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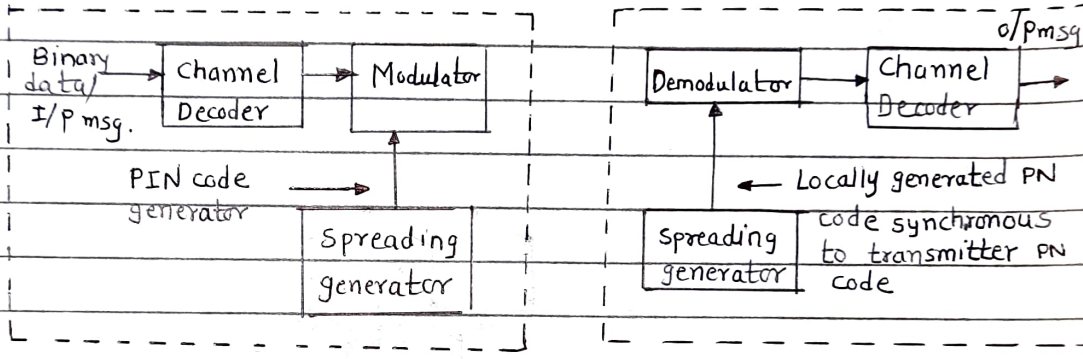
Mobile Computing

Assignment No. 1

Q.1 What is spread spectrum. What are the benefits of spectrum systems ?

→ **Spreading Spectrum** :- The process in which narrowband signal is converted to wideband signal is called as spreading of spectrum.



Basic Spread spectrum System.

Benefits of Spectrum Systems :-

1) It needs shorter acquisition time
2) Robust technology.
3) Frequency reuse can be implemented using SDM.

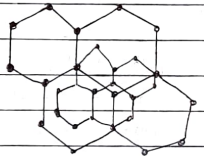
Q.2 Which are the methods of increasing cell capacity.?

→ **Ans:** Methods of increasing cell capacity

1) Cell splitting
2) Cell sectorization
3) Microcell Zones

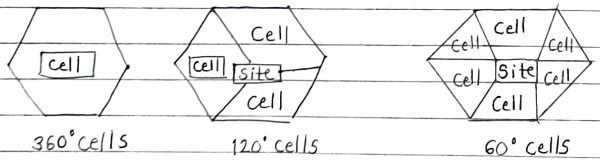
1. Cell Splitting :-

(1) Cell splitting is the process of dividing the radio coverage of a cell in a cellular system into two or more cell sites.
(2) Cell splitting is one of the ways to increase the capacity within the region of the original cell.
(3) To minimize interference, a certain distance must be maintained between cells using the same frequency.
(4) Particularly in a congested areas the cellular operator often splits an existing cell into two or more smaller cells.



Cell splitting

2. Cell Sectorization :-

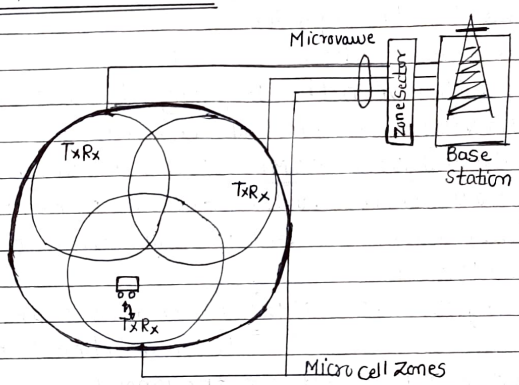


360° cells 120° cells 60° cells

Cell Sectorization

1) Another way to increase cellular system capacity is to replace the omnidirectional antenna at each base station by three or more sectors antennas.
2) Use of directional sector antennas substantially reduces the interference among co-channel cells.
3) This allows denser frequency reuse.

