Certainly! Here's an **expanded and detailed version of Practical 1(b): Different Types of Cables and Network Devices**, written in the same structured and academic style as your example for Practical 1(a). This can be directly used in a lab journal or practical record.

## **PRACTICAL – 1**

### **AIM 1(b): Study of Different Types of Cables and Network Devices**

## **Objective:**

To understand and identify different types of cables and networking devices used in setting up a computer network, their construction, function, advantages, and use cases.

## **Introduction:**

Computer networks rely on various physical media (cables) and hardware devices to transmit and manage data between connected systems. Different types of cables offer different data transfer speeds, transmission distances, and resistance to interference. Similarly, network devices play key roles in directing, managing, and securing the flow of data across the network. This practical introduces students to the fundamental hardware components that make computer networking possible.

## **1. Network Cables**

Cables serve as the transmission medium through which data travels in a wired network. There are three primary types:

### **1.1 Twisted Pair Cable**

* **Structure**: Made of two insulated copper wires twisted together. Twisting helps reduce electromagnetic interference from external sources and from neighboring pairs.
* **Types**:
  + **UTP (Unshielded Twisted Pair)** – No additional shielding; widely used in LANs.
  + **STP (Shielded Twisted Pair)** – Includes a foil or braided shielding for better resistance to interference.
* **Common Categories**:
  + **Cat5e** – Supports up to 1 Gbps over 100 meters.
  + **Cat6** – Supports up to 10 Gbps over shorter distances (~55 meters).
* **Connector Used**: RJ-45 (Registered Jack 45)
* **Applications**: Ethernet connections, telephone systems, home and office LANs.

📷 **Fig 1: Structure of Twisted Pair Cable (UTP and STP)**

### **1.2 Coaxial Cable**

* **Structure**: Contains a central copper conductor, surrounded by an insulating layer, a metallic shield (braid or foil), and an outer plastic covering.
* **Advantages**:
  + Better shielding than twisted pair.
  + Less signal loss over medium distances.
* **Connector Used**: BNC (Bayonet Neill–Concelman) or F-Type connectors.
* **Applications**: Cable television distribution, early Ethernet (10Base2, 10Base5), CCTV systems.

📷 **Fig 2: Cross-Section of Coaxial Cable**

### **1.3 Fiber Optic Cable**

* **Structure**: Composed of a glass or plastic fiber core, cladding, buffer coating, and outer jacket.
* **Working Principle**: Data is transmitted as pulses of light, enabling high-speed transmission with minimal loss.
* **Types**:
  + **Single-Mode Fiber (SMF)** – Narrow core; long-distance transmission using lasers.
  + **Multi-Mode Fiber (MMF)** – Wider core; short-distance transmission using LEDs.
* **Advantages**:
  + Extremely high bandwidth.
  + Immune to electromagnetic interference.
  + Can transmit over very long distances.
* **Connector Used**: SC, LC, ST
* **Applications**: Backbone networks, internet infrastructure, data centers.

📷 **Fig 3: Fiber Optic Cable and Modes of Transmission**

### **Comparison Table: Types of Cables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Feature** | **Twisted Pair** | **Coaxial Cable** | **Fiber Optic Cable** |
| Transmission Speed | Up to 10 Gbps | Moderate | Very High (Tbps) |
| Transmission Distance | Up to 100 meters | Up to 500 meters | Up to 40 km or more |
| Interference | Moderate (UTP), Low (STP) | Low | Very Low (immune) |
| Cost | Low | Medium | High |
| Flexibility | High | Medium | Low |
| Common Use | LAN, telephony | TV, CCTV | WAN, long-distance comm. |

## **2. Networking Devices**

Networking devices are hardware components responsible for connecting computers and other electronic devices to a network. Each device plays a specific role in managing and routing data.

