1. **What Cellular system: - In** a cellular system replaced the single high-power transmitter to with many no of low power transmitter each signal providing coverage to only a fraction of services area.
   Each base station is allocated a portion of the total number of channels and nearby base stations.

2. **Basic Cellular System:** - A basic cellular system can be comprised of three units
   1. Mobile Unit: It comprises a control unit, a transceiver, and an antennas system.
   2. Cell site: It is interface between the mobile unit and the MTSO. It comprises a control unit, antennas, power plant and the data transmission.
   3. Mobile telephone switching office: It is the central co-coordinating unit for all cell sites. It comprises of the cellular processor and the cellular switch.
      One of the most important points is that the MTSO is responsible for controlling the call processing operation and handling the billing activities of the subscriber.

3. **Performance Criteria:** There are three categories for specifying performance criteria.
   1. Voice Quality: Voice quality is very hard to judge without subjective tests for user' opinions. In this technical area, engineers can't decide how to build a system without knowing the voice quality that will satisfy the users. In military communications, the situations differ: armed forces personnel must user assigned equipment.
      CM: It is commercial communication system, it is used to measure the quality of the voice, suppose a set value x and y which is percent of the customer rate. CM5- Excellent, CM4- good

   2. Data Quality: There are several way to measure the data quality such as bit error, chip error, symbol error and frame error rate. Chip error and symbol error measure the quality of the data along the transmission path. And bit error and frame error measure the quality of the date at the throughput.

   3. Picture / Vision Quality: There are color acuity, depth perception, flicker, motion noise perceptions, and visual acuity a. the percentage of pixel loss rate can be characterized in vertical resolution loss and horizontal resolution loss of pixel.

   4. Service Quality:

4. **Component and operation of cellular system**:

   Component: An overall cellular network contain number of different elements from the base transceiver station (BTS) itself with it antennas back through a base through a base station controller (BSC), and a mobile switching center (MSC) to the location registers (HLR and VLR) and the link to the public switched telephone network (PSTN).

   Operations: Cellular network organization uses low power transmitter (100w or less) The areas are divided into cells. Each cell is served by own antenna and a base station consisting of transmitter, receiver and control unit.

5. **Planning a cellular system:**

6. **Analog & Digital cellular systems:**

Analog Cellular System:

1 G / First Generation Cellular system.
- Evolved in early 80s.
- Called AMPS – ADVANCED MOBILE PHONE SYSTEM
- Released in 1983.
- Employed in North & South America, China, Australia etc.

Digital Cellular System:

Digital cellular systems are those which incorporate digital modulation techniques. Digital systems provide significant improvements in capacity and system performance. The United States Digital Cellular System (USDC) was created in the late 1980s to handle more users in a given spectrum allotment.

7. **Concept of frequency reuse channels:**
   Frequency reusing is the concept of using the same radio frequencies within a given area, that are separated by considerable distance, with minimal interference, to establish communication.

   Frequency reuse offers the following benefits −
   - Allows communications within cell on a given frequency
   - Limits escaping power to adjacent cells
   - Allows re-use of frequencies in nearby cells
   - Uses same frequency for multiple conversations
   - 10 to 50 frequencies per cell

8. **Co-Channel Interference:**
   Co-channel interference or CCI is crosstalk from two different radio transmitters using the same channel. Co-channel interference can be caused by many factors from weather conditions to administrative and design issues. Co-channel interference may be controlled by various radio resource management schemes.

9. **Reduction factor**: The ratio of the minimum separations between two cochannel cell without interference to the radius of a cell.

10. **C/I for normal case in an omni directional antenna system:** Normal cellular practice is to specify C/I to be 18 dB or higher based on subjective tests.

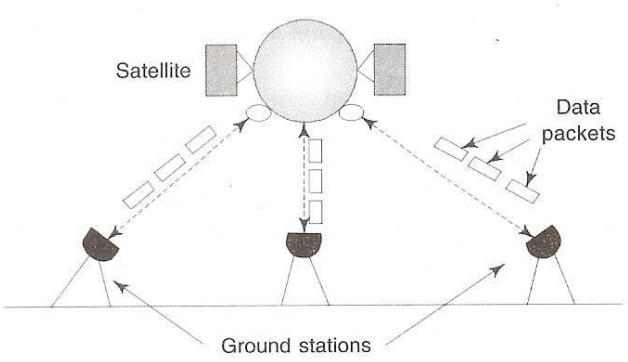
11. **Cell Splitting:** cell splitting is the process of sub diving a congested cell into smaller cells, each with its own base station and a corresponding reduction in antenna height and transmitter power. Cell splitting increases the capacity of a cellular system since it increases the number of times that channels are reused.
    By defining news cells which have a small radius than the original cell and by installing these smaller cells (called microcells) between the existing cell, capacity increases due to the additional number of channels per unit area.

UNIT 3

12. **Multiple access technique for wireless communications:**

    Introduction: Multiple access techniques are used to allow a large number of mobile users to share the allocated spectrum in the most efficient manner. As the spectrum is limited, so the sharing is required to increase the capacity of cell or over a geographical area by allowing the available bandwidth to be used at the same time by different users.

    In wireless communication systems: In wireless communication systems it is often desirable to allow the subscriber to send simultaneously information to the base station while receiving information from the base station.
    A cellular system divides any given area into cells where a mobile unit in each cell communicates with a base station. The main aim in the cellular system design is to be able to increase the capacity of the channel i.e. to handle as many calls as possible in a given bandwidth with a sufficient level of quality of service.
    There are several different ways to allow access to the channel:
    » Frequency division multiple-access (FDMA)
    FDMA splits the total bandwidth into multiple channels. Each ground station on the earth is allocated a particular frequency group (or a range of frequencies). Within each group, the ground station can allocate different frequencies to individual channels, which are used by different stations connected to that ground station. Before the transmission begins, the transmitting ground station looks for an empty channel within the frequency range that is allocated to it and once it finds an empty channel, it allocates it to the particular transmitting station.
    » Time Division Multiple Access (TDMA)
    Unlike FDMA, TDMA allows access to the full bandwidth of the frequency spectrum. In TDMA, each transmitter is allocated a predefined time slot. Each transmitter receives the time slot in turn and it is allowed to transmit data for the duration of the time slot.


Satellite
Data
packets
Ground stations