"> Name Space DNS in the internet Resolution, Caching, Registrars 	10	25
5.	Next Generation Protocols <ul style="list-style-type: none"> • IPv6 Addressing <ul style="list-style-type: none"> Representation Address space Address space allocation Auto configuration Renumbering • IPv6 Protocol <ul style="list-style-type: none"> Packet Format Transition from IPv4 to IPv6 	08	15



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	<ul style="list-style-type: none">ICMPv6<ul style="list-style-type: none">IntroductionError MessagesInformational MessagesNeighbor Discovery Messages		
	Total	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks (in %)					
R Level	U Level	A Level	N Level	E Level	C Level
20	54	26	0	0	0

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

References/Suggested Learning Resources:

(a) Books:

- Forouzan Behrouz, "Data Communication and Networking", McGraw Hill Education (India), New Delhi, 2005, 5th Edition.
- Behrouz A. Forouzan, Firouz Mosharraf, "Computer Networks: A Top-Down Approach", McGraw Hill Education (India), Special Indian Edition.
- Behrouz A. Forouzan, "TCP/IP Protocol Suite", McGraw-Hill Forouzan Networking Series, Forth Edition.
- Andrew S. Tanenbaum, David J. Wetherall, "Computer Networks", Pearson Education India, 5th Edition.
- James F. Kurose, Keith W. Ross, "Computer Networking, A Top-down approach", Pearson Publications, 7th Edition.
- Jesin A., "Packet Tracer Network Simulator", Pearson Education, New Delhi, Latest Edition.
- Laura Chappell, "Wireshark Network Analysis", Chappell University, 2nd Edition.

(b) Open source software and website:

- <https://www.geeksforgeeks.org/multipurpose-internet-mail-extension-mime-protocol/>
- <https://www.cloudns.net/blog/what-is-dynamic-dns/>
- <https://study-ccna.com/ios-basic-commands/>
- <https://study-ccna.com/>
- <https://nptel.ac.in/courses/106105183>
- <https://nptel.ac.in/courses/106106091>
- <https://www.wireshark.org/download.html>
- <https://www.netacad.com/courses/packet-tracer>



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9. <https://www.udemy.com/course/computer-networks-course-networking-basics/>

Suggested Course Practical List:

1. Apply IP addressing and subnetting concepts to solve below IP problems:
 - a. Rewrite the following IP addresses in binary notation
203.45.67.129
145.200.34.210
192.168.5.14
11.250.99.77
 - b. Rewrite the following IP addresses in dotted decimal notation
11001011.00101101.01000001.10000001
10010001.11001000.00100010.11110010
11000000.10101000.00000101.00001110
00001011.11111010.01100011.01001101
 - c. Consider the following IP addresses
214.229.206.83/28
153.120.147.39/26
115.173.104.1/18
70.173.166.71/1
Find the following for each above IP address
 1. Network Address
 2. First Host Address
 3. Last Host Address
 4. Broadcast Address
 5. Next Subnet Address
 - d. An organization is granted block 212.18.190.0/24. The administrator wants to create 32 subnets.
 1. Find the subnet mask.
 2. Find the number of addresses in each subnet.
 3. Find the first and last address in subnet 1
 4. Find the first and last address in subnet 32.
2. Investigate IP protocols by capturing and studying IP datagrams using Wireshark and answer the following:
 - a. An IP datagram has arrived with the following partial information in the header (in hexadecimal) : 45000054 00030000
 - i. What is the header size?



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- ii. Are there any options in the packet?
 - iii. What is the size of data?
 - iv. Is the packet fragmented?
 - v. How many more routers can the packet travel to?
 - vi. What is the protocol number of the payload being carried by the packet?
3. Capture and study ICMPv4 packets generated by Other utility programs such as ping and traceroute using relevant software.
 4. Create a small IPv4 static routing network using relevant software.
 5. Create a small IPv6 network using any relevant software.
 6. Configure RIP routing protocol using relevant software.
 7. Configure OSPF routing protocol using relevant software.
 8. Configure BGP routing protocol using relevant software.
 9. Use the Transport layer protocols (TCP and UDP) to solve below problems:
 - a) The following is a dump (contents) of a UDP header in hexadecimal format.
1A2B 0F90 0040 0000
 - a. What is the source port number?
 - b. What is the destination port number?
 - c. What is the total length of the user datagram?
 - d. What is the length of the data?
 - e. Is the packet directed from a client to a server or vice versa?
 - f. What is the application-layer protocol?
 - g. Has the sender calculated a checksum for this packet?
 - b) The following is part of a TCP header dump (contents) in hexadecimal format.
9C4F 0050 0000000A 00000005 6012 2000
 - a. What is the source port number?
 - b. What is the destination port number?
 - c. What is the sequence number?
 - d. What is the acknowledgment number?
 - e. What is the length of the header?
 - f. What is the type of the segment?
 - g. What is the window size?
 10. Capture and Study TCP and UDP Packets using relevant software.
 11. Configure Domain Name Server (DNS) and Web Server using relevant software.
 12. Configure File Transfer Protocol (FTP) using relevant software.
 13. Implementation of Client–Server Communication using HTTP using relevant software.
 14. Configure Mail Server Using relevant software.



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List of Laboratory/Learning Resources Required:

1. Computer System with basic configuration and connected with LAN and Internet.
2. Wireshark or any other similar software to capture and investigate packets.
3. Cisco Packet Tracer or any other similar software.
4. Virtualization Software (Virtual Box, VM Ware etc.)

Suggested Project List:

- a) Create a webserver. Host any two websites in this webserver. Create a domain server for the domain of these websites and enter the domain of the websites in it. Access these websites from another computer's browser with its domain name.
- b) Configure an email server in intranet and access it by using any email client.
- c) Configure an ftp server in intranet and access it by using any ftp client.
- d) Configure Telnet & SSH Server in intranet and access it by using particular client.
- e) Configure Proxy server in intranet.
- f) Prepare one static and one dynamic network with DHCP server. Use routing protocol to route packets between these networks using any network simulator.
- g) Configure VLAN using any network simulator.
- h) Configure Site to Site VPN using any network simulator.

Suggested Activities for Students:

- a) Encourage students to participate in different coding competitions like Hackathon, online competitions on code chef etc.
- b) Students are encouraged to register themselves in various MOOCs such as: Swayam, edx, Coursera, Udemy etc. to further enhance their learning.
- c) Prepare charts to explain Working of Protocols at different Layers.
