Q1) Explain memory hierarchy in detail.

Answer:

Memory hierarchy is arrangement of computer memory based on **speed, cost and size**.

Order (fastest → slowest):

1. **Registers**
2. **Cache Memory**
3. **Main Memory (RAM)**
4. **Secondary Memory (HDD/SSD)**
5. **External Storage**

• Fastest memory = smallest and most expensive
• Slowest memory = larger but cheapest

➡ Purpose: To balance speed & capacity for better performance.

Q2) Explain RAM in detail. Mention types of RAM.

Answer:

RAM = Random Access Memory
• Volatile (data lost when power off)
• Holds running programs

Types of RAM:

1. **SRAM (Static RAM)**
   – Fast, expensive
   – Used in Cache
2. **DRAM (Dynamic RAM)**
   – Cheaper, slower than SRAM
   – Used as main memory

➡ CPU directly reads/writes programs from RAM.

Q3) Explain ROM and its types.

Answer:

ROM = Read Only Memory
• Non-volatile (data remains even after power off)
• Stores permanent instructions (boot firmware)

Types of ROM:

PROM — programmed once
EPROM — erased by UV light
EEPROM — erased electrically and re-written

➡ Used in firmware, BIOS, embedded systems.

Q4) Explain Cache memory and its working.

Answer:

Cache memory is a **high-speed memory** between CPU and RAM.
It stores **frequently used instructions and data**.

⚙ Working:

CPU first checks cache → **cache hit = fast access**
If not found → fetch from RAM → **cache miss**

Cache Levels:

• L1 — fastest, smallest
• L2 — larger
• L3 — slower among cache, largest

➡ Cache improves CPU performance significantly.

Q5) What is Virtual Memory? Explain how it works.

Answer:

Virtual memory technique extends RAM using **hard disk space**.

When RAM becomes full → OS moves some inactive data to disk (swap space).
Gives effect of **bigger memory than actual RAM**.

➡ Used in multitasking systems & large programs.

Q6) Explain Secondary Storage with examples.

Answer:

Secondary storage is **permanent, non-volatile storage**.

Examples:
HDD
SSD
Flash drive
CDs / Memory cards

Used for:
• OS installation
• Applications
• User files

Q7) Explain RAID and its types.

✨ **Answer:**

RAID — Redundant Array of Independent Disks
A technique to combine multiple disks to improve:

speed
reliability
fault tolerance

Common RAID Levels:

• **RAID 0 — striping** (high speed, no backup)
• **RAID 1 — mirroring** (data copied to two disks)
• **RAID 5 — parity + striping** (balance speed + safety)

➡ Used in servers, banking and critical storage.

Explain difference between Primary & Secondary Memory

Primary Memory:

- Directly accessed by CPU
- Temporary (mostly volatile)
- Faster but expensive
- Example: RAM, Cache

Secondary Memory:

- Used for long-term storage
- Non-volatile
- Slower but cheaper
- Example: HDD, SSD, Pen Drive

Define Cache Hit and Cache Miss

- **Cache Hit:**
  When required data is found in cache memory.
- **Cache Miss:**
  When required data is **not** found in cache, so data must be fetched from main memory.

What is SRAM and DRAM?

- **SRAM (Static RAM):**
  Faster, expensive, used in Cache memory, does not need refreshing.
- **DRAM (Dynamic RAM):**
  Slower, cheaper, used as main memory, needs refreshing continuously.

What is BIOS stored in?

BIOS is stored in **ROM (Read Only Memory)**

Explain booting and role of ROM

Booting:
The process of starting a computer and loading the operating system.

Role of ROM:
ROM contains BIOS/firmware which performs:

- Power-On Self Test (POST)
- Hardware initialization

- Boots OS loader from storage

What is page file in virtual memory?

A **page file** is a space on disk used as an extension of RAM, where inactive pages from main memory are stored to free RAM space.

Explain L1, L2, L3 cache levels

- **L1 Cache:** Smallest, fastest, located inside CPU core.
- **L2 Cache:** Larger than L1, slower, inside CPU but shared or per-core.
- **L3 Cache:** Biggest, slower than L2, shared among CPU cores.

Write advantages of virtual memory

- Allows running large programs even with low RAM
- Provides multitasking
- Utilizes disk space efficiently
- Improves memory management

SECTION-C (Short Questions – 2–3 marks)

Define RAM

RAM (Random Access Memory) is a volatile primary memory used to store data and programs currently in use.

Define ROM

ROM (Read Only Memory) is non-volatile memory containing permanent instructions like BIOS.

What is cache memory?

A small, high-speed memory between CPU and RAM used to store frequently accessed data.

What is virtual memory?

A memory management technique that uses secondary storage (disk) as an extension of RAM.

What is HDD?

HDD (Hard Disk Drive) is a magnetic non-volatile secondary storage device used for storing data permanently.

What is stored in BIOS?

Basic hardware configuration instructions and boot firmware stored in ROM.

Write full form of RAID

RAID — Redundant Array of Independent Disks

Write difference between SRAM and DRAM

SRAM	DRAM
Faster	Slower
Expensive	Cheaper
Used in cache	Used in main memory
No refresh needed	Needs refresh

Which memory is fastest?

Registers / Cache

Which memory is non-volatile?

ROM / SSD

MCQ / 1 Marks

1. Which memory is volatile? → RAM
2. Which is fastest? → Cache / Registers
3. ROM stores → Firmware / BIOS
4. Cache hit means → Data found in cache
5. RAID 1 uses → Mirroring
6. Virtual memory extends → RAM
7. L1 cache is → Fastest
8. SSD is → Secondary storage
9. SRAM used in → Cache
10. Hard disk is → Non-volatile