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Question Paper Code : 40987

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024.

Fifth Semester

Electronics and Communication Engineering

EC 3501 — WIRELESS COMMUNICATION

(Regulations 2021)

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Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is dwell time?
2. State the significance of frequency reuse.
3. Define Brewster angle.
4. State the principle behind knife edge diffraction model.
5. Why Gaussian Minimum Shift Keying modulation scheme is predominantly used in cellular communication?
6. State the difference between Frequency and Time Diversity schemes.
7. Is self-jamming a problem in CDMA? Justify.
8. Consider GSM, which is a TDMA/FDD system that uses 25 MHz for forward link, which is broken into radio channels of 200 kHz. If 8 speech channels are supported on a single radio channel and if no guard band is assumed, find the number of simultaneous users that can be accommodated in GSM.
9. State the difference between wireless and fixed Telephone networks.
10. State the difference between Packet and Circuit Switching used in Personal Communication Services/ Networks.

PART B — (5 × 13 = 65 marks)

11. (a) With suitable cellular communication scenario, write your understanding on Handoff Strategies namely Prioritizing Handoffs and Practical Handoff Considerations.

Or

- (b) Write your understanding on Cell Splitting and Sectoring coverage and capacity improving techniques used in cellular systems.

12. (a) Derive the mathematical expression of Free Space Propagation Model and apply it in the given problem: if a transmitter produces 50 W of power, express the transmit power in units of

(i) dBm and

(ii) dBW.

If 50 W is applied to a unity gain antenna with a 900 MHz carrier frequency, find the received power in dBm at a free space distance of 100 m from the antenna. What is $P_r(10 \text{ Km})$? Assume unity gain for the receiver antenna.

Or

- (b) Provide your understanding on the

(i) Factors influencing Small – Scale fading, (7)

(ii) Doppler Shift. Also apply the concept of Doppler shift in the given problem: In Digital Cellular System, if $f_c = 900 \text{ MHz}$ and the mobile velocity is 70 Km/Hr , Calculate the received carrier frequency if the mobile

(1) directly toward the transmitter, (2)

(2) directly away from the transmitter and (2)

(3) in a direction perpendicular to the direction of the arrival of the transmitted signal. (2)

13. (a) Explain the working mechanism of Direct Sequence Spread Spectrum (DS-SS). Analyze its Performance in Fading and Multipath Channels environment.

Or

- (b) Write your understanding on various Diversity Techniques used in cellular communication. Also compare and contrast their significant features.

14. (a) Derive the mathematical expression to determine capacity of Cellular System.

Or

- (b) Compare and Contrast various multiple access schemes namely TDMA, FDMA, CDMA and SDMA.

15. (a) Write your understanding on Packet Reservation Multiple Access used in Cellular Packet Switched Architecture.

Or

- (b) Write your understanding on the architecture of Universal Mobile Telecommunication Systems.

PART C — (1 × 15 = 15 marks)

16. (a) How many users can be supported for 0.5% blocking probability for the following number of trunked channels in a blocked calls cleared system?
- | | |
|-----------|-----|
| (i) 1, | (3) |
| (ii) 5, | (3) |
| (iii) 10, | (3) |
| (iv) 20, | (3) |
| (v) 100. | (3) |

Assume each user generates 0.1 Erlangs of traffic.

Or

- (b) An urban area has a population of two million residents. Three competing trunked mobile network (systems A, B, and C) provide cellular service in this area. System A has 394 cells with 19 channels each, system B has 98 cells with 57 channels each, and system C has 49 cells, each with 100 channels. Find the number of users that can be supported at 2% blocking if each user average two calls per hour at an average call duration of three minutes. Assuming that all three trunked systems are operated at maximum capacity, compute the percentage market penetration of each cellular provider.