(Subject Code and Roll No. to be filled in your Answer Book)

Roll No. | | | | | | | | | | |

M.Tech.

(SEM. III) THEORY EXAMINATION 2012–13

MOBILE COMMUNICATION

Time : 3 Hours *Total Marks : 100*

Note :– (i) Attempt any **five** questions.

(ii) **All** questions carry equal marks.

(iii) Any data not provided may be suitably assumed and same may be annotated in the answer sheet.

1. (a) What are the basic elements of a basic cellular system ? Describe the functionality of each element. Discuss the performance criteria and service quality of the cellular system.

(b) Describe the methods for increasing the coverage area for a noise limited system. What is a hole and what methods are used to fill these holes ? **(10+10=20)**

2. Attempt any **four** :

(a) How does diversity combining techniques improve mobile communication ?

(b) Usage of 60 GHz band for wireless LAN and wireless communication for 4G system.

(c) A Micro-cell Zone concept.

(d) MAHO

(e) Umbrella cell approach

(f) Adjacent channel interference. **(5×4=20)**

3. (a) What is meant by cell splitting ? How does cell splitting affect the system design ? Does the frequency reuse ratio (Q) change due to cell splitting ? For an identical received power at the boundaries of original larger cell with radius R_0 and new split cell with radius $R_0/2$, prove that cell site transmitter power of split cell must be 12 dB less than the cell site transmitter power of the original larger cell. Assume path loss exponent as 4.2 in typical mobile environment. Analyse the result. How many times split can be repeated ?

(b) Describe the process of handoff in GSM system.

(12+8=20)

4. (a) Discuss the model of a transmission medium of mobile wireless communication. What are Rayleigh and Ricean fading ?

(b) A receiver in an urban cellular radio system detects 1 mW signal at $d = d_0 = 1$ meter from the transmitter. In order to mitigate co-channel interference effect, it is required that the signal received at any base station receiver from another base station operates with the same channel must be-100 dBm. A measurement team has determined that the average path loss exponent n = 3. Determine the major radius of each cell if seven cell reuse pattern is used. What is the major radius if four cell reuse patter is used ?

(8+12=20)

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5. Attempt any **two** :

   (a) Cell sectoring and its purpose.

   (b) Leaky feeder radio communication.

   (c) Write briefly about the types of fading and its effect on communication system performance. Explain techniques to overcome phenomena of fading. **(10+10=20)**

6. (a) Explain the different propagation mechanisms in mobile communication system. How it affects communication system performance ?

   (b) Assume a receiver is located 10 km from a 50 W transmitter. The carrier frequency is 900 MHz, free space propagation is assumed. $G_t = 1$ and $G_r = 2$. Find :

      (i) the power at the receiver

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

      (iii) the rms voltage applied to the receiver input assuming that the receiver antenna has purely real impedance of 50 Ω and is matched to the receiver. **(8+12=20)**

7. Suppose that a mobile station is moving along a straight line between base station BS_1 and BS_2 as shown in the Figure given below. The distance between base stations is 2000 m. For simplicity, assume small scale fading is neglected and received power (in dB) at base station i, from the mobile station is modelled as function of distance on the reverse link :

$$P_n(d_i) = P_o - 10n \log_{10}(d_i/d_o) \text{ (dBm)} \quad i = 1,2$$

where d_i is the distance between the mobile and base station i, in meters. P_r is the received power at distance d_o from the mobile antenna. Assume that $P_o = 0$ dBm and $d_o = 1$m. Let n denote the path-loss exponent which is assumed to be equal to 2.9.

Assume the minimum usable signal level for acceptable voice quality at the base station receiver is $P_{r\,min} = -88$ dBm, and the threshold level used by the switch for handoff initiation is $P_{r\,H0}$. Consider the mobile is currently connected to BS_1 and is moving towards a handoff (time required to complete a handoff, once received signal level reaches the handoff threshold $P_{r\,H0}$ is $\Delta t = 4.5$ sec)

(a) Determine the minimum required margin $\Delta = P_{r\,H0} - P_{r\,min}$ to assure that calls are not lost due to weak signal condition during handoff. Assume that the base station antenna heights are negligible compared to distance between mobile and the base stations.

(b) Describe the effect of the margin $\Delta = P_{r\,H0} - P_{r\,min}$ on the performance of cellular system.

You may assume reasonable value of parameters if required.

(20)

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