

### **MAY-2012**

1. List and explain various methods to improve the cell capacity-10- TR pg. 54
2. Explain channel assignment strategies(5) TR pg. 30
3. Discuss frequency reuse in cellular systems. – (5) TR pg. 26
4. How does sectoring improve S/I in cellular systems? – (10) TR pg. 57

### **DEC-2012**

1. List and explain various methods to improve the cell capacity-(10) TR pg. 54
2. Derive the relationship between S/I (Signal to interference) and cluster size N. (10) TR pg. 37
3. Explain channel assignment strategies(5) TR pg. 30
4. Write short notes on :- Umbrella cell approach (5) TR pg. 35

### **MAY 2013**

1. Derive the relationship between S/I (Signal to interference) and cluster size N. (10) TR pg. 37
2. Derive relationship between channel capacity C and cluster size N – (5) TR pg. 28
3. What is umbrella cell approaches? (5) TR pg. 35

### **DEC 2013**

1. List and explain various methods to improve the cell capacity(10) TR pg. 54
2. Discuss frequency reuse in cellular systems.– (5) TR pg. 26

### **MAY 2014**

1. How does sectoring improve S/I in cellular systems? – (10) TR pg. 57
2. Explain umbrella cell concept in cellular system. (5) TR pg. 35
3. Explain how does 60° and 120° sectoring improves signal to interference ratio (10) TR pg. 59

### **DEC 2014**

1. Explain cellular capacity and coverage improvement techniques. (10) TR pg. 54
2. Discuss frequency reuse in cellular systems.– (5) (10) TR pg. 26

### **MAY 2015**

1. Derive the relationship between S/I (Signal to interference) and cluster size N. (10) TR pg. 37
2. Explain Umbrella cell approach.(5M) TR pg. 35

### **DEC 2015**

1. If 36 MHz total spectrum is allocated for a duplex wireless cellular system and simplex channel has 25 MHz RF bandwidth, find the total number of duplex channels, number of channels per cell if  $N=4$  cell reuse is used. – (5)
2. If S/I of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if path loss exponent is a)  $n=3$  and b)  $n=4$ ? Assume six first tier co channel cells and mobile unit is at the centre of the cell. – (10) TR Pg. 40.
3. Explain cellular capacity and coverage improvement techniques – (10) TR pg. 54
4. Compare 2G, 3G and 4G with respect to speed, applications and bandwidth. (5M)
5. An urban area has population of two million residents. Three competing trunked mobile networks 1 systems A, B, C, provide cellular service in this area. System A has 394 cells with 19 channels each. System B has 98 cells with 57 channels each; and system C has 49 cells each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages two calls per hour at an average call duration of 3 minutes. Assuming that all three trunked systems are operating at maximum capacity, compute the percentage market penetration of each cellular service provider Data:  $GOS=0.02$ ; (10M) TR Pg.51

Number of Channels	Total Traffic Intensity
57	45
19	12
100	88

### **MAY 2016**

1. Consider geographical area of a cellular system is 480 sq. km. 910 radio channels are available for traffic handling. Suppose area of a cell is 8 sq. km.
  - ii) How many times would the cluster size of 7 have to be replicated in order to cover the entire service area? Calculate the number of channels per cell and system capacity. (10M)
  - iii) If the cluster size is decreased from 7 to 4, then does it increase the system capacity? – (10)

### **DEC 2016**

1. Compare between FCA and DCA channel assignment strategies. (5M) TR pg. 30

2. Consider a cellular system with S/I ratio of 18 dB. The frequency reuse factor is  $N = 7$ , calculate the worst case for signal-to-co channel interference ratio. It is the frequency reuse factor 7 still being acceptable? If not, what is it? Assume path-loss exponent as 4 in a mobile radio environment. (5M) TR Pg. 40.
3. With respect to trunking theory describe following terms:
  - i) Busy Hour
  - ii) Traffic Intensity A,
  - iii) Average call arrival rate & Average call duration H.
  - iv) Erlang-B System & Erlang-C System.
  - v) Trunking efficiency & Grade of Service (GOS) (10M) TR Pg 45.

### **MAY 2017**

1. Explain how prioritizing in Hand off is done (5M) TR Pg 34.
2. Explain Handoff in 2G, 3G, & 4G in detail (10M)
3. A receiver in an urban cellular radio system detects a 1mW signal at  $d=d_0=1$  meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below - 100 dBm. A measurement team has determined that the average path loss exponent in the system is  $n=3$ . Determine the major radius of each cell in a 7-cell reuse pattern is used. What is the major radius of each cell if a 4-cell reuse pattern is used? (10M) TR Pg 65.

### **DEC 2017**

1. Microcell zone concept helps in improving capacity of a cellular system. Justify. (5M) TR Pg No 61.
2. While designing a cellular system, how are co-channel and adjacent channel interferences kept under control? What is the role of S/I ratio and Q in this? (10M)
3. Short notes on: Trunking & GOS (10M) TR Pg no 44.

