INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
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B.Tech V SEMESTER END EXAMINATIONS (REGULAR/ SUPPLEMENTARY) - FEBRUARY 2024
Regulation: UG20
WIRELESS COMMUNICATION NETWORKS
Time: 3 Hours   (ELECTRONICS AND COMMUNICATION ENGINEERING)   **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain the regulatory frameworks and standards that contribute to the prevention and management of adjacent channel interference, ensuring fair coexistence and optimal performance of neighboring communication networks. [BL: Understand| CO: 1|Marks: 7]

   (b) A cell phone subscriber makes a call with a request rate of 0.3 calls/hour. The average duration of call is found to be 0.5 hour. Determine

   i) Traffic intensity

   ii) Total offered load, if the number of users in the given cell is 20. [BL: Apply| CO: 1|Marks: 7]

MODULE – II

2. (a) Outline the key considerations and methodologies in modeling partition losses within the same floor in indoor environments. [BL: Understand| CO: 2|Marks: 7]

   (b) If a transmitter produces 50 watts of power, express the transmit power in units of dBm and dBW. If 50 watts 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 the received power at 10 km? Assume unity gain for the receiver antenna.

   [BL: Understand| CO: 2|Marks: 7]

MODULE – III

3. (a) Differentiate between bandwidth and received power in small-scale multipath channels which affect the achievable data rates and spectral efficiency. [BL: Understand| CO: 3|Marks: 7]

   (b) Consider a transmitter which radiates a sinusoidal carrier frequency of 1850 MHz. For a vehicle moving at 60 mph, compute the received carrier frequency if the mobile is moving

   i) Directly towards the transmitter

   ii) Directly away from the transmitter

   iii) In a direction which is perpendicular to the direction of arrival of the transmitted signal.

   [BL: Apply| CO: 3|Marks: 7]

4. (a) Outline the challenges and trade-offs that arise in accurately estimating and predicting the time dispersion parameters of mobile multipath channels. [BL: Understand| CO: 4|Marks: 7]

(b) Calculate the mean excess delay, RMS delay spread, and the maximum excess delay (10 dB) for the multipath profile given in the Figure 1. Estimate the 50% coherence bandwidth of the channel. Would this channel be suitable for AMPS or GSM service without the use of an equalizer?
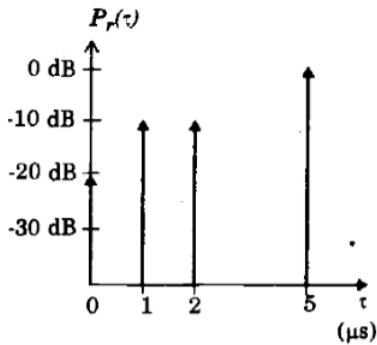
[BL: Apply| CO: 4|Marks: 7]

Figure 1

MODULE – IV

5. (a) Discuss the theoretical basis for deriving the improvement achieved by selection diversity.

[BL: Understand| CO: 5|Marks: 7]

(b) Illustrate the decision feedback equalization (DFE) address the challenges of inter symbol interference (ISI) by utilizing feedback information. What are the trade-offs and considerations in implementing DFE in communication systems with varying channel conditions and modulation schemes?

[BL: Apply| CO: 5|Marks: 7].

6. (a) Summarize the principles and challenges associated with feedback or scanning diversity techniques.

[BL: Understand| CO: 5|Marks: 7]

(b) Interpret the significance of maximum likelihood sequence estimation (MLSE) equalization in the context of recovering transmitted symbols from a received sequence. How does MLSE adapt to diverse communication scenarios?

[BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) Explain the wireless local loop (WLL) technology address the challenges of providing last- mile connectivity in telecommunications networks. What considerations should be taken into account in optimizing the deployment of WLL systems for voice and broadband services in both urban and rural areas?

[BL: Understand| CO: 6|Marks: 7]

(b) How do advancements in MAC layer mechanisms, such as contention-based and contention-free access, impact the performance of IEEE 802.11 networks?

[BL: Understand| CO: 6|Marks: 7]

8. (a) Infer the objectives and characteristics of the IEEE 802.16 standard (WiMAX). How does it differ from IEEE 802.11 in terms of coverage, mobility support, and suitability for broadband wireless access in fixed and mobile scenarios?

[BL: Understand| CO: 6|Marks: 7]

(b) How do WPAN technologies, such as bluetooth and zigbee, address the unique requirements of short-range wireless communication for personal devices, home automation, and IoT applications?

[BL: Understand| CO: 6|Marks: 7]

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