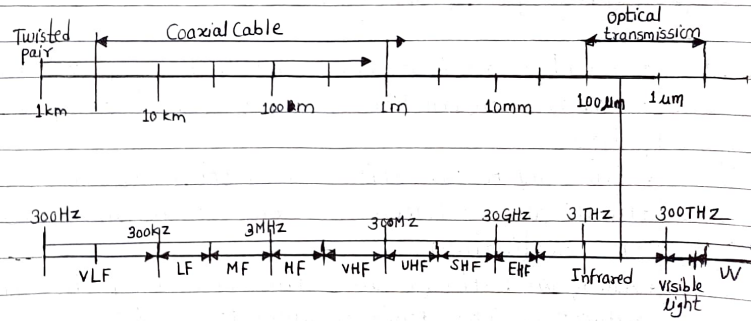
3. Using Micro cell Zone :-



1) The technique known as microcell that uses zones instead of sectors to reduce the number of handoffs.
2) The disadvantage of cell sectoring is the need for an increased number of handoffs.

Q.3 Draw & Explain electromagnetic spectrum for communication.

⟹ Solution :



The fig. illustrates the frequency spectrum for radio transmission. Frequency starts at 300 Hz & go up to over 300 THz.

- The relation between frequency F & wavelength λ is given by the equation.

$\lambda = c/f$, where, $c = 3 \times 10^8$ m/s

Depending Upon the frequency, the radio waves exhibit following three types of behaviour.

1. Ground Wave (<2 MHz) : Low frequency waves usually follow Earth's surface and can propagate long distance These waves are used for submarine communication or AM radio.
2. Sky Wave (2-30 MHz) These waves are reflected at the atmosphere & Hence can bound back and forth between the ionosphere & the Earth's surfac travelling around the world. They are used for internatio broadcast.
3. Line-of-Sight (>30 MHz) : These waves follow a straight line of sight. They are used in Mobile phones systems. Also satellite systems. cordless telephones etc. use these waves.

9.5 What ~~are~~ various issues in signal pro...

→ 1. Free Space propagation :-

- In this, radio waves travel in free space away from the obstructions which will effect the propagation path.
- The only factor affects free space propagation is the distance between the transmitting antenna & the destination
- Along with the distance the strength of the signal reduces & signal tends to travel lesser distance.

2. Ground Wave Propagation :-

- The ground wave propagation in which waves travel along the surface of the earth.
- All the radio signals transmitted in the daytime propagate by ground wave method.

3. Sky Wave propagation :

- Waves in HF range & frequencies just above & below HF gets reflected back from the ionized layers of the atmosphere are known as skywaves.
- These waves are launched into the sky & get reflected back from ionized layer.
- To cover maximum distance between transmitter & receiver multiple reflections must take place.

4. Space Wave propagation :-

Waves above HF range level in straight line are known as space Waves.

9.6 Discuss multiplexing in wireless communications.

→ Multiplexing means the ability to send data coming from multiple sources, users or channels over a common shared transmission medium with minimum interference & maximum utilization.

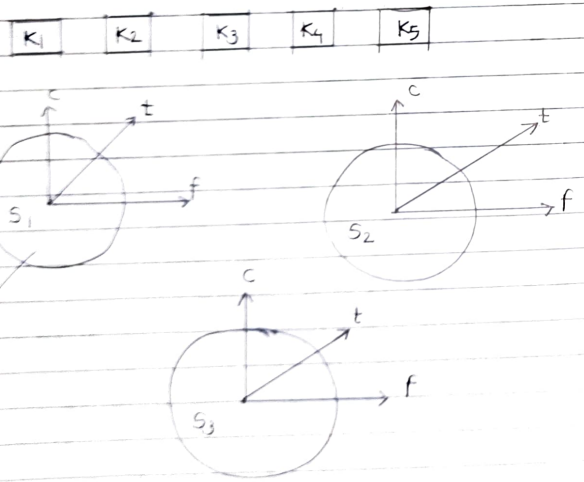
- Four types of multiplexing are commonly Used in communication systems.

1. Space Division Multiplexing (SDM)
2. Time Division Multiplexing (TDM)
3. Frequency Division Multiplexing (FDM)
4. Code Division Multiplexing (CDM)

1. Space Division Multiplexing :-

- In space division multiplexing, the entire region of transmission is divided into multiple spaces. For exchang data, each user is allocated a communication channel.
- It can be noted that there is some space between each channel. This space is called guard channel. For the remaining channels, three additional spaces would be needed.

Application :- SDM is also used in cellular systems where the service area is divided into different cells. Each cell is assigned different frequenc band such that there is no interference in adjacent cells.



