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Question Paper Code : 70521

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Sixth Semester

Electronics and Communication Engineering

EC 8652 – WIRELESS COMMUNICATION

(Common to : Computer and Communication Engineering/Electronics and Telecommunication Engineering)

(Regulations 2017)

Time : Three hours — Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Differentiate between large scale fading and small scale fading.

2. A vehicle is travelling at a speed of 70 km/hr towards a base station. The frequency of the signal transmitted by base station is 900 MHz. What is the frequency of the received signal at the vehicle?

3. Differentiate between co-channel and adjacent channel interference in a cellular system.

4. Determine the signal-to-noise interference ratio in dB for a cellular system with cluster size as 7, number of co-channel cells in the first tier as 6 and the path loss exponent is n=4.

5. What is the need for Cyclic Prefix in an OFDM system?

6. Find the duration of one OFDM symbol with CP, if the subcarrier spacing is 20 KHz and Guard Interval is 33 μs.

7. What is the need for Equalization? Mention its types.

8. Differentiate between micro and macro diversity techniques.

9. What is meant by spatial multiplexing? Give its advantage.

10. Mention the significance of Beam forming and its types.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the parameters of multipath fading channels which affect the performance of a wireless communication system. (5)

(ii) Show how the wireless channels are classified based on the channel parameters. (8)

Or

(b) Derive the expression for the total E field measured at the receiver and the received signal power using a 2-Ray Ground Reflection model.

12. (a) Discuss the various multiple access techniques and compare their merits and demerits.

Or

(b) Explain the process of handoff, different types of handoff and the practical handoff considerations in a cellular radio system.

13. (a) (i) Explain OFDM Transmitter and Receiver architecture with a neat block diagram. (8)

(ii) Discuss the advantages and drawbacks of OFDM over single carrier modulation techniques. (5)

Or

(b) Discuss the principle of Minimum Shift Keying modulation scheme and the transmitter and receiver architecture with a neat block diagram.

14. (a) Illustrate various diversity combining techniques used in a wireless communication system and compare their performances.

Or

(b) (i) Discuss the probability density function of Rayleigh fading model. (6)

(ii) Derive the BER expression for BPSK transmission over Rayleigh fading channel. (7)

15. (a) Derive the capacity of wireless channel with and without fading.

Or

(b) Illustrate Transmitter diversity technique with a suitable pre-coding technique.

PART C — (1 × 15 = 15 marks)

16. (a) (i) Discuss the Free space propagation model and hence determine the path loss. (7)

(ii) A vertical $\lambda/2$ dipole antenna is used at a mobile terminal (receiver) with a gain of 5 dB and it receives a carrier frequency of 2 GHz. Mobile terminal is located at a distance of 2 km from the unity gain transmitter antenna which radiates a power of 50W. The height of transmitter antenna is 80 m and that of receiver antenna is 3m above ground. Assume a free space propagation model. Determine the following:

(1) The physical length of the receiver antenna (2)

(2) The effective aperture of the receiver antenna (2)

(3) The power received by the receiver antenna. (2)

(4) Path loss in dB. (2)

Or

(b) (i) Analyze the effect of PAPR in an OFDM system and techniques used to overcome the problem. (7)

(ii) Consider a practical WiMAX system using OFDM, with the total number of subcarriers N = 256 and a bandwidth of 15.625 kHz per subcarrier. Assume that WiMAX employs a cyclic prefix which is 12.5% of the symbol time. Determine the following :

(1) Total Bandwidth of the system. (2)

(2) OFOM symbol duration with and without CP. (2)

(3) Total number of samples in OFDM symbol with and without CP. (2)

(4) Loss in spectral efficiency due to addition of CP. (2)

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