### **MAY 2018**

1. If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) four-cell reuse, (b) seven-cell reuse, and (c) 12-cell reuse. (4M)

2. Consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is  $6\text{Km}^2$  and the total coverage area of the system is  $2000\text{Km}^2$ . Calculate
- The system capacity if the cluster size,  $N = 4$
- The system capacity if the cluster sizes,  $N = 7$
- How many times would a cluster of size 4 have to replicated to cover the entire cellular area?
- Does decreasing the reuse factor  $N$  increase the system capacity? Justify your answer. (10M)

### **DEC 2018**

1. With respect to trunking theory describe following terms: i) Busy Hour ii) Traffic intensity A iii) Average call arrival rate  $H$  iv) Average call duration v) Trunking efficiency & GoS (5M) TR Pg 45.
2. There are six co channel cells in the first tier, and all of them are at the same distance from the mobile ( $N=7$ ), If a signal to interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, Calculate frequency reuse factor and cluster size that should be used for maximum capacity if path loss exponent is  $n=3$  and  $n=4$ . (10M)

### **Frequency Reuse**

- 1) Discuss frequency reuse in cellular systems. – (5) TR pg. 26
- 2) Write short notes on: - Umbrella cell approach (5) TR pg. 35
- 3) If 36 MHz total spectrum is allocated for a duplex wireless cellular system and simplex channel has 25 MHz RF bandwidth, find the total number of duplex channels, number of channels per cell if  $N=4$  cell reuse is used. – (5)
- 4) If S/I of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be used for maximum capacity if path loss exponent is a)  $n=3$  and b)  $n=4$ ? Assume six first tier co channel cells and mobile unit is at the centre of the cell. – (10) TR Pg. 40.
- 5) Consider geographical area of a cellular system is 480 sq. km. 910 radio channels are available for traffic handling. Suppose area of a cell is 8 sq. km.  
How many times would the cluster size of 7 have to be replicated in order to cover the entire service area? Calculate the number of channels per cell and system capacity.  
If the cluster size is decreased from 7 to 4, then does it increase the system capacity? – (10M)
- 6) Consider a cellular system with S/I ratio of 18 dB. The frequency reuse factor is  $N = 7$ , calculate the worst case for signal-to-co channel interference ratio. It is the frequency reuse

factor 7 still being acceptable? If not, what is it? Assume path-loss exponent as 4 in a mobile radio environment. (5M) TR Pg. 40.

- 7) Explain how prioritizing in Hand off is done (5M) TR Pg 34.
- 8) Explain Handoff in 2G, 3G, & 4G in detail (10M)
- 9) A receiver in an urban cellular radio system detects a 1mW signal at  $d=d_0=1$  meter from the transmitter. In order to mitigate co-channel interference effects, it is required that the signal received at any base station receiver from another base station transmitter which operates with the same channel must be below - 100 dBm. A measurement team has determined that the average path loss exponent in the system is  $n=3$ . Determine the major radius of each cell in a 7-cell reuse pattern is used. What is the major radius of each cell if a 4-cell reuse pattern is used? (10M) TR Pg 65.
- 10) If a total of 33 MHz of bandwidth is allocated to a particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) four-cell reuse, (b) seven-cell reuse, and (c) 12-cell reuse. (4M)
- 11) Consider a cellular system in which total available voice channels to handle the traffic are 960. The area of each cell is  $6\text{Km}^2$  and the total coverage area of the system is  $2000\text{Km}^2$ . Calculate
  - i) The system capacity if the cluster size,  $N = 4$
  - ii) The system capacity if the cluster sizes,  $N = 7$How many times would a cluster of size 4 have to replicated to cover the entire cellular area? Does decreasing the reuse factor  $N$  increase the system capacity? Justify your answer

### **Channel Assignment Strategies,**

- 1) Explain channel assignment strategies (5) TR pg. 30
- 2) Compare between FCA and DCA channel assignment strategies.(5M) TR pg. 30

### **Interference and System Capacity**

- 1) How does sectoring improve S/I in cellular systems? – (10) TR pg. 57
- 2) Derive the relationship between S/I (Signal to interference) and cluster size  $N$ . (10) TR pg. 37
- 3) Derive relationship between channel capacity  $C$  and cluster size  $N$  – (5) TR pg. 28
- 4) Explain how  $60^\circ$  and  $120^\circ$  sectoring improves signal to interference ratio (10) TR pg. 59
- 5) Microcell zone concept helps in improving capacity of a cellular system. Justify. (5M) TR Pg No 61.

- 6) While designing a cellular system, how are co-channel and adjacent channel interferences kept under control? What is the role of S/I ratio and Q in this? (10M)

### Trunking and Grade of Service

1. An urban area has population of two million residents. Three competing trunked mobile networks 1 systems A, B, C, provide cellular service in this area. System A has 394 cells with 19 channels each. System B has 98 cells with 57 channels each; and system C has 49 cells each with 100 channels. Find the number of users that can be supported at 2% blocking if each user averages two calls per hour at an average call duration of 3 minutes. Assuming that all three trunked systems are operating at maximum capacity, compute the percentage market penetration of each cellular service provider Data: GOS=0.02; (10M) TR Pg.51

Number of Channels	Total Traffic Intensity
57	45
19	12
100	88

2. With respect to trunking theory describe following terms:
- i) Busy Hour
  - ii) Traffic Intensity A,
  - iii) Average call arrival rate & Average call duration H.
- Erlang-B System & Erlang-C System.
3. Trunking efficiency & Grade of Service (GOS) (10M) TR Pg 45
4. Short notes on: Trunking & GOS (10M) TR Pg no 44.
5. With respect to trunking theory describe following terms: i) Busy Hour ii) Traffic intensity A iii) Average call arrival rate H iv) Average call duration v) Trunking efficiency & GoS (5M) TR Pg 45.

### Improving Coverage and Capacity in Cellular Systems

- 1. List and explain various methods to improve the cell capacity-10- TR pg. 54
- 2. Explain cellular capacity and coverage improvement techniques. (10) TR pg. 54
- 3. There are six co channel cells in the first tier, and all of them are at the same distance from the mobile ( $N=7$ ), If a signal to interference ratio of 15dB is required for satisfactory forward channel performance of a cellular system, Calculate frequency reuse factor and cluster size that should be used for maximum capacity if path loss exponent is  $n=3$  and  $n=4$ . (10M)