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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Eighth Semester B.Tech Degree Supplementary Examination August 2024 (2019 Scheme)

Course Code: ECT402

Course Name: WIRELESS COMMUNICATION

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1 Determine the number of channels per cluster and the total channel capacity for a cellular telephone area composed of 10 clusters with seven cells in each cluster and 10 channels in each cell. (3)

2 What is cell splitting? How does it improve system performance? (3)

3 What is fading? List various types of small scale fading. (3)

4 A transmitter radiates a sinusoidal carrier frequency of 3GHz. For a vehicle moving at a speed of 72Kmph, compute the received frequency if the mobile is moving
i) Directly towards the transmitter
ii) Directly away from the transmitter (3)

5 Describe cyclic prefix. Why is cyclic prefix required in OFDM? (3)

6 Define average error probability and outage probability. (3)

7 Describe the selection combining technique used in diversity receivers. (3)

8 Define equalization in the context of digital communication systems. Differentiate between linear and nonlinear equalization techniques. (3)

9 What are the advantages and limitations of ground wave propagation for long-distance communication? (3)

10 Define critical frequency and maximum usable frequency and establish the relation between them. (3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11 a) Describe the evolution of wireless communication systems through the generations (2G, 3G, 4G, and 5G). List out the key technological advancements and capabilities introduced in each generation. (7)

b) Describe the role of Bluetooth technology in the development of personal area networks. What are the main features that distinguish Bluetooth from other wireless technologies? (7)

OR

12 a) Describe different types of handoff techniques. How do these techniques address the challenges associated with maintaining seamless connectivity during mobility? (8)

b) A cellular service provider uses a digital TDMA scheme with a worst case tolerance of 23dB signal-to-interference ratio. Calculate the optimal value of cluster size N and frequency reuse factor Q that should be used for maximum capacity for omnidirectional antennas. (No of co-channel cells is 6 and path loss exponent n = 4.) (6)

Module II

13 a) What is the importance of Two Ray model? Derive the expression for path loss in a two ray ground reflection model. (7)

b) Describe the concept of ergodic capacity in flat fading channels. Give the expression for capacity of flat fading AWGN channel with CSIR. Describe how it is obtained assuming AWGN capacity. (7)

OR

14 a) Derive the expression for the impulse response model of a multipath channel (7)

b) Compare and contrast flat fading with frequency-selective fading in wireless communication channels. (4)

c) Calculate the coherence time of a channel, if doppler shift is produced due to the movement of a mobile with a velocity of 50 m/sec and operating at 1800MHz. (3)

Module III

15 a) Derive expression for average probability of error in BPSK under Rayleigh flat fading when symbol duration is roughly equal to channel coherence time. (8)

b) Determine the average SNR per bit of BPSK modulation in Rayleigh slow-fading channel such that 95% of the times, average probability of bit error is less than 10^{-4}. (6)

OR

16 a) With the help of block diagrams, explain the implementation of an OFDM system (9)

b) What is Peak-to-Average Power-Ratio (PAPR) in OFDM system? How can it be reduced? (5)

Module IV

17 a) Describe Alamouti scheme for 2x2 Multiple Input Multiple Output (MIMO) systems. (7)

b) Compare and contrast the various multiple access methods, including Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code Division Multiple Access (CDMA), and Orthogonal Frequency Division Multiple Access (OFDMA). (7)

OR

18 a) What is the role of the Least Mean Squares (LMS) algorithm in adaptive equalization? (7)

b) Outline the differences between uplink and downlink transmission in multiuser systems and the challenges associated with them. (7)

Module V

19 a) Derive the expression for the refractive index of ionosphere (9)

b) Determine the maximum ionic density and critical frequency of an ionospheric layer with refractive index 0.92 and a frequency of 10MHz (5)

OR

20 a) How does the Earth's magnetic field influence ionospheric propagation? (7)

b) A receiving antenna is located 65 km from the transmitting antenna. The Height of the transmitting antenna is 100meters. What is the required height of the receiving antenna. Consider effective radius of earth. (7)

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