2. Frequency division Multiplexing :

- In frequency division multiplexing, the entire frequency range is divided into frequency bands.
- Each signal gets a certain band of the spectrum for the whole time.
- Different frequency bands are separated by guard spaces

Application :-

This scheme is used for radio stations within the same region, where each radio system uses its own frequency.

Advantage :-

- No complex coordination between sender & receiver is required.
- This complex w scheme works for analog signals as well.

3. Time Division Multiplexing :

- In TDM, the entire spectrum is given to a particular channel for a certain time travel interval.
- As shown in fig, a channel K is given the whole bandwidth for a certain amount of time.

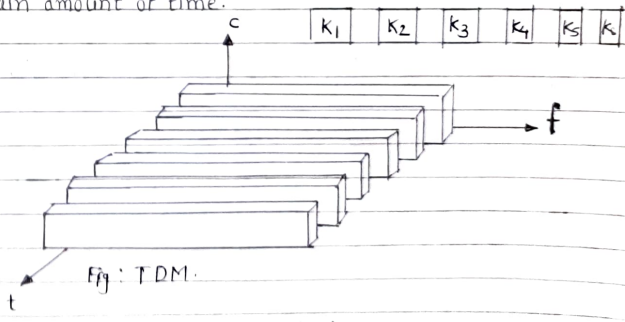


Fig : TDM.

Advantage :- There is only one carrier in the medium at any time which results in high throughput even if there are many users.

4. Code Division Multiplexing :-

- In this scheme, all channels use same frequency at the same time for transmission.
- Users are now separated using codes.
- In this, signals from multiple independent sources can be transmitted at the same time over the same frequency band.
- This task can be achieved via spread spectrum technique in which special codes called as orthogonal codes are used to spread each signal over a large, common freque band.

Advantages :-

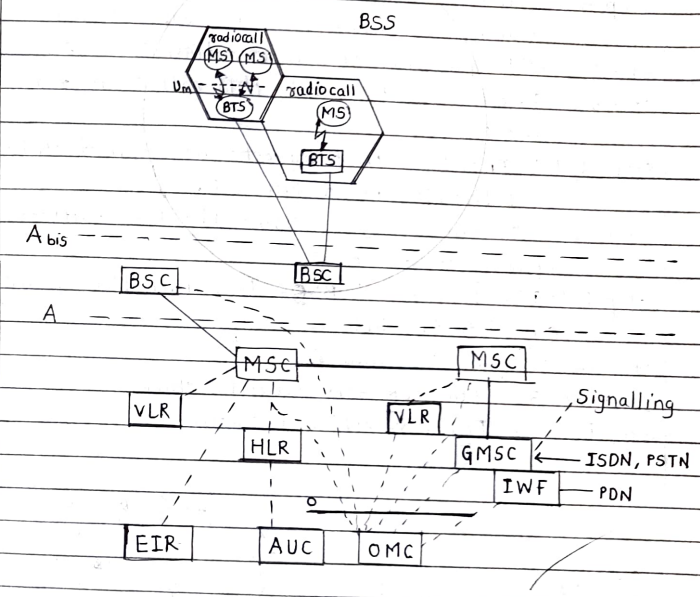
1. It gives good protection against interference & tapping.
2. Bandwidth utilization is very efficient
3. No synchronisation is needed between the sender & the receiver.

RSS

BSS

OSS

Q.7 Draw neat diagram of GSM System Architecture.



GSM System Architecture.

Q.8 Describe call Initiation & Call termination procedure in GSM systems.

→ Call Termination Procedure :-

Step 1 :- A PSTN user dials the phone number of a GSM subscriber.

Step 2 :- GMSC identifies the HLR for the subscriber & signals the call setup to the HLR.

Step 3 :- The HLR now checks whether the number exists & whether the user has subscribed to the requested service

Step 4 :- The HLR requests a mobile subscriber roaming number (MSRN) from the current VLR.

Step 5 :- HLR forwards this information to GMSC

Step 6 :- The GMSC forwards this call setup request to the MSC.

Step 8, 9 : The MSC first requests the current status of the MS from the VLR.

