Total No. of printed pages = 4

ECE 181802

16/6/22

Roll No. of candidate

2022

B.Tech. 8th Semester End-Term Examination

MOBILE COMMUNICATION

ECE + ETE

(New Regulation 2017-18 & New Syllabus 2018-19)

Full Marks – 70   Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *four* from the rest.

1.   Answer the following (MCQ/Fill in the blanks) :   (10 × 1 = 10)

   (i)   If the system is designed with the usage of hexagonal shaped cells, how are
         the base-stations located?

         (a)   At the centre of cell   (b)   At the edge of cell

         (c)   At the corner of the cell   (d)   All of the above

   (ii) Coherence time refers to

         (a)   Time required to attain a call with the busy base station

         (b)   Time required for synchronization between the transmitter and the
               receiver

         (c)   Minimum time for change in magnitude and phase of the channel

         (d)   None of the above

   (iii) Which method of cellular network assists in minimizing the co-channel
         interference associated with the angle of degree?

         (a)   Cell Splitting

         (b)   Cell Sectoring
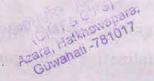
         (c)   Cell Segmentation and Dualization

         (d)   None of the above

                                                                            [Turn over

(iv) MIMO technology makes advantage of a natural radio wave phenomenon called

    (a) Reflection   (b) Multipath

    (c) Refraction   (d) Diffraction

(v) Doppler spread refers to

    (a) Signal fading due to Doppler shift in the channel

    (b) Temporary failure of message transfer

    (c) Large coherence time of the channel as compared to the delay constraints

    (d) All of the above

(vi) Isotropic radiation is also known as

    (a) Omni-directional radiation   (b) Bi-directional radiation

    (c) Tri-directional radiation   (d) None of these

(vii) Name of the multiple access technique in which fill bandwidth is used for fill time by all users is

    (a) FDMA   (b) CDMA

    (c) TDMA   (d) None of these

(viii) Which has same probability of error?

    (a) BPSK and QPSK   (b) BPSK and ASK

    (c) BPSK and PAM   (d) BPSK and QAM

(ix) Which of the following is not a category of space diversity technique?

    (a) Selection diversity   (b) Time diversity

    (c) Feedback diversity   (d) Equal gain diversity

(x) Which of the following leads to evolution of 3G networks in CDMA systems?

    (a) IS-95   (b) IS-95B

    (c) CdmaOne   (d) Cdma2000

2. (a) What is the difference between call blocking and call dropping? Which is more objectionable?

(b) Prove that for hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$.

(c) For given path loss exponent (i) n = 4 and (ii) n = 3, find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal-to-interference ratio of 15 dB is minimum required for satisfactory forward channel performance of a cellular system. There are six co-channel cells in the first tier, and all of them are at equal distance from the mobile. Use suitable approximations. (3 + 5 + 7 = 15)

3. (a) Differentiate between the following terms :

(i) Large-scale fading and small-scale fading.

(ii) Fast fading and slow fading

(iii) Frequency-selective fading and flat fading

(b) Define:

(i) Coherence bandwidth

(ii) Doppler spread

(iii) Coherence time

(c) Assume a receiver is located 10 Km from a 50 W transmitter. The carrier frequency is 600 GHz and free space propagation is assumed, $G_t = G_t = 1$

(i) Find the power at the receiver

(ii) Find the magnitude of the E-field at the receiver antenna.

(iii) Find the rms voltage applied to the receiver input, assuming that the receiver antenna has a purely real impedance of 50 Ω and is matched to the receiver. (6 + 3 + 6 = 15)

4. (a) Show that the free space power received by a receiver antenna which is separated from a radiating transmitter antenna by a distanced is given by

$$P_r = P_t + G_t + G_r - (32.44 + 20 \log d + 20 \log f)$$

Where P = power, G = Gain, f = frequency

   (b) Describe the three basic propagation mechanisms in a mobile communication system.

   (c) A mobile located 5 km away from a base station and uses a vertical $\lambda/4$ monopole antenna with a gain or 2.55 dB to receive cellular radio signals. The E-field at 1 km from the transmitter is measured to 10^{-3} V/m, the carrier frequency is 900 MHz.

      (i) Find the length and effective aperture of the receiving antenna.

      (ii) Find the received power at the mobile using 2-ray model assuming the height of the Tx antenna is 50 m and the R_x antenna is 1.5 m above ground.

   (d) What is frequency planning and why is it necessary? $(4 + 3 + 6 + 2 = 15)$

5. (a) Differentiate between :

      (i) FDMA and TDMA.

      (ii) CDMA and SDMA

   (b) Why do we use monopole antennas while having dipole antennas?

   $(6 + 6 + 3 = 15)$

6. (a) Define Diversity. Explain briefly different types of diversity.

   (b) Define Equalization technique.

   (c) Explain RAKE receiver circuit with its merits and demerits. $(7 + 2 + 6 = 15)$

7. Write short notes on (any *three*) : $(3 \times 5 = 15)$

   (a) IS-95

   (b) CDMA 2000

   (c) WCDMA

   (d) OFDM

   (e) MIMO system