Punjab Baord Class 12 Computer Applications Question Paper with Solutions(Memory Based)

| Time Allowed :3 Hour | Maximum Marks :60 | Total Questions :24 |

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1. Explain the different types of network topologies (Bus, Star, Ring, Mesh).

Solution:
Concept: A **network topology** refers to the physical or logical arrangement of devices (nodes) and communication links in a computer network. It defines how computers, printers, and other devices are connected and how data flows between them. Different topologies are used depending on network size, reliability requirements, and cost considerations.
The four common types of network topologies are Bus, Star, Ring, and Mesh.

1. Bus Topology:
In a **Bus topology**, all devices are connected to a single central cable called the **backbone**. Data transmitted from a node travels along the bus until it reaches the intended receiver.
Characteristics:

- All devices share a single communication line.

- Terminators are placed at both ends of the cable to prevent signal reflection.

- Data travels in both directions along the bus.

Advantages:

- Simple and inexpensive to install.

- Requires less cable compared to other topologies.

- Suitable for small networks.

Disadvantages:

- If the backbone cable fails, the entire network stops working.

- Difficult to troubleshoot.

- Network performance decreases as the number of devices increases.

2. Star Topology:
In a **Star topology**, all devices are connected to a central device such as a **hub** or **switch**. All communication between devices passes through this central node.
Characteristics:

- Each device has a dedicated cable connection to the central hub.

- The hub manages and controls data transmission.

Advantages:

- Easy to install and manage.

- Failure of one node does not affect the rest of the network.

- Easy to detect and isolate faults.

Disadvantages:

- If the central hub fails, the entire network becomes inactive.

- Requires more cable than bus topology.

- Higher installation cost.

3. Ring Topology:
In a **Ring topology**, each device is connected to two other devices, forming a circular data path. Data travels in one direction around the ring until it reaches the destination.
Characteristics:

- Each node acts as a repeater to transmit signals to the next node.

- Data travels through each device until it reaches the intended node.

Advantages:

- Data packets travel in an orderly manner.

- Reduced chances of data collision.

- Equal access for all devices.

Disadvantages:

- Failure of a single device can disrupt the entire network.

- Difficult to add or remove devices.

- Troubleshooting can be complex.

4. Mesh Topology:

In a **Mesh topology**, every device is connected to every other device in the network through dedicated point-to-point links.

Characteristics:

- Multiple paths exist between nodes.

- Data can travel through several alternative routes.

Advantages:

- Highly reliable and fault tolerant.

- Failure of one link does not affect the entire network.

- Provides high security and privacy.

Disadvantages:

- Very expensive due to large number of cables and ports.

- Complex installation and configuration.

- Not practical for large networks.

> **Quick Tip**
>
> - **Bus** – Single backbone cable.
>
> - **Star** – All devices connected to a central hub.
>
> - **Ring** – Devices connected in a circular path.
>
> - **Mesh** – Every device connected to every other device.
>
> Bus is the simplest, Star is the most commonly used in LANs, Ring ensures orderly data flow, and Mesh provides maximum reliability.

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2. Differentiate between guided (Twisted pair, Fiber-optic) and unguided (Radio, Microwave, Infrared) transmission media.

Solution:

Concept: Transmission media refers to the physical path through which data travels from the sender to the receiver in a communication network. It can be broadly classified into two categories:

- **Guided Transmission Media (Wired):** Signals travel through a physical path such as cables.

- **Unguided Transmission Media (Wireless):** Signals propagate through free space using electromagnetic waves.

1. Guided Transmission Media:

Guided media use a **physical cable or conductor** to transmit signals from one device to another. The signal follows a fixed path within the medium.

Types of Guided Media:

(a) Twisted Pair Cable

A twisted pair cable consists of **two insulated copper wires twisted together**. The twisting helps reduce electromagnetic interference and signal noise.

Characteristics:

- Widely used in telephone networks and LANs.

- Available as **UTP (Unshielded Twisted Pair)** and **STP (Shielded Twisted Pair)**.

- Supports moderate data transmission speeds.

Advantages:

- Low cost and easy to install.

- Flexible and lightweight.

- Suitable for short-distance communication.

Disadvantages:

- Limited bandwidth.

- Susceptible to electromagnetic interference.

