BT-8/M-11

WIRELESS AND MOBILE COMMUNICATION

Paper : ECE-402(E)

Time : Three Hours]   [Maximum Marks : 100

Note : Attempt *five* questions in all, selecting at least *one* question from each Unit.

UNIT–I

1. Consider a hexagonal cellular wireless network with a frequency reuse 9. The base stations and the mobile units use omni directional antennas with gain 0 dB. Every transmitter has an output power of 1 Watt, which is assumed the same for both mobile transmitters and base station transmitters. The noise temperature power is $N_0 = 120$ dBw and the path loss is given by a Hata model with

   $Lp(dB) = 115 + 40 \log 10 \, r,$

   where r is the distance in km.

   (i) For a mobile located in the desired cell, find the maximum cell radius R to give a Signal-to-Noise plus Interference Ratio (SNIR = S/N_0+I) of at least 10 dB for both up and downlink.

   (ii) Assume that the base stations are now placed on the corner of the cells (i.e. three base stations per site) and use 120° sector antennas, find the new maximum cell radius that guarantees the required SNR of 10 dB. Consider only the first tier of interference.

2. (a) Calculate the free-space path loss at a frequency of 1 GHz, for each of the following paths, to a point on the earth directly under the satellite:
    (i)   from a LEO satellite at an altitude of 500 km.
    (ii) from a MEO satellite at an altitude of 12,000 km.
    (iii) from a geostationary satellite at 36,000 km.
    (b) What is Fast fading and how is it caused ?

UNIT–II

3. (a) Discuss various diversity techniques used to combat fading.
    (b) What is the need of Rake receiver ? Discuss the working of rake receiver.

4. (a) Show that the probability density function for short term fading is given by Rayleigh distribution. Find the corresponding cumulative distribution function.
    (b) Compare FDMA, TDMA and SDMA.

UNIT–III

5. A cell pattern is a repetitive pattern that covers an area without overlap. Examples to cell patterns are triangles $\left(d = r, \ a = \dfrac{\sqrt{27}r^2}{4}\right)$, squares $(d = \sqrt{2}r, a = 2r^2)$, and hexagons $\left(d = \sqrt{3}r, \ a = \dfrac{\sqrt{27}r^2}{2}\right)$, where r is the distance from the mid-point to the edge of a cell (radius), a is the area of the cell and d is the distance between the centers of two adjacent cells. A cluster is a set of cells such that a

repetitive pattern of clusters covers an area without overlap. For hexagonal cells the co-channel reuse ratio is $Q = \sqrt{3N}$, where N is the number of cells per cluster.

    (i)   Explain what the co-channel reuse ratio Q is.

    (ii) Express Q as a function of N for quadratic and triangular cell patterns, respectively.

    (iii) Order the three cell patterns in the order of their efficiency. Motivate your answer.

6.   (a) Discuss the various channel assignment strategies used in mobile communication system.

     (b) Explain queuing of handoff and prioritizing handoff request. Which type of handoff is used in second generation communication systems ?

UNIT–IV

7.   Write short notes on the following :

    (a) UMTS.

    (b) Location tracking.

8.   (a) Discuss briefly various GSM channels.

     (b) Explain the IS-95 CDMA reverse channel in detail.

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