

EC 620: Computer Networks

| Course code | Course title | Credits | | | Total Credits | CIE Marks | SEE Marks | Total Marks |
|-------------|-------------------|---------|---|---|---------------|-----------|-----------|-------------|
| | | L | T | P | | | | |
| EC 620 | Computer Networks | 3 | 0 | 1 | 4 | 50 | 50 | 100 |

Course outcome: At the end of the course, the student should be able

1. Explain the concepts of devices related to network architecture, their topologies, and configurations
2. Demonstrate the working knowledge of protocols and their design issues.
3. Identify and analyze the IP address assignment and standards associated with each network.
4. Analyze and design the routing strategies.
5. Analyze the features and operations of end to end delivery mechanisms and their functionalities
6. Demonstrate the skill sets related to the usage of EDA tool for analysis and simulation.

UNIT 1:

Introduction: Data Communications: Components, Representations, Data Flow, Networks: Physical Structures, Network Types: LAN, WAN, Switching, Internet.

Network Models: Protocol Layering: Scenarios, Principles, Logical Connections, TCP/IP Protocol Suite: Layered Architecture, Layers in TCP/IP suite, Description of layers, Encapsulation and Decapsulation, Addressing, Multiplexing and De-multiplexing, The OSI Model: OSI Versus TCP/IP.

Data-Link Layer: Introduction: Nodes and Links, Services, Categories of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Stop and wait ARQ, GBN ARQ, SR ARQ protocols, Piggybacking.

10 Hours

UNIT 2:

Media Access Control: Random Access: ALOHA, CSMA, CSMA/CD, CSMA/CA. **Controlled Access:** Reservation, Polling, Token Passing.

Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet: Characteristics, Addressing, Access Method, Efficiency, Implementation, Fast Ethernet: Access Method, Physical Layer, Gigabit Ethernet: MAC Sublayer, Physical Layer, 10 Gigabit Ethernet.

08 Hours

UNIT 3:

Wireless LANs: Introduction: Architectural Comparison, Characteristics, IEEE 802.11: Architecture, MAC Sublayer, Addressing Mechanism, Physical Layer.

Connecting Devices: Hubs, Switches, Virtual LANs: Membership, Configuration, Communication between Switches, Advantages. Network Layer: Introduction,

Network Layer services: Packetizing, Routing and Forwarding, Other services, Packet Switching: Datagram Approach, Virtual Circuit Approach, IPV4 Addresses: Address Space, Classfull Addressing, Classless Addressing, DHCP, Network Address Translation (NAT), Forwarding of IP Packets: Based on destination Address and Label

08 Hours

UNIT 4:

Network Layer Protocols: Internet Protocol (IP): Datagram Format, Fragmentation, Options, Security of IPv4 Datagrams, ICMPv4: Messages, Debugging Tools, Unicast Routing: Introduction, Routing Algorithms: Distance Vector Routing, Link State Routing, Path vector routing,

Unicast Routing Protocol: Internet Structure, Routing Information Protocol (RIP), Open Shortest Path First(OSPF), Border Gateway Protocol(BGP).

10 Hours

UNIT 5:

Transport Layer: Introduction: Transport Layer Services, Connectionless and Connection Oriented Protocols, User Datagram Protocol: User Datagram, UDP Services, UDP Applications, Transmission Control Protocol: TCP Services, TCP Features, Segment, Connection, State Transition diagram, Windows in TCP, Flow control, Error control, TCP congestion control.

06 Hours

Self-learning Component: Electronic Mail (SMTP), FTP, socket programming: Creating network applications with both UDP and TCP on any network simulator (open source like NS2, Wire mesh etc.).

Text Books:

1. **Behrouz A Forouzan:** “*Data Communication and Networking*”, 5th Edition, McGraw-Hill, 2017 (EBook available on web).
2. **Behrouz A Forouzan:** “*TCP/IP Protocol suite*”, 4th Edition, Tata McGraw-Hill Education, 2010.
3. **James F. Kurose, Keith W. Ross:** “*Computer networking- A Top-Down Approach*”, Pearson education, 6th Edition, 2013 (EBook available on web).
4. **Wayne Tomasi:** “*Introduction to Data Communication and Networking*”, 1st Edition, Pearson education 2007.

E-Resource:

1. **Video Lectures:** <https://nptel.ac.in/courses/106105081/>

EC 620L: Computer Networks Lab

List of Experiments:

PART-A: Simulation experiments using CISCO Packet Tracer/ GNS3 Tool.

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Using CISCO packet Tracer, perform the following experiments
 - a. Configure a basic Network topology.
 - b. Ping and Trace.
 - c. Investigate Unicast, Broadcast and Multicast Traffic.
3. Using CISCO Packet Tracer, Perform the following experiments
 - a. Skills Integration challenge-planning subnets and configuring IP addresses.
 - b. Observing the effects of collision in a shared media environment.
 - c. Static routing and default routing.
4. Configure a Network topology using Distance Vector Routing protocol (IPv4, Ipv6).
5. Configure a Network topology using Link State Routing protocol (IPv4, Ipv6).
6. Using CISCO Packet Tracer, Perform the followings
 - a. Network Address Translation (NAT)
 - b. Access Control List (ACLs)
7. Using packet Tracer, perform the following experiments
 - a. Basic switching configuration.
 - b. Configure VLAN and Inter-VLAN routing for a Network.

PART-B: Implement the following in C/C++/python.

1. Write a program for a HDLC frame to perform the following.
 - i) Bit stuffing and destuffing.
 - ii) Character stuffing and destuffing.
2. Write a program for distance vector algorithm to find suitable path for transmission.
3. Implement Dijkstra's algorithm to compute the shortest routing path.
4. For the given data, use CRC-CCITT polynomial to obtain CRC code.

Verify the program for the cases

i) Without error

ii) With error

5. Implementation of Stop and Wait Protocol and Sliding Window Protocol (GBN and SR Protocol).
6. Write a program for minimum spanning tree using kruskal's/Prim's algorithm.
7. Write a socket programing for client – server Model.

References

Todd Lammle: “*CCNA Routing and switching complete study Guide*” 2nd Edition, SYBEX, 2013.