Registration Number :

B.E. / B.Tech. (Full Time) DEGREE END SEMESTER EXAMINATION – APRIL/MAY 2014
ELECTRONICS AND COMMUNICATION ENGINEERING BRANCH
SIXTH SEMESTER – (REGULATIONS R 2008)
EC9352 – WIRELESS COMMUNICATION

Duration : 3 Hours Max. Marks = 100

Answer ALL the questions.

PART- A (10 x 2 = 20 marks)

1. Highlight the pros and cons of Frequency Division Duplexing and Time Division Duplexing methods for cellular access.
2. Prove that for a hexagonal cell geometry, the co-channel reuse ratio is given by $Q = \sqrt{(3N)}$.
3. Find the far-field distance for an antenna with maximum dimension of 1m and operating at a frequency of 900 MHz.
4. Determine the maximum and the minimum frequencies received from a stationary GSM transmitter that has a center frequency of 1950 MHz, given that the receiver is travelling at 100 km/hr.
5. Compare the signal constellations of QPSK and OQPSK schemes and show the possible transitions that can occur over adjacent symbol durations.
6. Justify the necessity to convert the modulation symbols from serial mode to parallel mode in OFDM systems.
7. Show the need for micro-diversity and macro-diversity in cellular systems.
8. Differentiate between spatial diversity and spatial multiplexing techniques.
9. What are the channel bandwidths and data rates provided by the GSM and the IS-95 systems.
10. What is the need for adaptive modulation and coding in wireless LANs.

PART – B (5 x 16 = 80 marks)

11. (i) What are the reasons for handoffs in cellular systems. (4)
(ii) Suppose that a mobile is moving with a velocity of 80 km/hr, along a straight line between base stations BS1 and BS2 which are separated by 2 kms. Assume the base station antenna heights are negligible compared to the distance between the mobile and the base stations. Further small scale fading is assumed negligible and the received power at the base stations is estimated based on the log-distance path loss model, with P_0 = 0 dBm , d_0 = 1m and path loss exponent =2.9. The minimum usable signal level for acceptable voice quality at the base station receiver is $P_{r,min}$ = -88 dBm and let $P_{r,HO}$ be the threshold power level for handoff initiation. Consider that the mobile is currently connected to BS1 and is moving toward a handoff. The time required to complete a handoff once the handoff is initiated is 4.5 seconds. Determine the minimum required handoff margin Δ, to assure that calls are not lost due to weak signal condition during handoff. Also describe the effects of selecting an improper handoff margin Δ on the performance of the cellular system. (12)

12a. Distinguish between large scale fading and small scale fading. Derive an expression for the path loss using the 2-ray ground reflection model and highlight under what conditions it may be used.

Using the above path loss model explain how you will go about deriving the wireless link power budget, including all the relevant factors.

(OR)

12b. Explain the time domain and the frequency domain parameters that characterize the small scale fading behavior of a mobile multipath wireless channel. If a baseband binary message with the bit rate 384 kbps is modulating an RF carrier using 8-PSK, (a) Find the range of values for the RMS delay spread of the channel for which the received signal is a flat faded signal and determine the coherence bandwidth, (b) If the carrier frequency is 1.8 GHz what is the coherence time of the channel assuming a vehicle speed of 60 km/hr, (c) Is the channel fast fading or slow fading, (d) How many bits are sent while the channel appears stationary.

13a. Explain with suitable diagrams the different blocks present in an OFDM transceiver and explain the significance of each block. Show the impact of increasing the number of sub-carriers on the power spectral characteristics of the OFDM signal.

(OR)

13b. Explain with suitable diagrams the transmitter and receiver for MSK modulation scheme. Compare the power spectral characteristics of MSK with that of Sunde's FSK and QPSK.

14a. (i) Explain Selection Combining and Maximal Ratio Combining Techniques and highlight their merits and demerits. (8)

(ii) Explain the need for RAKE receivers for a CDMA based wireless communication system. Also explain its usage for multipath mitigation and the soft handoff process in CDMA based systems. (8)

(OR)

14b. Explain the coding and decoding process involved in Space Time Block Coding using Alamouti Codes and highlight the significance of the channel state information.

15a. (i) Classify the forward and reverse logical channels used in GSM. Also explain the signal exchange that takes place during call setup using these channels, between calling subscriber, BTS, BSC/MSC and called subscriber. (12)

(ii) If a normal GSM time slot consists of 6 trailing bits, 8.25 guard bits, 26 training bits and 2 traffic bursts of 58 bits of data, find the frame efficiency. (4)

(OR)

15b. (i) Highlight the different factors that affect the capacities of FDMA, TDMA and CDMA techniques when applied in cellular mobile communication systems. (8)

(ii) Given the following parameters for a CDMA based cellular system, calculate the number of active users supported per sector for a frequency reuse of 1; channel bandwidth B_w = 1.23 MHz; data rate R = 9.6 Kbps; E_b/N_o required = 6 dB; voice activity factor v = 0.4; other cell interference factor β = 0.6, power control accuracy α = 85% and gain due to sectoring λ = 2.55. Compare with the number of active users per sector realized over the same B_w of 1.23 MHz, for a 7-cell reuse FDMA based system with a user channel bandwidth of 30 kHz. (8)

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