

Full marks 100

Time 3 hours

Answer **any five** questions, each carries 20 marks
Answer must be written at one place for each attempted question

- Q.1 a) Discuss the importance of cell clustering for cellular wireless communication.
- b) Explain with example the capacity expansion by the use of cell sectoring.
- c) A Cellular system has a total of 500 duplex voice channels without frequency reuse and uses omnidirectional antenna. The service area is 1000km^2 and area of each cell is 5 km^2 . The required signal-to-co-channel interference ratio is 18 dB. Consider the path loss exponent κ equal to 3, and 4 respectively. Determine
- The cell cluster size
 - The number of cell clusters in the service area; and
 - The maximum number of users in service at any instant

Discuss the effects of the path loss exponent on the frequency reuse. (Consider the first tier neighbor cells).
5+6+9

- Q2. a) Describe the free space propagation path loss model.
- b) When is two-ray propagation model suitable? On what factors does the loss depend for this model?
- c) What is called shadowing? How much (range) is the loss for shadowing may occur?
- d) A base transmitting antenna produces 40 Watt of power and applied to a unity gain antenna with 900 MHz carrier frequency. A receiving antenna with unity gain located at a distance 5 km from the base transmitter is used for the power reception. What is the received power in dBm and dBW?
5+5+4+6

- Q3. a) Discuss the concept of macro, micro and pico cells. When are they become useful?
- b) When a cell with radius R is split to a new cell of radius $R/2$, what will be the base station transmits power for the two cases. Find the transmit power ratio in dB. Does cell splitting increase capacity of the system?
- c) Derive the expression for S/I ratio in a worst-case scenario when mobile resides in a cell edge? Repeat the same for 120° and 60° sectoring?
5+5+10

Q4. a) Write spectrum allocation for uplink and downlink in GSM cellular system ?
 b) On what factors the spectral efficiency of wireless system depends? Give two definitions for spectral efficiency.
 c) Consider a GSM cellular system with frequency reuse factor 9. It has the uplink and forward link each having 25 MHz bandwidths. There are 125 duplex channels each having bandwidth 200 kHz with 45 MHz frequency separation. Now consider the system bandwidth is divided into number of subbands with band gap 20 kHz and each subband is partitioned into time slots. Each channel supports 8 users using TDMA with slot duration 0.577 ms and frame duration 4.615 ms. Calculate

- i. The number of subbands
- ii. The maximum number of simultaneous users that can be accommodated during one use of available frequency spectrum
- iii. Number of users per cell
- iv. The spectral efficiency for narrow band TDMA 5+5+10

Q5. a. Describe the AMPS key features as 1G network with their limitations.
 b. Draw GSM 2G cellular network architecture.
 c. How 2.5 G GPRS and 3G UMTS network evolve from GSM?
 d. Discuss the different multiple access technology used in 1G to 3G with reason. 4x5

Q6. a. How is satellite communication related with personal communication?
 b. Discuss the basic advantages of satellite communication.
 c. Differentiate satellite vs terrestrial communication 5+10+5

Q7.a. How is orbit period related with altitude for GEO, MEO and LEO?
 b. What are the main points to be considered in allocating frequency for satellite communication?
 c. Discuss about three satellite network architectures. 5+7+8

Q8. Write Short Notes $4 \times 5 = 20$

a) Multipath propagation in wireless communication, b) Handoff in cellular network, c) Location Tracking in cellular network, d) DS-SS method