### **2.1 Hub**

* **Function**: A basic device that connects multiple Ethernet devices in a LAN. It transmits data received from one port to all others (broadcasting).
* **Limitation**: Cannot filter or route data; causes data collisions.
* **OSI Layer**: Layer 1 (Physical Layer)
* **Use Case**: Small legacy networks; rarely used in modern setups.

📷 **Fig 4: Hub Network Layout**

### **2.2 Switch**

* **Function**: Connects devices in a LAN and uses MAC addresses to forward data only to the intended recipient.
* **Advantage**: Reduces traffic and collisions; more secure and efficient than hubs.
* **OSI Layer**: Layer 2 (Data Link Layer)
* **Use Case**: Most common device in LANs today.

📷 **Fig 5: Switch Functionality in a LAN**

### **2.3 Router**

* **Function**: Forwards data packets between networks based on IP addresses. It connects a LAN to the internet or another LAN.
* **Advanced Functions**: NAT, DHCP, firewall, QoS.
* **OSI Layer**: Layer 3 (Network Layer)
* **Use Case**: Internet connectivity for homes and businesses.

📷 **Fig 6: Router Connecting LAN to Internet**

### **2.4 Modem (Modulator-Demodulator)**

* **Function**: Converts digital signals from a computer into analog signals for transmission over telephone or cable lines, and vice versa.
* **Types**:
  + DSL Modem
  + Cable Modem
  + Fiber Modem (ONT – Optical Network Terminal)
* **Use Case**: Internet access via ISPs.

📷 **Fig 7: Modem as a Gateway Device**

### **2.5 Access Point (AP)**

* **Function**: Extends a wired network by enabling wireless (Wi-Fi) access for devices.
* **Not a Router**: Simply bridges wired and wireless networks.
* **Use Case**: Wi-Fi in offices, schools, public places.

📷 **Fig 8: Access Point Wireless Connectivity**

### **Comparison Table: Network Devices**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Device** | **OSI Layer** | **Intelligent?** | **Main Function** | **Usage Scenario** |
| Hub | Layer 1 | ❌ No | Broadcasts data to all ports | Legacy networks |
| Switch | Layer 2 | ✅ Yes | Forwards data to specific devices | Most modern LANs |
| Router | Layer 3 | ✅ Yes | Routes data between networks | Internet access, WANs |
| Modem | Layer 1 | ⚠️ Partial | Converts signals for ISP access | Home/office internet |
| Access Point | Layer 2 | ⚠️ Partial | Provides Wi-Fi connectivity | Wireless-enabled networks |

## **3. Real-World Applications**

|  |  |
| --- | --- |
| **Network Device** | **Real-World Example** |
| Hub | Used in early Ethernet labs for learning |
| Switch | Office networks to manage local traffic |
| Router | Home Wi-Fi routers like TP-Link, Netgear |
| Modem | ISP-provided modem for broadband internet |
| Access Point | Wi-Fi zones in cafes, airports, institutions |

## **4. Procedure (Lab Activity)**

1. Observe different physical cables (Twisted Pair, Coaxial, Fiber Optic).
2. Identify their connectors (RJ-45, BNC, SC/LC).
3. Connect a twisted pair cable between two PCs using a switch.
4. Observe the connection status and data transmission.
5. Study the modem and router provided by ISP (identify ports).
6. Set up an access point and connect a wireless device.

## **5. Conclusion**

In this experiment, we explored the fundamental building blocks of computer networking—cables and devices. Each cable type has distinct advantages and limitations based on transmission speed, distance, and cost. Similarly, network devices like switches, routers, and modems serve specific roles in enabling effective and secure communication. A clear understanding of these components is crucial for any IT or computer science professional involved in networking.

## **6. Viva Questions**

1. What is the difference between a router and a switch?
2. Which cable is used for long-distance, high-speed transmission?
3. What are the advantages of fiber optic cables?
4. Which device connects a LAN to the internet?
5. What is the function of an access point?

Would you like this converted into a **PDF**, **Word Document**, or do you want me to add images or diagrams to match the "Fig" placeholders?