WC

1812401600 1
Vishwas Acharya

Assignment-2

Date:

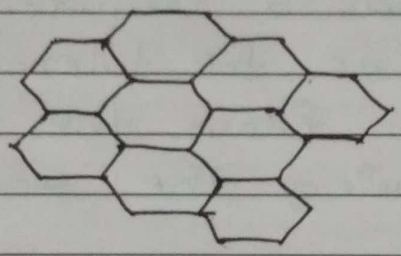
1

Q1) Explain Hexagonal geometry cell and concept of frequency reuse in detail.

Ans · Hexagonal Geometry cell:

↳ A hexagon is tessellating cell shape in that cells can be laid next to each with no overlap; therefore, they can cover the entire geographical region without any gaps.

↳ This approximation is frequently employed in planning and analysis of cellular networks.



Area of Hexagonal geomentry cell = 83% of circle

↳ No overlapping

↳ proper geometric shape

· Frequency Reuse:

↳ It is the scheme in which allocation and reuse of channels throughout a coverage region is done.

↳ Each cellular base ~~sata~~ station is alloted a group of radio channels or frequency sub-bands to be used within a small geographic area known as a cell.

↳ The shape of the cell is Hexagonal.

YASH

Royal ECO

- The process of selecting and allocating the frequency sub-bands for all of the cellular base station within a system is called Frequency reuse or Frequency planning.

- **Silent Features of using Frequency Reuse:**

↳ Frequency reuse improve the spectral efficiency and signal Quality (Q.S)
↳ Frequency reuse classical scheme proposed for GSM systems offers a protection against interference
↳ The number of times a frequency can be reused is depend on the tolerance capacity of the radio channel from the nearby transmitter that is using the ~~same~~ same frequencies.
↳ In Frequency Reuse scheme, total bandwidth is divided into different sub-bands that are used by cells.
↳ Frequency reuse scheme allow WiMax system operators to reuse the same frequencies at different cell sites.

- Cell with the same letter uses the same set of channels group or frequencies sub-band.
- To find the total num of channel allocated to a cell:

S = Total number of duplex channels available to use
k = Channels allocated to each cell ($k < S$)
N = Total num of cells $\Rightarrow S = kN \quad F = V_N$

YASH Royal ECO

2) Explain S/I ratio consideration and calculation for Minimum Co-channel and adjacent interference in detail.

Ans- Interference is a major limiting factor in the performance of cellular radio system.

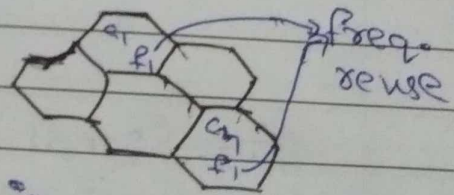
- Sources of Interference
  - ↳ Another mobile in the same cell
  - ↳ A call in progress in a neighboring cell
  - ↳ Other base stations operating in the same frequency band
  - ↳ Any non cellular system which inadvertently leaks energy into the cellular frequency band.

- The two major types of system generated interferences are

- Co-channel interference
- Adjacent channel interference

- Co-channel Interference

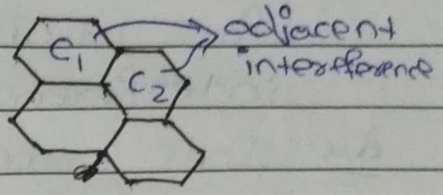
↳ It uses same frequency in a given coverage area.



↳ Interference from this cells is called as co-channel interfer
↳ Why it happes because Radio transmitter is operating on same frequency.

Royal ECO

- Adjacent Interference



↳ It is the interference caused to the signal which are adjacent in frequency to the desired signal
↳ minimized by doing filtering

- S I Ratio

$$\frac{S}{I} = \frac{S}{\sum_{i=1}^{i_0} I_i}$$

where S - desired signal power
I_i - Interference power caused by the ith interfering co-channel cell base station.