(b) Fiber-Optic Cable

Fiber-optic cables transmit data in the form of **light signals through thin strands of glass or plastic fibers**. Light pulses are generated by lasers or LEDs and travel through the fiber using total internal reflection.

Characteristics:

- Very high bandwidth and data transmission speed.

- Long-distance communication capability.

- Immune to electromagnetic interference.

Advantages:

- Extremely high data transmission rate.

- Secure communication with minimal signal loss.

- Suitable for backbone networks and internet infrastructure.

Disadvantages:

- Expensive installation and maintenance.

- Fragile compared to copper cables.

2. Unguided Transmission Media:
Unguided media transmit signals through **air or free space** using electromagnetic waves. No physical conductor is required.
Types of Unguided Media:
(a) Radio Waves
Radio waves are electromagnetic signals that can travel long distances and penetrate buildings and obstacles.
Characteristics:

- Used in radio broadcasting, mobile communication, and wireless networks.

- Omnidirectional transmission.

Advantages:

- Covers large geographical areas.

- No physical wiring required.

Disadvantages:

- Prone to interference and noise.

- Lower security compared to wired communication.

(b) Microwave Transmission
Microwave communication uses **high-frequency electromagnetic waves** that travel in straight lines between transmitting and receiving antennas.
Characteristics:

- Requires line-of-sight communication.

- Often used in satellite communication and cellular networks.

Advantages:

- High data transmission capacity.

- Suitable for long-distance communication.

Disadvantages:

- Affected by weather conditions.

- Requires careful alignment of antennas.

(c) Infrared Transmission
Infrared communication uses **infrared light waves** to transmit data over short distances.
Characteristics:

- Commonly used in remote controls, wireless keyboards, and short-range device communication.

- Signals cannot penetrate walls.

Advantages:

- Secure communication since signals remain confined to a room.

- Low interference with other wireless systems.

Disadvantages:

- Limited range.

- Requires direct line-of-sight.

Key Differences Between Guided and Unguided Media:

Feature	Guided Media	Unguided Media
$Transmission Path$	$Physical cables$	$Air/free space$
$Examples$	$Twisted Pair, Fiber Optic$	$Radio, Microwave, Infrared$
$Interference$	$Less interference$	$More susceptible to noise$
$Installation Cost$	$Higher(cabling required)$	$Lower(wireless)$
$Security$	$More secure$	$Less secure$

Quick Tip

- **Guided Media = Wired Communication** (Twisted Pair, Fiber Optic).

- **Unguided Media = Wireless Communication** (Radio, Microwave, Infrared).

- Guided media provides **better security and reliability**, while unguided media provides **mobility and flexibility**.

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3. Define the role of network devices like Modems, Routers, Gateways, and Switches.

Solution:
Concept: Network devices are hardware components used to connect computers and other devices in a network. They control the transmission of data, manage network traffic, and ensure communication between different networks and devices.

1. Modem (Modulator–Demodulator):
A **modem** is a device that converts digital signals from a computer into analog signals for transmission over communication lines such as telephone cables, and converts incoming analog signals back into digital form.
Role of a Modem:

- Enables computers to connect to the internet.

- Converts digital signals to analog signals and vice versa.

- Used in DSL, cable, and telephone network connections.

2. Router:
A **router** is a networking device that connects multiple networks together and directs data packets between them based on IP addresses.
Role of a Router:

- Connects different networks such as a home network and the internet.

- Determines the best path for data packets.

- Manages network traffic and prevents congestion.

3. Gateway:
A **gateway** is a device that connects two different networks that may use different communication protocols. It acts as a translator between incompatible networks.
Role of a Gateway:

- Allows communication between networks with different protocols.

- Translates data formats and communication rules.

- Often used to connect local networks to external networks.

4. Switch:
A **switch** is a networking device used to connect multiple devices within the same local area network (LAN). It forwards data to the correct device using MAC addresses.
Role of a Switch:

- Connects computers, printers, and other devices in a LAN.

- Sends data only to the intended destination device.

- Improves network efficiency and reduces collisions.

> **Quick Tip**
>
> - **Modem** – Converts digital and analog signals for internet access.
>
> - **Router** – Connects different networks and directs data packets.
>
> - **Gateway** – Translates communication between different protocols.
>
> - **Switch** – Connects devices within a LAN and forwards data using MAC addresses.

