B.E./B.TECH (FULL TIME) DEGREE ARREAR EXAMINATIONS, MAY 2014
ELECTRONICS AND COMMUNICATION ENGINEERING
SEVENTH SEMESTER   REGULATIONS: R-2004
EC 471– WIRELESS AND MOBILE COMMUNICATION

Time: 3 Hours   **Answer ALL Questions**   **Max.Marks: 100**
Part-A (10x2=20 Marks)

1. Prove that for a hexagonal geometry, the co-channel reuse ratio is given by $Q = \sqrt{3N}$, where $N = i^2 + ij + j^2$.
2. A cellular service provider decides to use a digital TDMA scheme which can tolerate a signal to interference ratio of 15dB in the worst case. Find the optimal value of N for 60° sectoring.
3. Define Coherence bandwidth and Coherence time.
4. Distinguish between flat and frequency selective fading.
5. What is the significance of cyclic prefix in OFDM system?
6. Differentiate spatial diversity and spatial multiplexing.
7. What are the advantages of diversity techniques?
8. Find the outage probability of QPSK modulation at $P_s = 10^{-3}$ for a Rayleigh fading channel with Selection Combining diversity for M = 1 (no diversity), M = 2, and M = 3. Assume branch SNRs $\gamma_1 = 10$ dB, $\gamma_2 = 15$ dB, and $\gamma_3 = 20$ dB.
9. If GSM uses a frame structure where each frame consists of eight time slots, and each time slot contains 156.25 bits, and data is transmitted at 270.833 kbps in the channel, find the time duration of a frame and how long must a user occupying a single time slot wait between two successive transmissions.
10. What is the need for power control in CDMA based cellular systems

PART-B   **(5x16=80 Marks)**

11. (i)Explain the various capacity expansion techniques in cellular systems.   **(8)**

    (ii)An Urban area has a population of two million residents. Three competing trunked mobile networks (Systems A, B, and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channel 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 trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider. Given from Erlang B chart for GOS= 2%   **(8)**

No. of Channel	19	57	100
Total Traffic	12	45	88

12.a.(i) Explain the difference between the three basic propagation mechanisms that give rise to signal attenuation in a wireless medium. **(8)**

(ii) Assume a receiver is located 10km from a 50W transmitter. If the carrier frequency is 1900MHz, $G_t=1$, $G_r=2$, find the power at the receiver assuming a free space propagation. Also determine the received power at the mobile using two ray ground reflection model considering the transmitter antenna height as 50m, receive antenna height as 1.5m above the ground and the ground reflection as -1. **(8)**

(OR)

12.b.(i)Explain the Clarke's model for multipath flat fading channel. **(8)**

(ii) Find the average fade duration for a threshold level of $\rho=0.707$ when the Doppler frequency is 20Hz. For a binary digital modulation with bit duration of 50bps, is Rayleigh fading slow or fast? What is the average number of bit errors per second for the given data rate. Assume that a bit error occurs whenever any portion of a bit encounters a fade for which $\rho<0.1$. **(8)**

13. a. Explain the OFDM transmitter and receiver. Also bring out its advantages and disadvantages.

(OR)

13. b. With neat diagram, explain the MIMO transmitter and receiver. Derive the ergodic capacity for the MIMO system.

14. a. (i) With the help of neat diagram, discuss the decision feedback equalization. **(8)**
   (ii) Explain the working principles of RAKE receiver and give its features. **(8)**

(OR)

14. b. (i) With suitable diagrams, explain the different diversity techniques. **(8)**
   (ii)Explain the different diversity combining strategies and compare their performances in terms of the probability of signal outage due to fading. **(8)**

15. a. Illustrate the working principles of FDMA, TDMA and CDMA and compare their features.

(OR)

15 .b. With neat diagram, explain the reference architecture of GPRS.