- Assuming that the transmitting power of each base station is equal and the path loss exponent same through out the coverage area

$$\frac{S}{I} = \frac{R^{-n}}{\sum_{i=1}^{i_0} (D_i)^{-n}}$$

i_0 = The number of Co-channel interfering cells

S/I = Signal to interference ratio at the desired mobile receiver.

Considering first layer of interfering cells. If all the interfering base stations are

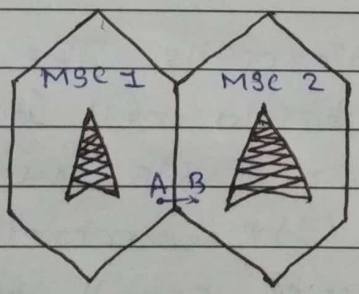
equidistant from the desired base station (by D between cell centers)

$$\frac{S}{I} = \frac{(D/R)^n}{i_o} = \frac{(\sqrt{3N})^n}{i_o}$$

34 Write note on Handoff Strategies and Umbrella Cell concept in detail.

Ans In cellular telecommunications, the terms handover or handoff refers to the process of transferring ongoing call or data connectivity from one Base station to the other Base station.

- When a mobile moves into the different cell while the conversation is in progress then the MSC [Mobile Switching Center] transfer the call to a new channel belonging to the new Base station.



- Types of Handoff:

1) Hard Handoff :- When there is an actual break in the connectivity while switching from one Base station to another BS.

- There is no burden on the Base station & MSC became the switching takes place so quickly that it can hardly be noticed by the users.
- The connection quality is not good, Hard handoff adopted the break before make policy.

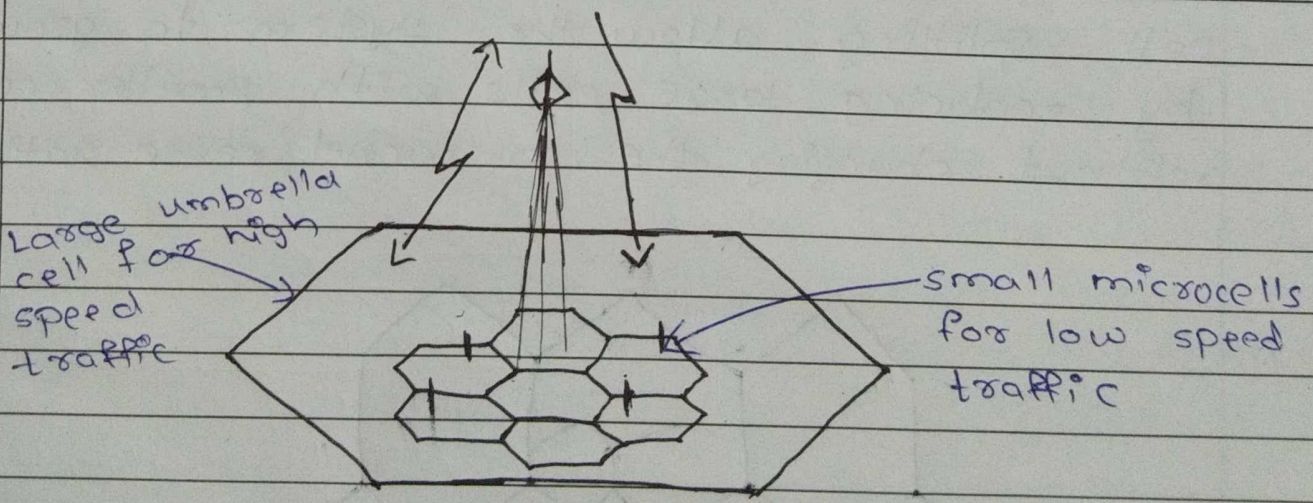
2. Soft Handoff: In this, at least one of the links is kept when radio signals are added or removed to the Base station.
- It adopted the make before break policy.
- Soft Handoff is more costly than Hard Handoff.

