Chapter 1 – Short Questions with Answers (O.S)

1. What is an Operating System?

- An OS is software that acts as a bridge between user and computer hardware.
- It manages hardware resources (CPU, memory, I/O devices).
- Example: Windows, Linux.

2. Describe the general operations of a computer?

- **Input → Processing → Output → Storage.**
- Takes input, processes using CPU, gives output, stores in memory.
- Example: Typing in MS Word → CPU processes → Text saved on hard disk.

3. Draw a diagram of modern computer system?

- Components: **Input Devices → CPU (ALU + Control Unit) → Memory → Output Devices → Storage.**
- (Students can draw simple block diagram).

4. Describe interrupts.

- Signal that stops CPU temporarily.
- Allows CPU to handle urgent tasks (like keyboard press).
- Example: Printer "paper out" sends interrupt.

5. Define I/O Interrupts.

- Special signals from I/O devices to CPU.
- They ask CPU to pause and handle input/output.
- Example: Mouse click → CPU responds.

6. Describe the structure of input/output system.

- **I/O devices → Device controllers → Drivers → Operating system.**
- OS manages communication between hardware and software.
- Example: Printer driver helps OS control printer.

7. Define main memory.

- Memory directly accessed by CPU (RAM).
- Stores running programs and data.
- Example: When you open MS Word, it loads into RAM.

8. Describe different storage devices.

- **Primary storage:** RAM, Cache (fast, temporary).
- **Secondary storage:** Hard disk, SSD (permanent).
- **Tertiary storage:** CDs, DVDs, USBs (portable).

9. What are two mode operation?

- **User Mode:** Programs run with limited rights.
- **Kernel Mode:** OS runs with full hardware control.
- Example: Games run in user mode, OS runs in kernel mode.

10. What is the Dual Mode Operation?

- CPU works in two modes: **User** and **Kernel.**
- Protects system from accidental or malicious programs.
- Example: Antivirus runs in user mode, while OS controls kernel mode.

11. Describe CPU Protection.

- Prevents misuse of CPU by programs.
- Uses **timer** to stop a program from running forever.
- Example: Stops an infinite loop program from hanging the system.

12. Describe Memory Protection.

- Ensures one program cannot use memory of another program.
- Uses **base and limit registers**.
- Example: Prevents MS Word from accessing Chrome's memory.

13. Describe the function of I/O Protection.

- Protects devices from illegal access.
- Only OS can directly control hardware.
- Example: User cannot directly control hard disk without OS permission.

14. What is DMA and also describe its functionality?

- **DMA = Direct Memory Access.**
- Allows I/O devices to send/receive data without CPU involvement.
- Example: Copying files from USB to RAM directly.

15. Describe protection methods of computer operation.

- **CPU Protection:** Timer prevents overuse.
- **Memory Protection:** Base and limit registers.
- **I/O Protection:** Only OS can control device.

Expanded Long Questions (Chapter 1 – OS)

Q1: What is an Operating System and also draw its abstract view of components of a computer system?

Answer:

1. An **Operating System (OS)** is system software that manages hardware and software resources.
2. It acts as a **bridge between user and hardware**.
3. Provides a platform where application programs run easily.
4. Functions of OS:
   o Resource allocation (CPU, memory, devices).
   o Provides security and protection.
   o Ensures user convenience.
5. **Abstract View of Computer System:**
   o **Users → Application Programs → Operating System → Hardware (CPU, Memory, I/O devices).**
6. **Examples:**
   o **Windows OS** helps run MS Office, games, etc.
   o **Linux OS** manages servers and networks.

☐ Diagram (students can draw):

- Four layers: **User → Applications → OS → Hardware.**

Q2: Explain the computer system operations.

Answer:

1. **Booting Process:**
   o Starts computer with **bootstrap program** stored in ROM.
   o Loads OS into memory.

- o Example: When you press the power button, BIOS runs first, then OS loads.
2. **Interrupts:**
    - o Signal sent to CPU by hardware/software.
    - o CPU pauses its task to handle urgent jobs.
    - o Example: Keyboard key press, printer error.
3. **I/O Operations:**
    - o Input (keyboard, mouse), Output (monitor, printer).
    - o Controlled by device controllers and drivers.
4. **Storage Operations:**
    - o Data is stored in memory hierarchy (RAM, HDD, SSD).
    - o Example: A file is typed in MS Word (RAM) and saved to HDD.
5. **Importance:**
    - o Without these operations, the system cannot run smoothly.
    - o Ensures efficiency, fairness, and user satisfaction.

Q3: What is Storage Hierarchy and also draw its diagram?

Answer:

1. **Definition:** Arrangement of storage devices based on speed, cost, and capacity.
2. **Principle:** Faster → Smaller size → Expensive. Slower → Larger size → Cheaper.
3. **Levels:**
    - o **Registers:** Fastest, very small, inside CPU.
    - o **Cache Memory:** High-speed memory between CPU and RAM.
    - o **Main Memory (RAM):** Temporary storage for running programs.
    - o **Secondary Storage (HDD/SSD):** Permanent storage for OS, files, software.
    - o **Tertiary Storage (CD/DVD/USB/Cloud):** Backup and archive.
4. **Example:**
    - o While watching a YouTube video:
        - ▪ Registers → CPU processes frames.
        - ▪ Cache → Stores recent data.
        - ▪ RAM → Running video.
        - ▪ HDD → Stores video file permanently.

☐ Diagram: Pyramid from top (Registers) to bottom (Tape/Cloud).

Q4: What is Hardware Protection and also explain its types?

Answer:
Definition:
Hardware protection prevents **unauthorized or harmful access** to CPU, memory, and devices.

Types:

1. **CPU Protection:**
    - o Timer is used to prevent infinite loops or CPU misuse.
    - o Example: If a program hangs, OS can stop it.
2. **Memory Protection:**
    - o Prevents one program from entering another program's memory.
    - o Uses **base register & limit register.**
    - o Example: MS Word cannot access Chrome's memory.
3. **I/O Protection:**
    - o Only OS can directly access devices.
    - o Example: Printer, hard disk, scanner controlled by OS drivers.
4. **Dual Mode Operation:**
    - o **User Mode:** Programs run with restrictions.
    - o **Kernel Mode:** OS runs with full control.
    - o Example: Video game in user mode, OS in kernel mode.

Conclusion:
Hardware protection is necessary to ensure **security, stability, and fairness** in computer systems.

External / Important Question Answers

Q1: What is the difference between main memory and secondary memory?

- **Main Memory (RAM):**
    - Fast, volatile, temporary.
    - Directly accessed by CPU.
    - Example: Running MS Word.
- **Secondary Memory (HDD/SSD):**
    - Slow, non-volatile, permanent.
    - Stores OS, software, and files.
    - Example: Windows OS on hard disk.

Q2: Why do we need dual mode operation in computers?

- To separate **user processes** from **system processes.**
- Protects hardware from misuse.
- Example: A normal program cannot directly format the hard disk because OS is in kernel mode.

Q3: Explain the role of timer in CPU protection.

- Timer prevents one program from running forever.
- After a fixed time, interrupt is generated.
- OS checks and decides next process to run.
- Example: Prevents an infinite loop from blocking other users in a multi-user system.

Q4: What is bootstrap program?

- A small program stored in ROM.
- Runs first when computer is powered on.
- Loads operating system into memory.
- Example: BIOS runs at startup to load Windows or Linux.

Q5: Define device driver with example.

- Device driver = Software that allows OS to control hardware.
- Converts OS commands into device instructions.
- Example:
    - Printer driver lets OS print documents.
    - Graphic card driver runs games.