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4. Explain the functions of common network protocols: HTTP, FTP, SMTP, and TCP/IP.

Solution:
Concept: A **network protocol** is a set of rules that governs how data is transmitted and received over a computer network. Protocols define the format, timing, sequencing, and error control of data communication between devices.

1. HTTP (Hypertext Transfer Protocol):

HTTP is a protocol used for transferring web pages and other resources on the World Wide Web between a client (web browser) and a web server.

Functions of HTTP:

- Allows web browsers to request web pages from servers.

- Transfers hypertext documents such as HTML files.

- Supports communication between clients and web servers.

2. FTP (File Transfer Protocol):

FTP is a protocol used for transferring files between computers over a network, especially between a client and a server.

Functions of FTP:

- Enables uploading and downloading of files between systems.

- Provides file management operations such as rename, delete, and move.

- Commonly used for transferring large files over the internet.

3. SMTP (Simple Mail Transfer Protocol):

SMTP is a protocol used for sending emails from one server to another over the internet.

Functions of SMTP:

- Transfers outgoing emails from the sender to the mail server.

- Routes emails between different mail servers.

- Works with other protocols like POP3 or IMAP for receiving emails.

4. TCP/IP (Transmission Control Protocol / Internet Protocol):

TCP/IP is a suite of communication protocols used for connecting devices on the internet and ensuring reliable data transmission.

Functions of TCP/IP:

- TCP ensures reliable and error-free delivery of data.

- IP handles addressing and routing of data packets.

- Enables communication between different networks across the internet.

Quick Tip

- **HTTP** – Transfers web pages.

- **FTP** – Transfers files.

- **SMTP** – Sends emails.

- **TCP/IP** – Manages reliable communication and routing on the internet.

5. Define DBMS and list its advantages over a traditional file system.

Solution:
Concept: A **Database Management System (DBMS)** is software that allows users to create, store, organize, retrieve, and manage data in a structured way. It acts as an interface between the database and users or application programs, ensuring that data is stored efficiently and accessed securely.

Definition of DBMS:
A **DBMS** is a collection of programs that enables users to define, create, maintain, and control access to a database.

DBMS = Software that manages databases and provides controlled access to data.

Examples include MySQL, Oracle, Microsoft SQL Server, and PostgreSQL.

Advantages of DBMS over Traditional File System:
1. Reduced Data Redundancy
In a traditional file system, the same data may be stored in multiple files, leading to duplication. A DBMS minimizes redundancy by storing data in a centralized database.

2. Improved Data Consistency
When data is duplicated in different files, inconsistencies may occur. A DBMS ensures that updates are reflected everywhere, maintaining consistent data.

3. Better Data Security
A DBMS provides security mechanisms such as authentication, authorization, and access control to protect sensitive data.

4. Data Sharing and Multi-user Access
Multiple users can access and modify the database simultaneously in a controlled manner.

5. Data Integrity
DBMS enforces rules and constraints that maintain the accuracy and reliability of data.

6. Backup and Recovery
DBMS provides mechanisms for data backup and recovery in case of system failure.

> **Quick Tip**
>
> - **DBMS** – Software used to store, manage, and retrieve data efficiently.
>
> - Key advantages: **Reduced redundancy, improved consistency, better security, data sharing, and backup/recovery**.
>
> Compared to the traditional file system, a DBMS provides **better organization, reliability, and control of data**.

6. Explain the concepts of Primary Key, Foreign Key, and Candidate Key.

Solution:
Concept: In a relational database, **keys** are attributes or sets of attributes that help uniquely identify records in a table and establish relationships between tables. Keys play an important role in maintaining data integrity and ensuring efficient data retrieval.

1. Primary Key:
A **Primary Key** is a field or a combination of fields that uniquely identifies each record in a table. It ensures that no two rows have the same value for the primary key.
Characteristics of Primary Key:

- Each value must be **unique**.

- It **cannot contain NULL values**.

- There can be **only one primary key** in a table.

Example:
In a `Student` table, the `Student_ID` can act as the primary key because it uniquely identifies each student.

