



# SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION



Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai

## UNIT 3

### WIRELESS TRANSMISSION

#### 1. What is the difference between narrowband and wideband systems?

**Answer:**

Narrowband systems operate over a small frequency range, typically less than 25 kHz, and are suited for applications requiring minimal bandwidth, like traditional telephony. Wideband systems, on the other hand, utilize a larger frequency range (greater than 25 kHz), allowing for higher data rates and better signal quality, commonly used in modern wireless communications.

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#### 2. Explain the concept of spread spectrum.

**Answer:**

Spread spectrum is a communication technique that spreads a signal over a wide bandwidth, making it more resistant to interference and jamming. It uses techniques like Direct Sequence Spread Spectrum (DSSS) and Frequency Hopping Spread Spectrum (FHSS) to improve security and reliability in wireless communication.

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#### 3. What is frequency hopping in spread spectrum systems?

**Answer:**

Frequency hopping is a spread spectrum technique where the carrier frequency changes rapidly in a predetermined sequence. This method reduces the chance of interference and eavesdropping, as the signal hops between different frequencies during transmission, making it more secure and robust.

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#### 4. What is Multiple Input Multiple Output (MIMO)?

**Answer:**

Multiple Input Multiple Output (MIMO) is a wireless technology that uses multiple antennas at both the transmitter and receiver to improve communication performance. MIMO enhances data

rates, increases link reliability, and makes better use of available spectrum by exploiting multipath propagation.

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## **5. Describe MIMO channel capacity.**

**Answer:**

MIMO channel capacity refers to the maximum data transmission rate achievable over a MIMO channel. It is significantly higher than that of Single Input Single Output (SISO) systems due to the spatial multiplexing gain, which allows multiple data streams to be transmitted simultaneously through different spatial channels.

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## **6. What is diversity gain in MIMO systems?**

**Answer:**

Diversity gain in MIMO systems refers to the improved reliability and performance achieved by using multiple antennas. By transmitting the same signal over different paths, the likelihood of signal degradation is reduced, leading to better reception and reduced error rates, especially in multipath environments.

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## **7. What is Orthogonal Frequency Division Multiplexing (OFDM)?**

**Answer:**

Orthogonal Frequency Division Multiplexing (OFDM) is a digital transmission technique that divides a signal into multiple closely spaced orthogonal sub-carriers. It enhances spectral efficiency and resilience to interference and multipath fading, making it ideal for high-data-rate applications like broadband communication.

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## **8. Explain the MIMO-OFDM system.**

**Answer:**

A MIMO-OFDM system combines the benefits of both MIMO and OFDM technologies. It uses multiple antennas to improve data rates and reliability, while OFDM provides robust communication over multipath channels. This combination enhances capacity and performance in wireless communication systems, particularly in high-speed scenarios.

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## **9. What are the different multiple access techniques in wireless communication?**

**Answer:**

The primary multiple access techniques are:

- **FDMA (Frequency Division Multiple Access):** Allocates separate frequency bands to different users.
- **TDMA (Time Division Multiple Access):** Divides time into slots for each user to transmit.

- **CDMA (Code Division Multiple Access):** Uses unique codes for each user to share the same frequency band.
  - **SDMA (Space Division Multiple Access):** Utilizes spatial separation to allow multiple users to transmit simultaneously.
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## 10. What is a Wireless Local Area Network (WLAN)?

**Answer:**

A Wireless Local Area Network (WLAN) is a wireless network that allows devices to connect and communicate within a limited geographical area, typically using IEEE 802.11 standards. WLANs provide high-speed internet access and facilitate networking in homes, offices, and public spaces.

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## 11. Describe Wireless Personal Area Network (WPAN) and give examples.

**Answer:**

A Wireless Personal Area Network (WPAN) is a short-range wireless network that connects devices within a personal space, typically within 10 meters. Examples include **Bluetooth**, which enables communication between devices like headphones and smartphones, and **Zigbee**, used for low-power, low-data-rate applications like home automation.