SECTION-A

1. Define Mobile computing.

Mobile Computing:
A technology enabling users to access and transmit data wirelessly using portable devices like smartphones, laptops, or tablets. It relies on wireless networks, mobile devices, and cloud computing to provide seamless connectivity and flexibility anytime, anywhere.

2. List the advantages of mobile computing.

Advantages of Mobile Computing:

- **Portability**: Access data anywhere.
- **Flexibility**: Work remotely with ease.
- **Improved Productivity**: Enables multitasking and real-time communication.
- **Access to Cloud Services**: Seamless data storage and retrieval.
- **Cost Efficiency**: Reduces infrastructure needs.

3. Distinguish between mobile computing and wireless networking.

Mobile Computing:

- Focuses on accessing and processing data on portable devices.
- Includes devices, software, and wireless networks.

Wireless Networking:

- Provides the infrastructure for wireless communication.
- Focuses on connectivity between devices using technologies like Wi-Fi or Bluetooth.

4. List the wireless networking standards used in Mobile computing.

Wireless Networking Standards in Mobile Computing:

- **Wi-Fi (IEEE 802.11)**

- **Bluetooth (IEEE 802.15.1)**
- **Zigbee (IEEE 802.15.4)**
- **LTE/4G/5G**
- **Infrared (IrDA)**
- **WiMAX (IEEE 802.16)**

5. Classify the types of wireless networks

Types of Wireless Networks:

1. **Wireless Personal Area Network (WPAN)**: Bluetooth, Zigbee.
2. **Wireless Local Area Network (WLAN)**: Wi-Fi.
3. **Wireless Metropolitan Area Network (WMAN)**: WiMAX.
4. **Wireless Wide Area Network (WWAN)**: Cellular networks (4G, 5G).
5. **Ad-hoc Networks**: Peer-to-peer communication.

6. Give the uses of Ad-Hoc networks?

Uses of Ad-Hoc Networks:

- **Disaster Recovery**: Communication during natural calamities.
- **Military Applications**: Secure and flexible communication in the field.
- **Sensor Networks**: Monitoring environmental conditions.
- **Vehicle-to-Vehicle Communication**: Supports intelligent transport systems.
- **Event Coverage**: Temporary networks for events or conferences.

7. Classify the types of MAC Protocol.

Types of MAC Protocols:

1. **Contention-Based Protocols**: ALOHA, CSMA (e.g., Wi-Fi).
2. **Contention-Free Protocols**: TDMA, FDMA, CDMA.

3. **Hybrid Protocols**: Combines contention-based and contention-free (e.g., Z-MAC).

8. What is DHCP?

DHCP (Dynamic Host Configuration Protocol):
A network protocol that automatically assigns IP addresses and other configuration details (e.g., subnet mask, gateway) to devices on a network, ensuring efficient and dynamic management of IP resources without manual intervention.

9. List the characteristics of MANETs.

Characteristics of MANETs (Mobile Ad-hoc Networks):

- **Dynamic Topology**: Network structure changes frequently.
- **Decentralized**: No fixed infrastructure.
- **Self-Configuring**: Nodes manage themselves.
- **Limited Bandwidth**: Wireless links have constraints.
- **Energy Constraints**: Relies on battery-powered devices.

10. What is base station?

Base Station:
A fixed communication hub in wireless networks that connects mobile devices to the network infrastructure. It manages communication by transmitting and receiving signals, ensuring seamless connectivity within its coverage area. Examples include cell towers and Wi-Fi access points.

SECTION-B

11. Differentiate SDMA, FDMA, and TDMA medium access techniques.

SDMA (Space Division Multiple Access):
Allocates spatially separated channels using directional antennas. It increases capacity by reusing frequencies in different locations.

FDMA (Frequency Division Multiple Access):
Divides the frequency spectrum into distinct bands, assigning each band to a user. Ideal for continuous transmission like radio broadcasting.

TDMA (Time Division Multiple Access):
Shares a single frequency among multiple users by dividing it into time slots. Used in digital cellular systems like GSM.

Each technique optimizes the use of limited bandwidth differently based on spatial, frequency, or time divisions.

12. Describe the structure of TCP segment.

TCP Segment Structure:
A TCP segment consists of a header and data.

- **Header** (20-60 bytes):
    - **Source Port and Destination Port**: Identifies sender and receiver applications.
    - **Sequence Number**: Tracks data order.
    - **Acknowledgment Number**: Confirms received data.
    - **Header Length**: Size of the TCP header.
    - **Control Flags**: Manage connection (e.g., SYN, ACK).
    - **Window Size**: Specifies buffer size for flow control.
    - **Checksum**: Ensures data integrity.
    - **Urgent Pointer**: Indicates priority data.
- **Data**: Payload carried by the segment.

TCP ensures reliable data delivery using these fields.

13. Why does congestion occur in a network?

Congestion in a Network:
Congestion occurs when the demand for network resources exceeds capacity, leading to performance degradation.

Causes include:

- **Excessive Traffic**: High data load surpassing bandwidth limits.
- **Slow Processing**: Delays in routers or switches.
- **Insufficient Buffer Space**: Packet loss due to limited storage.
- **Inefficient Protocols**: Poor resource management or flow control.

Congestion results in packet loss, delays, and reduced throughput.

13. Why does congestion occur in a network?

Congestion in a Network:
Congestion occurs when network resources (e.g., bandwidth, buffer space) are overwhelmed by excessive data traffic.

Causes:

- High data load exceeding bandwidth.
- Slow processing at routers or switches.
- Insufficient buffer space leading to packet drops.
- Poorly optimized protocols or flow control.

Effects include delays, packet loss, and reduced network performance.

