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 (10 Hrs.)

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

Unit 5: Transport Layer (6 Hrs.)

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. Queueing Techniques for Scheduling
5.7. Introduction to Ports and Sockets, Socket Programming

Unit 6: Application Layer (7 Hrs.)

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 (4 Hrs.)

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, dnsip, 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: