MCE ASSIGNMENT-1 ANSWERS

Q1. (a) The cell size in cellular systems is typically hexagonal for two main reasons:

1. The hexagonal shape provides equal distance between the cell towers, which ensures that each tower has the same coverage area and provides efficient utilization of the available spectrum.
2. The hexagonal shape also allows for efficient frequency reuse, as the distance between cells with the same frequency is maximized, reducing interference between cells.

b. The co-channel reuse ratio is defined as the ratio of the carrier frequency reuse distance to the cell radius. Given the co-channel reuse ratio of 6.24, the frequency reuse factor can be calculated as follows:

Frequency reuse factor = (1/co-channel reuse ratio)^2 = (1/6.24)^2 = 1/39.06 = 1/7 (approx.).

Q2. (a) Handoff margin is a term used in cellular communication networks to represent the additional signal strength or quality margin that is required to ensure a smooth and proper handoff of a mobile device from one cell to another. The significance of handoff margin is that it determines the point at which a mobile device will be handed off from one cell to another. A larger handoff margin will result in a mobile device being handed off later than if the handoff margin were smaller. This can be beneficial in maintaining a stable connection, but can also result in reduced network capacity and increased latency. A smaller handoff margin will result in a mobile device being handed off earlier, which can increase network capacity but also increase the likelihood of dropped calls and decreased call quality.

b. There are two types of handoff based on decision making and RF management:

1. Hard Handoff: In this type of handoff, the mobile device is switched from one cell to another without any overlap between the cells. This requires the mobile device to disconnect from the current cell and connect to the new cell.
2. Soft Handoff: In this type of handoff, the mobile device maintains a connection to both the current cell and the new cell for a brief period of time during the handoff process. This allows for a seamless transition and reduces the likelihood of dropped calls. Soft handoff is typically used in CDMA (Code Division Multiple Access) networks.

Q3. a. The important subsystems and functions of a GSM (Global System for Mobile Communications) system include:

1. Mobile Station (MS): The mobile device that is used by the user to make calls and send text messages.
2. Base Station Subsystem (BSS): The components that are responsible for managing the radio interface between the mobile devices and the network.

3. Network Switching Subsystem (NSS): The components that are responsible for routing calls and messages within the network.
4. Operation and Maintenance Subsystem (OMS): The components that are responsible for managing and maintaining the network.

The Network Switching Subsystem (NSS) is considered the heart of the GSM system as it is responsible for routing calls and messages, and providing the necessary signaling and control functions.

b. NCHO (Network Controlled Handover) and MCHO (Mobile Controlled Handover) are two types of handover procedures in a GSM system.

1. NCHO: This type of handover is controlled by the network and is typically used in situations where the network needs to optimize call quality or network resource utilization.
2. MCHO: This type of handover is controlled by the mobile device and is typically used when the mobile device detects that it is moving into an area with better signal strength or quality. The mobile device initiates the handover by sending a request to the network to switch to a new cell.

Q4. a. Adjacent channel interference is a type of interference that occurs in cellular communication networks when a signal in an adjacent frequency band impinges on the desired signal. This can reduce the signal quality and cause errors in the received data. Techniques to mitigate adjacent channel interference include:

1. Frequency Planning: Assigning different frequencies to cells in a manner that minimizes the overlap of adjacent channel signals.
2. Filtering: Using filters to reduce the strength of adjacent channel signals.
3. Modulation and Error Correction: Using higher-order modulation and error correction codes to reduce the impact of interference on the desired signal.

Adjacent channel interference can be determined by measuring the signal-to-interference ratio (SIR) between the desired signal and the interfering signal. A higher SIR indicates lower levels of interference.

b. Cell Dragging: In a cellular communication network, cell dragging refers to the phenomenon where a mobile device that is moving at a high speed causes the edge of the cell it is connected to move along with it. This can result in a degradation of service for other users in the cell that are not moving.

Cell Breathing: Cell breathing refers to the dynamic changes in the size and shape of a cell in a cellular communication network in response to changes in network load. In areas with high network utilization, cells may shrink in size to minimize interference and increase capacity. In areas with low network utilization, cells may expand in size to reduce the number of unnecessary handovers and improve coverage.