- Umbrella cells:

↳ It covers several microcells. The power level inside an umbrella cell is increased comparing to the power levels used in the micro cells, that from the umbrella cell.
↳ A freeway crossing very small cells produces an important number of handover among the different small neighboring cells.
↳ In order to solve this problem the concept of umbrella cells is introduced.
↳ When the speed of the mobile is too high, the mobile is handed off to the umbrella cells

YASH
Royal ECO

- The mobile will then stay longer in the umbrella cell.
- This will reduce the number of handover & the work of the network
- The umbrella cell approach ensures that the number of handoff in minimized for high speed users & provides additional microcell channels for pedestrain users.
- Using different antenna heights & different power levels it is possible to provide large & small cells which are co-located at a single location.
- This technique is called umbrella cell approach.
- It is used to provide large area coverage to high speed users while providing small area coverage to users travelling at low speed.

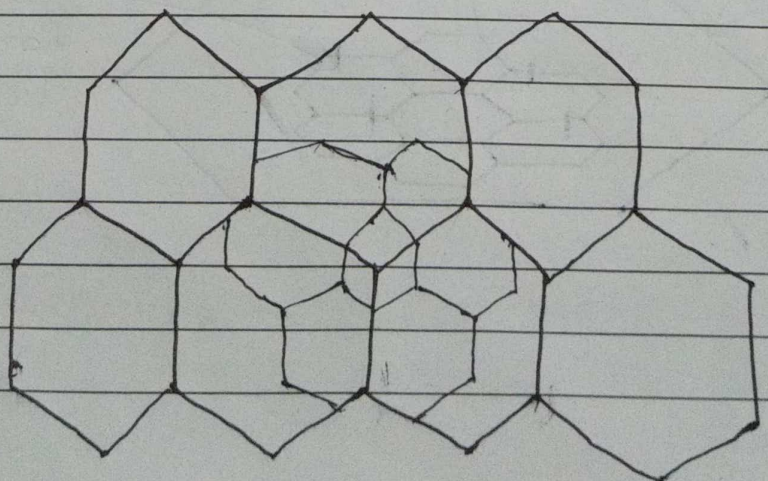


Date: 8

4) Write note on capacity in Cellular Sys. cell splitting, cell sectorization in detail.

Ans. **Cell Splitting:** It is the process of subdividing the congested cell into smaller cells.

- It allows an orderly growth of the cellular system.
- Each of the smaller cells will have their own base station with a reduction in antenna height & transmitted power
- The smaller cells are known as Microcells.
- It increase the capacity of the cellular system as it increases the number of times the channels are reused
- The increased number would increase the number of clusters over the coverage region, which in turn increase the number of channels & these capacity in the coverage area.
- Cell Splitting allow the system to grow by replacing large cells with smaller cells without changing the co-channel reuse ratio &



YASH

Royal ECO

- **Cell Sectorization :-** The co-channel interference in a cellular system can be decreased by replacing the omni directional antenna at the base station by several directional antennas, each radiating within a specified sector.
  - The process of reducing the co-channel interference & thus increasing the capacity of the system by using directional antenna is known as sectoring.
  - It uses directional antenna to control the interference & frequency reuse of channels
  - In general a cell is partitioned into three 120 degree sectors or six 60 degree sectors
  - When sectoring is employed, the channels use in a particular cell are broken down into sectored groups & are used only in a particular sector.
  - The Improvement in S/I suggests that the minimum required S/I of 18 dB can be easily achieved with 7-cell reuse by employing 120 degress sector technique when compared to 12-cell reuse
  - Therefore sectoring reduces interference & increases the capacity by an amount of (12/7) i.e. 1.714

- **Disadvantages :-** Increased number of antenna at each base station

- Decrease in trunking efficiency due to channel sectoring at each base station
- As sectoring reduces the coverage area of a particular group of channels the numbers of handoff increase