15. Is 3G cellular wireless technology superior to 2G technology? Justify your answer

Yes, 3G is superior to 2G technology.

Justification:

- **Speed**: 3G offers data rates up to 2 Mbps, while 2G is limited to 64 Kbps.
- **Data Services**: Supports high-speed internet, video calls, and mobile TV.
- **Multimedia Support**: Enhanced capabilities for streaming and multimedia.
- **Global Roaming**: Improved international compatibility.
- **Security**: Advanced encryption compared to 2G.

3G significantly enhances mobile communication, catering to modern data-intensive applications.

16. Give examples of typical Applications of Unicast and Multicast communication.

Unicast Communication Applications:

- **Web Browsing**: User accessing a website.
- **Email**: Sending a message to a specific recipient.
- **File Transfer**: Using protocols like FTP.

Multicast Communication Applications:

- **Online Streaming**: Live video broadcasting to multiple viewers.
- **Video Conferencing**: Group meetings in real-time.
- **IPTV**: Streaming TV channels over the internet.

These communication modes are chosen based on the number of recipients and the application's requirements.

17. Describe the mobile satellite systems.

Mobile Satellite Systems:
Mobile satellite systems provide communication services using satellites for areas with limited or no terrestrial infrastructure.

Types:

1. **GEO (Geostationary Orbit)**: Satellites remain fixed relative to the Earth, ideal for broadcasting and weather monitoring.
2. **LEO (Low Earth Orbit)**: Provides low-latency services like voice and data communication.
3. **MEO (Medium Earth Orbit)**: Combines GEO's coverage with LEO's low latency.

Applications:

- Remote communication (e.g., ships, airplanes).
- Disaster recovery and emergency services.

- GPS navigation and tracking.

Satellite systems are crucial for global and remote connectivity.

SECTION-C

18. Compare the architecture of TCP/IP protocol suite with the ISO/OSI architecture.

Comparison of TCP/IP and ISO/OSI Architectures:

1. **Number of Layers**:
    - **OSI Model**: Seven layers (Physical, Data Link, Network, Transport, Session, Presentation, Application).
    - **TCP/IP Model**: Four layers (Link, Internet, Transport, Application).
2. **Layer Functions**:
    - OSI has distinct layers for session and presentation, while TCP/IP combines these into the application layer.
    - OSI focuses on theoretical design; TCP/IP is more implementation-oriented.
3. **Development**:
    - OSI was developed as a reference model.
    - TCP/IP originated from ARPANET, designed for practical communication.
4. **Flexibility**:
    - TCP/IP is more robust and adaptable for real-world networking.
    - OSI provides a detailed, structured framework but is less commonly used.

Both models guide networking but differ in complexity and real-world application. TCP/IP dominates practical implementations.

19. Explain how does TCP detect and handle congestion.TCP detects congestion mainly through packet loss or increased delays, indicating network overload. It uses these key methods to handle congestion:

1. **Slow Start**: Begins transmission slowly, increasing the rate exponentially until congestion is detected.
2. **Congestion Avoidance**: After detecting congestion, TCP increases data flow linearly to avoid overwhelming the network.

3. **Fast Retransmit**: Retransmits lost packets quickly upon receiving duplicate acknowledgments.
4. **Fast Recovery**: Temporarily reduces transmission rate and then gradually increases it to recover from congestion.

These mechanisms help TCP adjust its sending rate dynamically, ensuring reliable data transfer while minimizing congestion and maintaining network stability.

20. What do you understand by 2.5G? How is it different from 2G and 3G technologies?

2.5G is an intermediate mobile technology between 2G and 3G, enhancing data transmission speeds over 2G. It uses technologies like GPRS (General Packet Radio Service) to support basic internet access and multimedia messaging.

Differences:

- **2G**: Primarily supports voice calls and limited data (up to 64 Kbps).
- **2.5G**: Offers packet-switched data, faster than 2G (up to 144 Kbps), enabling basic web browsing and email.
- **3G**: Provides high-speed data (up to several Mbps), supporting video calls, mobile TV, and advanced internet services.

2.5G bridges the gap, improving data capabilities without full 3G infrastructure.

21. Explain in detail about UMTS architecture.

UMTS Architecture:
UMTS (Universal Mobile Telecommunications System) is a 3G mobile communication system designed for high-speed data and multimedia services. Its architecture has three main parts:

1. **User Equipment (UE)**: Mobile devices like smartphones that connect to the network via a SIM card.
2. **UMTS Terrestrial Radio Access Network (UTRAN)**: Consists of Node Bs (base stations) and Radio Network Controllers (RNCs). Node Bs handle radio transmission, while RNCs manage resources, handovers, and connections.

3. **Core Network (CN)**: Divided into Circuit-Switched (for voice calls) and Packet-Switched (for data) domains. It connects UMTS to external networks like the Internet and PSTN.

The architecture supports high data rates, seamless mobility, and multimedia services through efficient radio access and core network integration.

22. Explain differences between GSM, GPRS and UMTS.

Differences Between GSM, GPRS, and UMTS:

- **GSM (2G)**: Primarily supports voice calls and basic data services (up to 9.6 Kbps). Uses circuit-switched technology.
- **GPRS (2.5G)**: Enhances GSM by enabling packet-switched data transmission, allowing moderate-speed internet access (up to 144 Kbps). Supports always-on connectivity.
- **UMTS (3G)**: Provides high-speed data (up to several Mbps), multimedia services, and video calls using WCDMA technology. Supports both packet and circuit switching.

In summary, GSM focuses on voice, GPRS adds better data capabilities, and UMTS offers advanced multimedia and broadband services.