2. Foreign Key:
A **Foreign Key** is a field in one table that refers to the **primary key of another table**. It is used to establish a relationship between two tables.
Characteristics of Foreign Key:

- It maintains **referential integrity** between tables.

- It can contain duplicate values.

- It may contain NULL values if the relationship is optional.

Example:
In an `Orders` table, the `Student_ID` field may refer to the `Student_ID` in the `Student` table.

3. Candidate Key:
A **Candidate Key** is an attribute or a set of attributes that can uniquely identify a record in a table. A table may have multiple candidate keys.
From the set of candidate keys, one key is selected as the **primary key**.
Characteristics of Candidate Key:

- Must uniquely identify each record.

- Cannot contain duplicate values.

- A table may have multiple candidate keys.

Example:
In a `Student` table, both `Student_ID` and `Email` could uniquely identify a student. Thus, both are candidate keys, but one of them is chosen as the primary key.

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7. Write the syntax and use of SQL DDL commands (CREATE, ALTER, DROP) and DML commands (INSERT, UPDATE, DELETE).

Solution:
Concept: SQL (Structured Query Language) is used to manage and manipulate data in relational databases. SQL commands are mainly classified into two categories:

- **DDL (Data Definition Language):** Used to define and modify the structure of database objects such as tables.

- **DML (Data Manipulation Language):** Used to insert, modify, and delete data stored in database tables.

1. DDL Commands
DDL commands are used to create and modify the structure of database objects.

(a) CREATE Command
The **CREATE** command is used to create a new table or database object.
Syntax:

```
CREATE TABLE table_name (
    column1 datatype,
column2 datatype, ...  );
```

Example:

```
 CREATE TABLE Student (
        ID INT,
    Name VARCHAR(50),
        Age INT);
```

(b) ALTER Command
The **ALTER** command is used to modify the structure of an existing table, such as adding or deleting columns.
Syntax:

```
ALTER TABLE table_name ADD column_name datatype;
```

Example:

```
ALTER TABLE Student ADD Address VARCHAR(100);
```

(c) DROP Command

The **DROP** command is used to delete an entire table or database object permanently.

Syntax:

```
DROP TABLE table_name;
```

Example:

```
DROP TABLE Student;
```

2. DML Commands

DML commands are used to manipulate the data stored in database tables.

(a) INSERT Command

The **INSERT** command is used to add new records into a table.

Syntax:

```
INSERT INTO table_name (column1, column2, ...)
        VALUES (value1, value2, ...);
```

Example:

```
INSERT INTO Student (ID, Name, Age)
        VALUES (1, 'Rahul', 20);
```

(b) UPDATE Command

The **UPDATE** command is used to modify existing records in a table.

Syntax:

```
UPDATE table_name
SET column_name = value
WHERE condition;
```

Example:

```
UPDATE Student
SET Age = 21
WHERE ID = 1;
```

(c) DELETE Command

The **DELETE** command is used to remove records from a table.

Syntax:

```
DELETE FROM table_name
WHERE condition;
```

Example:

```
DELETE FROM Student
WHERE ID = 1;
```

---

8. Describe the use of built-in MySQL functions like COUNT(), SUM(), and MAX().

Solution:

Concept: MySQL provides several **built-in aggregate functions** that perform calculations on a set of values and return a single result. These functions are commonly used in database queries to summarize and analyze data stored in tables.

1. COUNT() Function

The **COUNT()** function is used to count the number of rows or records in a table that satisfy a specified condition.

Syntax:

```
SELECT COUNT(column_name) FROM table_name;
```

Example:

```
SELECT COUNT(ID) FROM Student;
```

This query counts the total number of student records in the `Student` table.

2. SUM() Function

The **SUM()** function is used to calculate the **total sum** of numeric values in a column.

Syntax:

```
SELECT SUM(column_name) FROM table_name;
```

Example:

```
SELECT SUM(Salary) FROM Employees;
```

This query calculates the total salary of all employees in the `Employees` table.

3. MAX() Function

The **MAX()** function is used to find the **maximum (largest) value** in a column.

Syntax:

```
SELECT MAX(column_name) FROM table_name;
```

Example:

```
SELECT MAX(Marks) FROM Student;
```

This query returns the highest marks obtained by a student in the `Student` table.

