

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VII (NEW) EXAMINATION – WINTER 2024

Subject Code:3171608

Date:04-12-2024

Subject Name: Wireless Communication

Time:10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Describe the Bluetooth technology and its applications in personal area networks.	03
	(b) Define Wireless Local Loop (WLL) and explain its architecture.	04
	(c) Explain the significance of each generation in the development of mobile communication systems.	07
Q.2	(a) Define the channel and co-channel interference reduction factor.	03
	(b) Define handoff in cellular communication and discuss its importance in maintaining call quality during mobility.	04
	(c) Consider a cellular network with hexagonal cells arranged in a regular pattern. Each cell has a radius of 5 km. The frequency spectrum allocated for the network is 100 MHz, and the minimum required S/I ratio is 15 dB for both co-channel and adjacent interference. a. Calculate the area covered by each cell in the network. b. Determine the total number of cells in the network. c. Calculate the distance to frequency reuse ratio for the given network.	07
	OR	
	(c) Consider a cellular network deployed in a suburban area. The network uses a hexagonal cell layout with a radius of 3 km. The frequency spectrum allocated for the network is 50 MHz. The minimum required S/I ratio for co-channel interference is 18 dB, and for adjacent channel interference, it is 20 dB. a. Calculate the total number of cells in the network. b. Determine the distance to frequency reuse ratio for the given network. c. If the network uses a frequency reuse factor of 4, calculate the channel bandwidth required for each cell.	07
Q.3	(a) Define diffraction and scattering in the context of wireless communication.	03
	(b) Derive the free space propagation loss equation and discuss the factors affecting it.	04
	(c) Consider a wireless communication system deployed in a suburban area. The system operates at a frequency of 2.4 GHz. The transmit power of the base station is 40 dBm, and the receiver sensitivity of the mobile device is -100 dBm. The path-loss exponent for the link is 3.2, and the distance between the base station and the mobile device is 3 km. The antenna gain for both the base station and the mobile device is 6 dBi. a. Calculate the free space propagation loss for the given scenario. b. Determine the path loss using the log-distance path loss model. c. Calculate the received signal power at the mobile device, considering antenna gains.	07

OR

- Q.3** (a) Define small-scale multipath propagation and explain its impact on signal quality in wireless communication. **03**
- (b) Compare and contrast the path-loss characteristics of Non-Line-of-Sight (NLOS) and Line-of-Sight (LOS) wireless communication systems. **04**
- (c) Consider a cellular network deployed in a suburban area with hexagonal cells. Each cell has a radius of 4 km. The frequency spectrum allocated for the network is 800 MHz, and the path loss exponent is 4. The transmit power of each base station is 30 dBm, and the receiver sensitivity is -100 dBm. Assume that the system operates in a Line-of-Sight (LOS) environment. **07**
- a. Calculate the distance to frequency reuse ratio for the given cellular network.
- b. Determine the channel bandwidth required for each cell if the network uses a frequency reuse factor of 3.
- c. Calculate the received signal power at the cell edge assuming no fading effects.

- Q.4** (a) Define spread spectrum and discuss its role in GSM networks. **03**
- (b) Define soft handoff in CDMA systems and explain how it improves call quality and reliability. **04**
- (c) Describe the architecture of a GSM system. **07**

OR

- Q.4** (a) Discuss the steps involved in establishing a call in a GSM network, from the initiation of the call to the connection setup. **03**
- (b) Discuss the system architecture of GPRS (General Packet Radio Service) and its role in enabling packet-switched data transmission in GSM networks. **04**
- (c) Discuss the unique features of CDMA systems that distinguish them from other wireless technologies, such as FDMA and TDMA. **07**

- Q.5** (a) Compare: Wi-Fi and Wi-MAX Technology. **03**
- (b) Describe the working of Zigbee in detail. **04**
- (c) Differentiate: Time Division Multiple Access (TDMA), Frequency Division Multiple Access (FDMA), Orthogonal Frequency Division Multiplexing (OFDM), and Carrier Sense Multiple Access (CSMA) protocols. **07**

OR

- Q.5** (a) Discuss the key objectives of multiple access techniques and how they enable efficient use of the wireless spectrum. **03**
- (b) Explain the concept of forward and reverse channels in CDMA systems and their respective functions. **04**
- (c) Identify the common security threats faced by wireless networks, such as eavesdropping, spoofing, and denial of service attacks. **07**
