CELLULAR SYSTEMS-BASIC CONCEPTS

- Cellular system solves the problem of spectral congestion.
- Offers high capacity in limited spectrum.
- High capacity is achieved by limiting the coverage area of each BS to a small geographical area called cell.
- Replaces high powered transmitter with several low power transmitters.
- Each BS is allocated a portion of total channels and nearby cells are allocated completely different channels.
- All available channels are allocated to small no of neighboring BS.
- Interference between neighboring BSs is minimized by allocating different channels.
- Same frequencies are reused by spatially separated BSs.
- Interference between co-channels stations is kept below acceptable level.
- Additional radio capacity is achieved.
- Frequency Reuse-Fix no of channels serve an arbitrarily large no of subscribers

FREQUENCY REUSE

- used by service providers to improve the efficiency of a cellular network and to serve millions of subscribers using a limited radio spectrum
- After covering a certain distance a radio wave gets attenuated and the signal falls below a point where it can no longer be used or cause any interference
- A transmitter transmitting in a specific frequency range will have only a limited coverage area
- Beyond this coverage area, that frequency can be reused by another transmitter.
- The entire network coverage area is divided into cells based on the principle of frequency reuse
- A cell = basic geographical unit of a cellular network; is the area around an antenna where a specific frequency range is used.
- when a subscriber moves to another cell, the antenna of the new cell takes over the signal transmission
- a cluster is a group of adjacent cells, usually 7 cells; no frequency reuse is done within a cluster
- the frequency spectrum is divided into sub-bands and each sub-band is used within one cell of the cluster
- in heavy traffic zones cells are smaller, while in isolated zones cells are larger
- The design process of selecting and allocating channel groups for all of the cellular base stations within a system is called frequency reuse or frequency planning.

- Cell labeled with same letter use the same set of frequencies.
- Cell Shapes: Circle, Square, Triangle and Hexagon.
- Hexagonal cell shape is conceptual , in reality it is irregular in shape

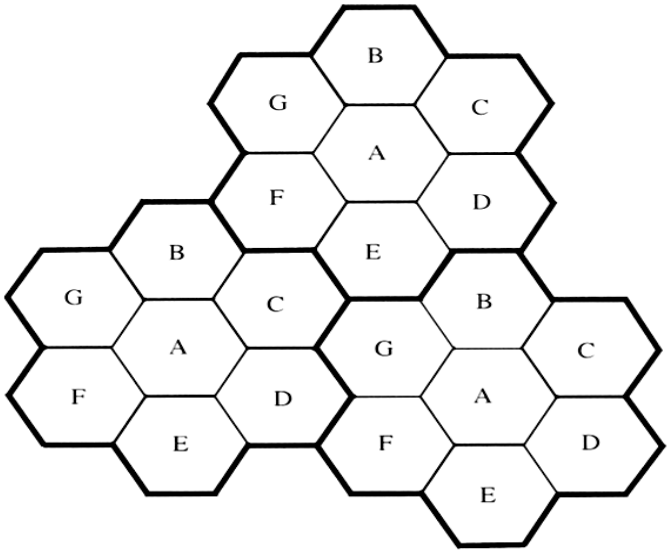

Figure 3.1 Illustration of the cellular frequency reuse concept. Cells with the same letter use the same set of frequencies. A cell cluster is outlined in bold and replicated over the coverage area. In this example, the cluster size, *N*, is equal to seven, and the frequency reuse factor is 1/7 since each cell contains one-seventh of the total number of available channels.

- In hexagonal cell model, BS transmitter can be in centre of cell or on its 3 vertices.
- Centered excited cells use omni directional whereas edge excited cells use directional antennas.
- A cellular system having 'S' duplex channels, each cell is allocated 'k' channels(k<S).
- If S channels are allocated to N cells into unique and disjoint channels, the total no of available channel is S=kN.
- The Frequency Reuse factor is given as 1/N, each cell is assigned 1/N of total channels.
- Lines joining a cell and each of its neighbor are separated by multiple of 60^0,certain cluster sizes and cell layout possible
- Geometery of hexagon is such that no of cells per cluster i.e N, can only have values which satisfy the equation

  $N=i^2+ij+j^2$

  N, the cluster size is typically 4, 7 or 12.

  In GSM normally N =7 is used.
- i and j are integers, for i=3 and j=2 N=19.