Course Title: **Computer Networks**

Course No: CSC-301   Full Marks: 60 + 20 + 20

Credit Hours: 3   Pass Marks: 24 + 8 + 8

Nature of the course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Discussion on the types of networking techniques, Internet, IPV4

Goal: This course introduces concept of Computer networking and discuss the different layers of networking model.

Course Contents:

Unit 1.   **33 Hrs.**

1.1 Computer Network:
- Introduction to networking
- Computer networks and its uses
- Internet, evolution of Internet and its application
- Advantages and disadvantages of computer networks
- Network edge: end system, clients, server and their functions
- Connection oriented and connectionless service
- Network core: circuit switching and packet switching, virtual circuit networks and datagram networks
- Network access: dial-up, modem, digital subscriber line (DSL) and physical media, ISPs, hybrid fiber coaxial cable, wireless networks
- Physical media: guided and unguided media
  - Guided Media:
    - ❖ Copper media: Twisted pair Cable (UTP & STP), and Coaxial cable (Thicknet & Thinnet)
  - Unguided Media: Infrared, Radio Wave, Microwave
    - ❖ Repeater Stations, Satellites are used to regenerate the signal
- ISPs and Internet back bone

1.2 Protocol Layers:
- Introduction
- Layered architecture: need of layered model
- The Internet protocol stack: Application, Transport, Network, Data link and physical layer and corresponding protocols
- Data encapsulation steps: message, segment, packet, frame bits
- Addressing at different layers of TCP/IP: physical (link) address, logical (IP) address, port address
- Network entities and layers: Repeater, Hub, Bridge, Switch, Router

1.3 Application Layer:
- Introduction of application layer and its function
- Principles of application layer protocols: application layer protocols, services needed to an application, services provided by transport layer protocols
- The web and HTTP: overview of HTTP, HTTP message format, cookies
- File Transfer: Introduction, FTP commands & replies
- Domain name system (DNS): Introduction and importance of DNS, working of DNS, DNS records, DNS messages

1.4 Transport Layer:
- Introduction to transport layer and its services
- Relationship between transport layer and network layer
- Transport layer in Internet: connection oriented and connectionless services
- Multiplexing and demultiplexing
- Connectionless transport: UDP, UDP segment structure
- Reliable data transfer: building a reliable data transfer protocol, pipelined reliable data transfer protocols, Go-Back-N (GBN), Selective repeat (SR)
- Connection oriented transport: TCP, TCP connection, TCP segment structure, time estimation and timeout, flow control: Sliding window
- Congestion control, approaches to congestion control and quality of service (Choke packet, leaky bucket, token bucket)

1.5 Network Layer:
- Introduction
- Network Service model: datagram and virtual circuit service
- Routing: definition, principles static vs. dynamic routing, distance vector vs. link state routing algorithm, hierarchical routing: inter - AS routing & intra -As routing
- The Internet Protocol (IP): IPv4 addressing, different classes of IPv4 addresses, private vs. public address, datagram format, IP datagram fragmentation
- Subnetting, subnet mask, introduction to CIDR
- Internet Control message protocol (ICMP), packet format
- Network address translation (NAT): introduction and need of NAT
- Routing in the Internet: Intra –As routing in Internet: RIP and OSPF, Inter –As routing: BGP
- IPv6: need of IPv6, IPv6 addressing, IPv6 datagram format, advantages of IPv6, transition from IPv4 to IPv6
- Introduction to multicast routing

Unit 2.   **12 Hrs.**

2.1 Link Layer and Local Area Networks: introduction
- Data Link layer: the services provided by the link layer
- Error detection and error correction techniques: parity checks, checksum, CRCC

- Multiple access protocols:
  - Channelization: time-division multiple access (TDMA), frequency –division multiple access (FDMA), code division multiple access (CDMA)
  - Random access protocols: introduction to ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA
  - Controlled access: polling, token- passing protocols
- Local area networks (LANs): Ethernet, token ring, FDDI
- LAN addresses and ARP: LAN address, address resolution protocol (ARP)
- Ethernet: frame structure, signal format, CSMA/CD, Ethernet technologies
- Wireless links: Introduction to IEEE 802.11 standards, IEEE 802.11b, Bluetooth
- Point to point protocol (PPP): introduction, frame format
- Asynchronous Transfer Mode (ATM): Characteristics, introduction to layers of ATM model (AAL, ATM layer, ATM Physical layer)
- Introduction to frame relay

2.2 Multimedia Networking: Introduction, multimedia networking application, streaming audio and video.

2.3 Network Management: Introduction, The infrastructure for network management.

References:
1. "Computer Networking, A top down approach featuring the Internet", *James F. Kurose, Keith W. Ross*
2. "Data Communication and Networking", *Behrouz A Forouzan*
3. "Computer Networks", *A.S. Tanenbaum*
4. "Data and Computer Communications", *William Stallings*