

WIRELESS COMMUNICATION

Time : 3 Hours

Min. Passing Marks : 24

Maximum Marks : 80

Instruction to Candidates :

Attempt any five questions, selecting one question from each unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit-I

- Describe the models of multipath faded radio signals.
 - What is the delay spread bound τ_{\max} of a 220 MHz public land mobile radio (PLMR) system if $P_T = 1$ watt (+30 dBm) and $P_{R \min} = -90$ dBm? How much is τ_{\max} if the sensitivity of the receiver is improved to $P_{R \min} = -100$ dBm? Why does increased sensitivity or increased system gain, $G_S = P + P_{R \min}$, lead to a higher delay-Spread bound. [8+8=16]

OR

- Compare similarities and differences in the fundamental concepts of a direct-sequence spread-spectrum (DS-SS) system versus a frequency hopping spread-spectrum (FH-SS) system.
 - The data rate (Source or information rate) of DS-SS product is $f_b = 10$ Kb/s. The spreading rate or chip rate is $f_c = 10$ mb/s. How much is the jamming margin M_j if an output $(S/N)_0$ of 12 dB is required for a bit error rate (BER) = 10^{-6} performance. [8+8=16]

Unit-II

- Determine the transmitter power required in an LOS microwave link operating at FDM mode, with a path length of 60 Km and a carrier frequency of 2GHz. The FM receiver's modulation index is 0.5, three modulation frequency is 5 MHz, and the receiver noise figure is 5dB. The transmitter and receiver antenna diameters are 1 m and branch losses are 5dB. [16]

OR

- A line of sight microwave link is to be established west of Chicago. The topographic survey of the site indicates a 330m elevation. Additional survey data show physical obstacles along the selected path, with the tallest at 25 m. Compute the antenna tower height for a 55-km length and a link operating frequency of 1.8 GHz. [16]

Unit-III

- Define briefly the operation of a time-division multiple-access (TDMA) scheme.
 - A communication satellite system is used exclusively for voice signal transmission, it employ an 8-psk modulation scheme with a spectral efficiency of 3.356 b/8/Hz, corresponding to an error power (P_e) of 10^{-8}

while maintaining a C/N equal to 21.5 dB of earth station transmit with TDMA one burst per frame for a frame period of 2 ms, determine the maximum number of voice channels the transponder bandwidth can accommodate if the total number of guard and preamble bits is 680. [16]

OR

- Describe the CDMA systems and what are the advantages and disadvantages of using CDMA for a cellular network.
 - Calculate the capacity and spectral efficiency of the DS-SS system with an omnidirectional cell using the following data : Bandwidth efficiency = 0.9, frequency reuse efficiency = 0.45, capacity degradation factor = 0.8, voice activity factor = 0.4, information bit rate = 16.2 kbps, $E_b/I_0 = 7$ dB, one way system bandwidth = 12.5 MHz. Neglect other sources of interferences. [8+8=16]

Unit-IV

- Describe the operation of mobile IP.
 - List and briefly define. The capabilities provided by mobile IP.
 - Describe the wireless protocols [6+5+5=16]

OR

- What is the difference between a single cell and a multiple-cell wireless LAN?
 - List and briefly define the IEEE 802 protocol layers.
 - What error correction schemes are used in Bluetooth baseband [6+5+5=16]

Unit-V

- List the main components of an earth station transmitter. With the assistance of a block diagram, briefly explain its function of operation.
 - With the assistance of a block diagram, describe the function of a satellite earth station down-converter. [8+8=16]

OR

- Define satellite access? Describe the difference between single and multiple access.
 - In a communication satellite link, the modulation scheme used in QPSK with a spectral efficiency of 1.85 b/s/Hz. Compute the maximum transponder channel capacity, assuming a 36 MHz transponder bandwidth. [8+8=16]