Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U6401

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2024

Sixth Semester

Electronics and Communication Engineering

21UEC601- WIRELESS COMMUNICATION

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

PART A - (5 x 1 = 5Marks)

1. Co- channel reuse ratio depends upon_____. CO1-U

   (a) Radius of the cell

   (b) Distance between the centers of the co channel cells

   (c) Frequency allocation of nearest cells

   (d) Both a) and b

2. ----------of the Power Delay Profile is defined to be the time delay during which multipath energy falls to X dB below the maximum. CO1-U

   (a) RMS delay spread (b) Maximum Excess delay

   (c) Mean Excess delay (d) None of the above

3. In DPSK system, input signal is differentially encoded and then modulated using a _____ modulator CO1-U

   (a) Amplitude (b)Frequency (c)BPSK (d) QPSK

4. Phase distortion occurs when _____. CO1-U

   (a) Phase response is function of frequency

   (b) Phase response is not a function of frequency

   (c) Both of the mentioned

   (d) None of the above

5. The data speed of Bluetooth is around _____ CO1-U

(a) 1 Mbps (b) 2 Mbps (c) 3 Mbps (d) 5 Mbps

PART – B (5 x 3= 15Marks)

6. Cellular system has 32 cells, each cell has 1.6 Km radius and the system reuse factor of 7. Determine the total geographical area covered. CO2-App

7. Compare the three basic propagation mechanisms. CO1-U

8. State the advantages of Offset-QPSK. CO1-U

9. List the techniques used to improve the received signal quality. CO1-U

10. What do you mean by cellular wireless network? CO1-U

PART – C (5 x 16= 80 Marks)

11. (a) i) A cellular service provider decides to use a digital TDMA scheme which can tolerate a signal-to-interference ratio of 15 dB in the worst case. Find the optimal value of N for (a) omnidirectional antennas, (b) 120° sectoring, and (c) 60° sectoring. Should sectoring be used? If so, which case (60°or 120°) should be used? (Assume a path loss exponent of n=4and consider trunking efficiency.) (8m) CO2-App (16)

ii) For given path loss exponent a) n=4 and b) n=3, Find the frequency reuse factor and the cluster size that should be used for maximum capacity. The signal to Interference ratio of 15 db is minimum required for satisfactory forward channel performance of a cellular system. There are six co-channel cells in the first tier and all of them are at the same distance from the mobile.

Use suitable approximations. (8m)

Or

(b) i) If a total of 33 MHz of bandwidth is allocated to particular FDD cellular telephone system which uses two 25 kHz simplex channels to provide full duplex voice and control channels, compute the number of channels available per cell if a system uses (a) four-cell reuse, (b) seven -cell reuse, and (c) 12-cell reuse. If 1 MHz of the allocated spectrum is dedicated to control channels, determine an equitable distribution of control channels and voice channels in each cell for each of the three systems. (8m) CO2-App (16)

ii) If a signal-to-interference ratio of 15 dB is required for satisfactory forward channel performance of a cellular system, what is the frequency reuse factor and cluster size that should be

used for maximum capacity if the path loss exponent is (a) n= 4, (b) n = 3? Assume that there are six co-channel cells in the first tier, and all of them are at the same distance from the mobile. Use suitable approximations. (8m)

12. (a) In the US digital cellular system, if fc=900MHZ and the mobile velocity is 70 km/hr. Calculate the received carrier frequency if the mobile
(a) directly toward the transmitter (Positive Doppler Shift
(b) directly away from the transmitter (Negative Doppler shift)
(c) in a direction perpendicular to the direction of the arrival of the transmitted signal. CO3-App (16)

Or

(b) Apply the conditions at which the ground appears to be in the first Fresnel zone and calculate the path loss in dB at a distance of 60 Km and the receiver antenna's height is 2 m for a unity gain antenna (both at transmitter and receiver). CO3-App (16)

13. (a) Derive the probability of error expressions for QPSK and GMSK in a slow flat-fading channel, where the received signal envelope has a Rician probability distribution. Compare the results. CO1-U (16)

Or

(b) Discuss the performance of spectrum when several users independently hop their carrier frequencies while using BFSK modulation CO1-U (16)

14. (a) Consider the design of the U.S Digital Cellular Equalizer. If the carrier frequency is 900MHz and the maximum Doppler shift is 66.67Hz.
1. Calculate the maximum mobile velocity for the given Doppler shift.
2. Calculate the Coherence time of the Channel.
3. Find the Doppler spread.
4. Assuming that the symbol rate is 24.3ksymbols/sec, calculate the maximum number of symbols that can be transmitted without updating the equalizer.
5. Assuming that there are 5 delay elements in an equalizer and there are 10μs delays in each, calculate the maximum number of taps.
6. Calculate the maximum multipath delay spread that could be equalized. CO4-App (16)

Or

(b) Consider the design of adaptive equalizer for a cellular system operates in an urban area. If the carrier frequency f_c=1800 MHz, Symbol rate = 25 k symbols/sec and the mobile velocity, v=80km/hr — CO4-App (16)

i. Find the Doppler shift. (6m)

ii. Determine the Coherent time of the channel. (6m)

iii. Find the maximum number of symbols that could be transmitted without updating the equalizer. (4m)

15. (a) Discuss about various cellular networks. — CO1-U (16)

Or

(b) Explain how the Lora WAN works better than WAN? — CO1-U (16)