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(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 0385 Roll No.

B. Tech.

(SEM. VIII) EXAMINATION, 2007-08

WIRELESS COMMUNICATION

Time : 3 Hours] *[Total Marks : 100*

Note : *(1) Attempt **all** questions.*

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

(3) Be precise in your answer.

*(4) **No** second answer book will be provided.*

1 Attempt any **four** parts of the following :

(a) For LOS transmission, show that the received power (relative to transmitted power) decreases by 6 dB for every doubling of distance and also for every doubling of the radio frequency.

(b) Using the ground reflection two ray model and the method images, find total electric field at any time t at a distance d.

(c) How the percentage of coverage area is determined within a cell ? Calculate the

percentage of area with a received signal that is equal or greater than threshold γ.

(d) What are the factors influencing small scale fading ? Show that the mobile radio channel can be modeled as a linear filter with time varying impulse response.

(e) With the help of block diagram, explain the spread spectrum channel impulse response measurement system and give its advantages and disadvantages.

(f) What is the concept of multipath shape factors for fading channels ? Define the three multipath shape factors and give the fading rates variance relationships in terms of the shape factors.

2 Attempt any **four** parts of the following :

(a) Why spread spectrum modulation is used in mobile radio environment ? Draw and explain the block diagram of a DS-SS system and show how interference is minimized at the receiver.

(b) Compare similarities and differences between basic concepts of DS-SS versus FH-SS system. Analyze the performance of a synchronous frequency hopping spread spectrum system and show that the irreducible error rate due to

multiple access interference is equal to $\frac{1}{2}\left[\frac{K-1}{M}\right]$ where K is number of MA users and M is number of possible hopping slots.

(c) What is diversity technique ? What are the drawbacks of selection diversity ? How maximal ratio combining overcomes them ? Show that the average signal to noise ratio (SNR) at detector input of a maximal ratio combiner is given by $\bar{\gamma}_M = M\Gamma$ where M is the number of diversity branches and Γ is average SNR of each branch.

(d) What is the need of equalization ? With the help of block diagram, explain a communication system using an adaptive equalizer at the receiver and show that the equalizer is an inverse filter of the channel.

(e) How transversal filter structure can be used as an adaptive equalizer ? Show that the optimum weight $\dot{W}$ is given by $\dot{W} = R^{-1}P$, where R is input correlation matrix and P is cross correlation vector.

(f) Derive the probability of error expressions for DPSK and noncoherent orthogonal binary FSK in a slow flat fading channel where the received signal envelope has a Ricean probability distribution.

3 Attempt any **two** parts of the following :

(a) Give the model for Human speech production. Draw the block diagram of a linear predictive coder (LPC) system and explain it. How the predication coefficients are determined ? Describe a code-excited LPC.

(b) Why non-uniform quantization is necessary for speech signals ? Give the μ law and Λ law compandings and plot them. For PCM with μ law compander, the output signal to quantization noise ratio is given by $\left(\frac{S}{N_q}\right) = \frac{3L^2}{\left[l_n(1+\mu)\right]^2}$ where L is the number of quantization levels. Show that for

$$\mu = 255, \left(\frac{S}{N_q}\right)_{dB} = 6.02n - 10.1\, dB$$

where n is the number of binary digits in PCM.

(c) List the multiple excess techniques used in different wireless communication systems. Explain the TDMA scheme, its salient features and the frame structure. Find expressions for the efficiency and number of channels in TDMA system.

4 Attempt any four parts of the following :

(a) Explain the principle of frequency reuse in a cellular network. Show that the frequency reuse factor is given by k/S where k is the average number of channels per cell and S is the total number of channels available.

(b) Name the technique used to increase the capacity of a cellular system and compare them. Explain cell sectoring and show how co-channel interference is reduced in this.

(c) What is handoff in cellular systems ? List the performance metrics used to make handoff decisions and give the various handoff strategies.

(d) Differentiate co-channel and adjacent channel interference in a cellular system and mention their causes. Find out the expression for signal

to co-channel interference ratio (S/I) and show that a minimum cluster size of seven is required to meet an S/I requirement of at least 18 dB. Assume path loss exponent n=4.

(e) What is GSM ? Mention the GSM services and features. Give the GSM system architecture and the various interfaces used in this.

(f) List the key specifications of leading 2G technologies. How 2G GSM technology can be upgraded to 2.5 G HSCSD (High Speed Circuit Switched Data) ?

5 Attempt any **two** parts of the following :

(a) What are the advantages and disadvantages of using CDMA for cellular network ? Discuss the frequency and channel specification of CDMA digital cellular standard (IS-95) and explain the forward CDMA channel. How power control is done in IS-95 ?

(b) Mentioned the vision and capabilities of 3G wireless networks as defined by ITU in IMT-2000 standard. Give the spectrum allocation, radio transmission technologies (RTT) and functional network architecture for IMT-2000 and illustrate the class of functions to be supported by IMT-2000.

(c) Explain the united states digital cellular USDC (IS-136) standard under the following headings :

(1) Radio interface

(2) USDC channels

(3) Frame structure on forward and reverse link

(4) Speech and channel coding.