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9. Differentiate between Mutable and Immutable objects in Python.

Solution:
Concept: In Python, objects are classified as **mutable** or **immutable** depending on whether their values can be changed after creation. This property determines how data can be modified and managed in a Python program.

1. Mutable Objects:
A **mutable object** is an object whose value or contents can be modified after it is created. Changes can be made without creating a new object.
Characteristics:

- The object's value can be changed after creation.

- Memory location remains the same after modification.

- Supports operations like adding, removing, or updating elements.

Examples of Mutable Objects:

- Lists

- Dictionaries

- Sets

Example:

```
my_list = [1,2,3]
my_list.append(4)
```

Here the list changes to `[1,2,3,4]` without creating a new object.

2. Immutable Objects:
An **immutable object** is an object whose value cannot be changed after it is created. Any modification results in the creation of a new object.
Characteristics:

- Value cannot be modified after creation.

- Any change creates a new object in memory.

- Provides safer data handling and prevents accidental changes.

Examples of Immutable Objects:

- Integers

- Strings

- Tuples

Example:

$$x = 10$$

$$x = x + 5$$

Here a new object with value 15 is created.

Key Differences Between Mutable and Immutable Objects:

Feature	Mutable	Immutable
$Modification$	$Can be modified$	$Cannot be modified$
$Memory$	$Same object remains$	$New object created$
$Examples$	$List, Dictionary, Set$	$Integer, String, Tuple$

> **Quick Tip**
>
> - **Mutable** = Changeable objects (List, Dictionary, Set).
>
> - **Immutable** = Unchangeable objects (Int, String, Tuple).
>
> In short:
>
> Mutable → Value can change | Immutable → Value cannot change

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10. Define Cybercrime and explain types like Hacking, Phishing, and Ransomware.

Solution:
Concept: Cybercrime refers to illegal activities carried out using computers, networks, or the internet. These crimes involve unauthorized access, data theft, financial fraud, or disruption of digital systems. Cybercriminals exploit vulnerabilities in computer systems to gain access to sensitive information or damage digital resources.

Definition of Cybercrime:
Cybercrime is any criminal activity in which a computer, network, or internet-connected device is used as a tool, target, or both.

1. Hacking
Hacking is the act of gaining unauthorized access to a computer system or network in order to steal, modify, or destroy data.
Characteristics:

- Unauthorized access to computer systems.

- Data theft or manipulation.

- Can lead to privacy breaches and system damage.

Example: A hacker breaking into a company's database to steal confidential customer information.

2. Phishing
Phishing is a cyber attack in which attackers send fraudulent emails, messages, or websites that appear to be from trusted sources to trick users into revealing sensitive information.
Characteristics:

- Fake emails or websites that mimic legitimate organizations.

- Used to steal passwords, credit card numbers, or personal information.

- Often targets online banking and email accounts.

Example: An email pretending to be from a bank asking the user to enter login credentials on a fake website.

3. Ransomware
Ransomware is a type of malicious software (malware) that locks or encrypts a victim's data and demands payment (ransom) to restore access.
Characteristics:

- Encrypts files or blocks access to systems.

- Demands money to unlock data.

- Often spreads through malicious attachments or infected websites.

Example: A company's computer system is locked by malware and attackers demand payment to restore access to the files.

> **Quick Tip**
>
> - **Cybercrime** – Illegal activities using computers or the internet.
>
> - **Hacking** – Unauthorized access to systems.
>
> - **Phishing** – Fake messages or websites used to steal information.
>
> - **Ransomware** – Malware that locks data and demands payment.
>
> In simple terms:
>
> $$\text{Hacking} \rightarrow \text{Break into systems}$$
> $$\text{Phishing} \rightarrow \text{Trick users to reveal information}$$
> $$\text{Ransomware} \rightarrow \text{Lock data and demand ransom}$$

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11. Explain the CIA Triad (Confidentiality, Integrity, and Availability) in cyber safety.

Solution:
Concept: The **CIA Triad** is a fundamental model used in cybersecurity to guide policies and practices for protecting information systems. It consists of three key principles: **Confidentiality, Integrity, and Availability**. These principles ensure that information is protected from unauthorized access, remains accurate, and is available to authorized users when needed.