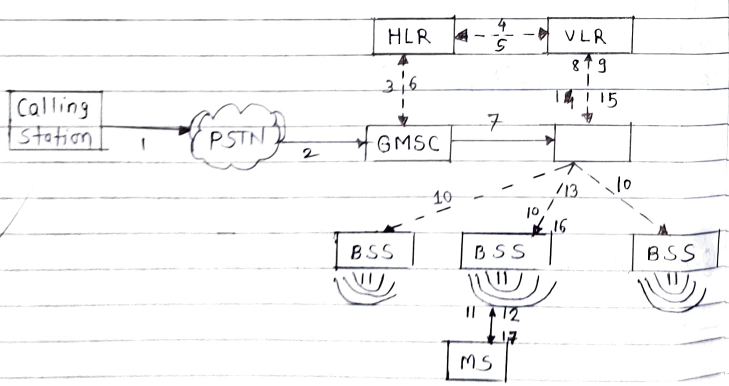
Step 10 : If the MS is available, the MSC initiates paging in all cells.

Step 11 :- The BTS of all BSS transmit this paging signal to the MS.

Step 12, 13 :- The MS answers.

Step 14, 15 : The VLR does security checks

Step 16, 17 : The connection is setup.



Q.9 Explain various types of Handoffs in GSM networks.

→ When a mobile user is engaged in conversation, the MS is connected to the BTS via radio link. If the mobile user moves to the coverage area of another BTS, the radio link to the old BTS is eventually disconnected & a radio link to the new BTS is established to continue the conversation. This process is called handover or handoffs.

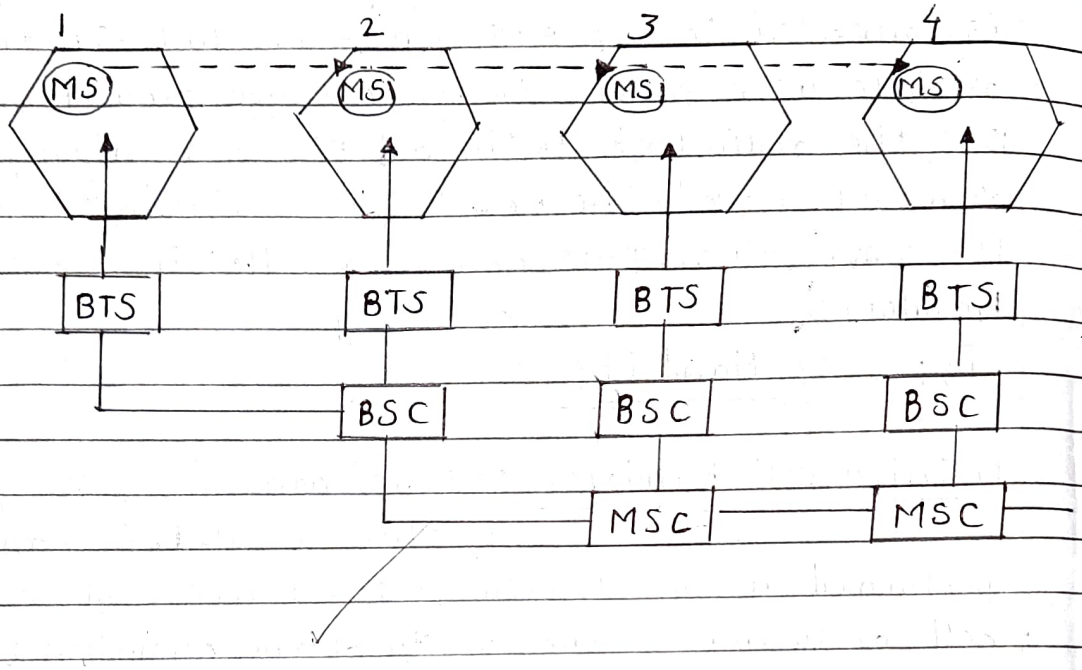
Types of Handoffs :-

1) Intra-cell handover :- This handover takes place within a cell. This handover is performed in order to optimize the traffic load in the cell or to improve the quality of the connection by changing the certain ~~or~~ carrier frequency.

2) Inter-Cell, Intra-BSC handover :- This handover occurs when a mobile station moves from one cell to another cell, the new cell & releases old one.

3) Inter-BSC, Intra-MSC handover :- This handover takes place between two cells managed by different BSCs. This Handover is controlled by MSC.

4) Inter MSC handover :- Inter MSC handover takes place between two cells belonging to different MSCs. Both MSCs perform the handover together.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