

Computer Networks

Course Title: Computer Networks
Course No: CSC258
Nature of the Course: Theory + Lab
Semester: IV

Full Marks: 60 + 20 + 20
Pass Marks: 24 + 8 + 8
Credit Hrs: 3

Course Description: This course introduces concept of computer networking and discuss the different layers of networking model.

Course Objective: The main objective of this course is to introduce the understanding of the concept of computer networking with its layers, topologies, protocols & standards, IPv4/IPv6 addressing, Routing and Latest Networking Standards

Course Contents:

Unit 1: Introduction to Computer Network (6Hrs.)

- 1.1. Definitions, Uses, Benefits
- 1.2. Overview of Network Topologies (Star, Tree, Bus,...)
- 1.3. Overview of Network Types (PAN, LAN, CAN, MAN,...)
- 1.4. Networking Types (Client/Server, P2P)
- 1.5. Overview of Protocols and Standards
- 1.6. OSI Reference Model
- 1.7. TCP/IP Models and its comparison with OSI.
- 1.8. Connection and Connection-Oriented Network Services
- 1.9. Internet, ISPs, Backbone Network Overview

Unit 2: Physical Layer and Network Media (4Hrs.)

- 2.1. Network Devices: Repeater, Hub, Switch, Bridge, Router
- 2.2. Different types of transmission medias (wired: twisted pair, coaxial, fiber optic, Wireless: Radio waves, micro waves, infrared)
- 2.3. Ethernet Cable Standards (UTP & Fiber cable standards)
- 2.4. Circuit, Message & Packet Switching
- 2.5. ISDN: Interface and Standards

Unit 3: Data Link Layer (8Hrs.)

- 3.1. Function of Data Link Layer (DLL)
- 3.2. Overview of Logical Link Control (LLC) and Media Access Control (MAC)
- 3.3. Framing and Flow Control Mechanisms
- 3.4. Error Detection and Correction techniques
- 3.5. Channel Allocation Techniques (ALOHA, Slotted ALOHA)
- 3.6. Ethernet Standards (802.3 CSMA/CD, 802.4 Token Bus, 802.5 Token Ring)
- 3.7. Wireless LAN: Spread Spectrum, Bluetooth, Wi-Fi
- 3.8. Overview Virtual Circuit Switching, Frame Relay & ATM
- 3.9. DLL Protocol: HDLC, PPP

Unit 4: Network Layer (10Hrs.)

- 4.1. Introduction and Functions
- 4.2. IPv4 Addressing & Sub-netting
- 4.3. Class-full and Classless Addressing
- 4.4. IPv6 Addressing and its Features
- 4.5. IPv4 and IPv6 Datagram Formats
- 4.6. Comparison of IPv4 and IPv6 Addressing
- 4.7. Example Addresses: Unicast, Multicast and Broadcast
- 4.8. Routing
 - 4.8.1. Introduction and Definition
 - 4.8.2. Types of Routing (Static vs Dynamic, Unicast vs Multicast, Link State vs Distance Vector, Interior vs Exterior)
 - 4.8.3. Path Computation Algorithms: Bellman Ford, Dijkstra's
 - 4.8.4. Routing Protocols: RIP, OSPF & BGP
- 4.9. Overview of IPv4 to IPv6 Transition Mechanisms
- 4.10. Overview of ICMP/ICMPv6&NATing
- 4.11. Overview of Network Traffic Analysis
- 4.12. Security Concepts: Firewall & Router Access Control

Unit 5: Transport Layer (6Hrs.)

- 5.1. Introduction, Functions and Services
- 5.2. Transport Protocols: TCP, UDP and Their Comparisons
- 5.3. Connection Oriented and Connectionless Services
- 5.4. Congestion Control: Open Loop & Closed Loop, TCP Congestion Control
- 5.5. Traffic Shaping Algorithms: Leaky Bucket & Token Bucket
- 5.6. Queuing Techniques for Scheduling
- 5.7. Introduction to Ports and Sockets, Socket Programming

Unit 6: Application Layer (7Hrs.)

- 6.1. Introduction and Functions
- 6.2. Web & HTTP
- 6.3. DNS and the Query Types
- 6.4. File Transfer and Email Protocols: FTP, SFTP, SMTP, IMAP, POP3
- 6.5. Overview of Application Server Concepts: Proxy, Web, Mail
- 6.6. Network Management: SNMP

Unit 7: Multimedia & Future Networking (4Hrs.)

- 7.1. Overview Multimedia Streaming Protocols: SCTP
- 7.2. Overview of SDN and its Features, Data and Control Plane
- 7.3. Overview of NFV
- 7.4. Overview of NGN

Laboratory Works:

The lab activities under this subject should accommodate at least the following;

1. Understanding of Network equipment, wiring in details
2. OS (Ubuntu/CentOS/Windows) installation, practice on basic Networking commands

- (ifconfig/ipconfig, tcpdump, netstat, nslookup, hostname, route...)
3. Overview of IP Addressing and sub-netting, static ip setting on Linux/windows machine, testing
 4. Introduction to Packet Tracer, creating of a LAN and connectivity test in the LAN, creation of VLAN and VLAN trunking.
 5. Basic Router Configuration, Static Routing Implementation
 6. Implementation of Dynamic/interior/exterior routing (RIP, OSPF, BGP)
 7. Firewall Implementation, Router Access Control List (ACL)
 8. Packet capture and header analysis by wire-shark (TCP,UDP,IP)
 9. DNS, Web, FTP server configuration (shall use packet tracer, GNS3)
 10. Case Study: Network Operation Center Visit (ISP, Telecom, University Network)
 11. LAB Exam, Report and VIVA

Text Books:

1. Data Communications and Networking, 4th Edition, Behrouz A Forouzan. McGraw-Hill
2. Computer Networking; A Top Down Approach Featuring The Internet, 2nd Edition, Kurose James F., Ross W. Keith PEARSON EDUCATION ASIA