1. Confidentiality
Confidentiality ensures that sensitive information is accessible only to authorized individuals and is protected from unauthorized access or disclosure.
Methods used to maintain confidentiality:

- Encryption of data

- User authentication and passwords

- Access control mechanisms

Example: Only authorized employees in a company can access confidential customer data.

2. Integrity
Integrity ensures that data remains **accurate, consistent, and unaltered** during storage or transmission. Unauthorized modification of data must be prevented.
Methods used to maintain integrity:

- Data validation checks

- Hash functions and checksums

- Access control and auditing

Example: Financial records in a bank database should not be modified without proper authorization.

3. Availability
Availability ensures that information and systems are accessible to authorized users whenever they are needed.
Methods used to maintain availability:

- Regular system maintenance

- Data backup and disaster recovery systems

- Protection against cyber attacks such as denial-of-service attacks

Example: Online banking services should be accessible to customers at all times.

Summary of CIA Triad:

Principle	Purpose
$Confidentiality$	$Protects data from unauthorized access$
$Integrity$	$Ensures data accuracy and reliability$
$Availability$	$Ensures data and systems are accessible when needed$

> **Quick Tip**
>
> - **Confidentiality** – Only authorized people can access data.
>
> - **Integrity** – Data must remain accurate and unchanged.
>
> - **Availability** – Data and systems must be accessible when needed.
>
> Thus, the **CIA Triad** forms the core foundation of cybersecurity and information protection.

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12. What are the main provisions of the Indian IT Act 2000?

Solution:

Concept: The **Information Technology Act, 2000 (IT Act 2000)** is a law enacted by the Government of India to provide legal recognition to electronic transactions and to deal with cybercrimes. The act establishes a legal framework for electronic governance and ensures security in digital communication and online activities.

Main Provisions of the IT Act 2000:

1. Legal Recognition of Electronic Records

The act provides legal recognition to **electronic documents and digital records**. This means electronic records can be used as valid evidence in legal and business transactions.

2. Legal Recognition of Digital Signatures

The IT Act allows the use of **digital signatures** for authentication of electronic documents, ensuring secure online transactions.

3. Regulation of Certifying Authorities

The act establishes a system for licensing and regulating **Certifying Authorities (CAs)** that issue digital signature certificates.

4. Cybercrime and Penalties

The IT Act defines various **cyber offenses** such as hacking, identity theft, data theft, and online fraud, and prescribes penalties and punishments for such crimes.

5. Electronic Governance (E-Governance)

The act enables the use of electronic records and digital signatures in government services, allowing online filing of documents, applications, and payments.

6. Protection of Data and Privacy

The IT Act provides provisions to protect **sensitive personal data** and penalizes unauthorized access or misuse of information.

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13. Explain the importance of E-waste management and proper disposal of electronic gadgets.

Solution:
Concept: E-waste (Electronic Waste) refers to discarded electronic devices such as computers, mobile phones, televisions, and other digital equipment that are no longer in use. Proper management and disposal of e-waste is important to reduce environmental pollution and protect human health.

Importance of E-waste Management:
1. Protection of the Environment
Electronic devices contain hazardous materials such as lead, mercury, and cadmium. Proper disposal prevents these harmful substances from contaminating soil, water, and air.

2. Protection of Human Health
Improper handling of electronic waste can expose people to toxic chemicals that may cause serious health problems. Proper recycling and disposal help reduce these risks.

3. Conservation of Natural Resources
Many electronic devices contain valuable materials such as copper, aluminum, and gold. Recycling e-waste helps recover these materials and reduces the need for mining new resources.

4. Reduction of Landfill Waste
Proper e-waste management reduces the amount of electronic waste dumped in landfills, helping to manage waste more efficiently.

5. Promotion of Recycling and Reuse
Old electronic devices can often be refurbished, reused, or recycled, which promotes sustainable use of technology and reduces environmental impact.

> **Quick Tip**
>
> - **E-waste** – Discarded electronic devices such as computers and phones.
>
> - Proper management helps in:
>
>   – Protecting the **environment**
>   – Protecting **human health**
>   – Conserving **natural resources**
>   – Promoting **recycling and reuse**
>
> Thus, proper e-waste disposal is essential for maintaining a **safe and sustainable environment**.