COMPUTER NETWORKS – NOTES

1. Introduction to Computer Networks

- A computer network is a system of interconnected devices that share data and resources.

- Goals: resource sharing, reliability, scalability, cost-effective communication.

- Applications: business communication, IoT, cloud computing, remote access.

2. Network Models

- OSI Model: 7 layers – Physical, Data Link, Network, Transport, Session, Presentation, Application.

- TCP/IP Model: Application, Transport, Internet, Network Access.

- Each layer provides specific services and protocols.

3. Physical Layer

- Handles transmission of raw bits over communication media.

- Media types: Twisted pair, Coaxial cable, Fiber optics, Radio waves, Microwaves.

- Concepts: bandwidth, attenuation, noise, multiplexing.

4. Data Link Layer

- Responsible for framing, flow control, error detection and correction.

- MAC protocols: CSMA/CD, CSMA/CA, ALOHA.

- Devices: switches, bridges.

5. Network Layer

- Handles routing and logical addressing (IP addressing).

- IPv4 & IPv6, Subnetting, CIDR.

- Routing protocols: RIP, OSPF, BGP.

6. Transport Layer

- Provides reliable or unreliable delivery (TCP & UDP).

- TCP features: flow control, congestion control, 3-way handshake.

- UDP: low-latency, connectionless communication.

7. Application Layer

- Network applications and protocols: HTTP, HTTPS, FTP, SMTP, DNS.

- Provides high-level services to end users.

8. Wireless Networks

- Wi-Fi (802.11), Bluetooth, cellular networks (4G/5G).

- Access points, SSID, wireless security (WPA2, WPA3).

9. Network Security

- CIA triad: Confidentiality, Integrity, Availability.

- Threats: phishing, malware, DDoS, spoofing.

- Security tools: firewalls, IDS/IPS, encryption.

10. Emerging Trends

- SDN (Software Defined Networking)

- IoT networks

- Cloud networking

- Virtualization and Network slicing