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# INTRODUCTION TO SYSTEM AND NETWORKING ASSIGNMENT

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# 1.What is meant by a signal?

- ✓ A **signal** is a form of energy that carries data or information from one place to another through a communication medium.
- ✓ In networking, signals are used to represent digital or analog data that travel through transmission media such as cables, fiber optics, or air.
- ✓ A **signal** is the **physical representation of data** — for example, electrical voltage in copper cables, light waves in optical fibers, or radio waves in wireless systems.

# 2.Write the types of data transmission media and the types of signals they propagate including the types of energy the signals are carried. Write also the

# encoding systems employed for each of the media described.

- ✓ Data transmission media can be grouped into two main types: **guided (wired)** and **unguided (wireless)** media
- ✓ Guided media are those that use physical cables to carry data signals. The first type is the **twisted pair cable**, which carries electrical signals representing digital or analog data. It uses electrical energy to transfer information, and encoding systems such as Non-Return-to-Zero (NRZ) and Manchester encoding are used to convert binary data into electrical pulses. The second type is the **coaxial cable**, which also carries electrical signals but provides better shielding and higher bandwidth than twisted pair cables. It typically uses encoding methods like Differential Manchester or NRZ to represent data. The third type is the **optical fiber cable**, which transmits information in the form of light signals rather than electricity. The energy type is light energy (photons), and encoding systems such as On-Off Keying (OOK) and 4B/5B encoding are used to represent binary ones and zeros using light pulses.

✓ Unguided or wireless media, on the other hand, transmit signals through air or space without physical cables. The **radio wave** medium uses electromagnetic energy to transmit data through radio frequencies. It commonly uses modulation systems such as Amplitude Modulation (AM) and Frequency Modulation (FM) to represent signals. **Microwave transmission** also uses electromagnetic energy but at much higher frequencies. It often employs Phase Shift Keying (PSK) and Frequency Shift Keying (FSK) for encoding digital information. **Infrared transmission** uses light energy to send data in short-range communication systems like remote controls or wireless devices. It uses pulse modulation or simple On-Off Keying. Finally, **satellite communication** uses high-frequency microwave signals to send data over very long distances through space, often using phase and frequency modulation techniques for encoding.

### 3. Write the advantages and disadvantages of network topologies

✓ A **bus topology** is easy to install and inexpensive since all devices share a single communication line,

but one cable failure can disrupt the entire network and make troubleshooting difficult.

- ✓ A **star topology** connects each device to a central hub, which makes it easy to manage and expand. However, if the central hub fails, the entire network stops working, and it requires more cables, increasing the cost.
- ✓ A **ring topology** connects devices in a circular path where each node connects to two others. It offers predictable performance and equal access to all nodes, but if one node or cable fails, it can bring down the entire network.
- ✓ The **mesh topology** provides multiple connections between devices, ensuring high reliability and fault tolerance, but it is expensive and complex to set up because it requires many cables.
- ✓ A **tree topology** organizes devices hierarchically and supports network expansion easily, but if the main backbone line fails, the entire network could go down.
- ✓ Lastly, a **hybrid topology** combines two or more topologies to create a flexible and reliable network structure, though it is usually costly and complex to manage.

**3.Indicate the most popularly used data transmission media based on your practical observation?**

- **Twisted pair cable**- which are commonly used in homes, schools, and offices for Local Area Networks (LANs).
- **Wi-Fi** – wireless

**4.Write the types of cables and their capacity to transmit signals, security level, and their cost?**

- **Twisted pair cables** (such as Cat5e or Cat6) can support data transmission speeds up to 1 gigabit per second for Cat5e and up to 10 gigabits per second for Cat6.
  - They are, however, very affordable and easy to install, which makes them the most common choice for LANs.

- **Coaxial cables** can also support high data rates and offer better shielding against interference compared to twisted pair cables.
  - They are more secure and reliable but cost slightly more
- **Fiber optic cables** provide the highest transmission capacity, reaching speeds up to 100 gigabits per second or more.
  - They offer excellent security since they are immune to electrical interference and difficult to tap without detection.
  - However, fiber optics are expensive to install and require specialized equipment and expertise.