

Module 3: Storage & Peripheral Devices (Classes 8–10)

Module Duration: 6 Hours (3 Classes × 2 Hours)

Required Equipment: Desktop Computer, Laptop, HDD, SATA SSD, NVMe SSD, External HDD, USB Flash Drive, Monitor, Keyboard, Mouse, Printer, Scanner, Webcam, Speakers, Graphics Card (GPU), Sound Card, Network Interface Card (NIC), Screwdriver Set

Module Learning Objectives

By the end of this module, students will be able to:

- Understand different storage technologies and their applications.
 - Compare HDD, SSD, and NVMe storage devices.
 - Install and benchmark storage devices.
 - Identify and configure common computer peripherals.
 - Understand graphics, audio, and network expansion cards.
 - Install and configure expansion cards safely.
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Class 8 (2 Hours)

Storage Devices & Storage Technologies

Learning Outcomes

After completing this class, students will be able to:

- Explain different storage technologies.
 - Compare HDD, SATA SSD, and NVMe SSD.
 - Calculate storage capacity.
 - Understand RAID concepts.
 - Install internal and external storage devices.
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8.1 Introduction to Storage Devices

Storage devices are used to permanently store operating systems, applications, and user data.

Types of Storage

- Primary Storage (RAM, Cache)
 - Secondary Storage (HDD, SSD, NVMe, USB Drive)
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8.2 Hard Disk Drive (HDD)

A Hard Disk Drive stores data using rotating magnetic platters.

Features

- Mechanical device
- Large storage capacity
- Low cost
- Slower than SSD
- More sensitive to physical shock

Common Capacities

- 500 GB
 - 1 TB
 - 2 TB
 - 4 TB
 - 8 TB+
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8.3 Solid State Drive (SSD)

An SSD stores data using flash memory.

Advantages

- Faster boot time
- No moving parts
- Lower power consumption
- Silent operation
- Better durability

Common Capacities

- 120 GB
 - 240 GB
 - 500 GB
 - 1 TB
 - 2 TB
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8.4 NVMe SSD

NVMe (Non-Volatile Memory Express) uses the PCI Express (PCIe) interface for high-speed data transfer.

Advantages

- Extremely fast read/write speeds
 - Lower latency
 - Faster application loading
 - Ideal for gaming, video editing, and professional workloads
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8.5 HDD vs SSD vs NVMe

Feature	HDD	SATA SSD	NVMe SSD
Technology	Magnetic Disk	Flash Memory	Flash Memory (PCIe)
Speed	Slow	Fast	Very Fast
Noise	Yes	No	No
Power Consumption	High	Low	Low
Durability	Medium	High	High
Price	Lowest	Moderate	Highest

8.6 Storage Capacity

Units of Storage

- 8 Bits = 1 Byte
- 1024 Bytes = 1 KB
- 1024 KB = 1 MB
- 1024 MB = 1 GB

- 1024 GB = 1 TB
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8.7 RAID Basics

RAID (Redundant Array of Independent Disks) combines multiple drives for performance, redundancy, or both.

Common RAID Levels

RAID 0 (Striping)

- Faster performance
- No fault tolerance
- Minimum: 2 drives

RAID 1 (Mirroring)

- Data duplicated on two drives
- High reliability
- Minimum: 2 drives

RAID 5

- Combines speed and redundancy
- Requires at least 3 drives

RAID 10

- High performance with redundancy
 - Requires at least 4 drives
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8.8 External Storage

Examples:

- External HDD
- External SSD
- USB Flash Drive
- Memory Card
- Network Attached Storage (NAS)

Uses:

- Backup
 - File Transfer
 - Portable Storage
 - Disaster Recovery
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8.9 Storage Benchmarking

Common Benchmark Software

- CrystalDiskMark
- AS SSD Benchmark
- ATTO Disk Benchmark

Performance Indicators

- Read Speed
 - Write Speed
 - Random Access
 - Response Time
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Practical Exercise

Students will:

- Install an HDD.
 - Install a SATA SSD.
 - Install an NVMe SSD.
 - Compare storage performance using benchmarking software.
 - Identify the fastest storage device.
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Assignment

Prepare a comparison report between HDD, SATA SSD, and NVMe SSD, including speed, capacity, price, and recommended use cases.

Class 9 (2 Hours)

Computer Peripheral Devices

Learning Outcomes

Students will be able to:

- Identify common peripheral devices.
- Connect and configure computer peripherals.
- Install peripheral drivers.
- Troubleshoot basic peripheral issues.

9.1 What are Peripheral Devices?

Peripheral devices are external hardware connected to a computer to provide input, output, or communication functions.

Categories

- Input Devices
- Output Devices
- Input/Output Devices

9.2 Monitor

A monitor displays visual output from the computer.

Types of Monitors

- CRT (Cathode Ray Tube)
- LCD (Liquid Crystal Display)
- LED (Light Emitting Diode)
- OLED (Organic LED)
- IPS Panel

- Curved Monitor

Important Specifications

- Screen Size
 - Resolution (HD, Full HD, QHD, 4K)
 - Refresh Rate (60Hz, 120Hz, 144Hz, 240Hz)
 - Response Time
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9.3 Keyboard

Types

- Membrane Keyboard
- Mechanical Keyboard
- Wireless Keyboard
- Multimedia Keyboard

Common Layouts

- QWERTY
 - AZERTY
 - DVORAK
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9.4 Mouse

Types

- Optical Mouse
- Laser Mouse
- Wired Mouse
- Wireless Mouse
- Gaming Mouse

Features

- DPI Settings
- Scroll Wheel
- Programmable Buttons

9.5 Printer

Types

- Inkjet Printer
- Laser Printer
- Dot Matrix Printer
- Thermal Printer

Applications

- Office Documents
- Photos
- Receipts
- Industrial Printing

9.6 Scanner

Types:

- Flatbed Scanner
- Sheet-fed Scanner
- Handheld Scanner
- Barcode Scanner

Uses:

- Document Digitization
- Photo Scanning
- OCR (Optical Character Recognition)

9.7 Webcam

Used for:

- Video Conferencing
- Online Classes

- Streaming
- Security Monitoring

Specifications

- Resolution
 - Frame Rate
 - Autofocus
 - Built-in Microphone
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9.8 Speakers

Types

- Stereo Speakers
 - 2.1 Speakers
 - 5.1 Surround Sound
 - Bluetooth Speakers
 - USB Speakers
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9.9 Peripheral Installation

Connection Interfaces

- USB
 - Bluetooth
 - HDMI
 - DisplayPort
 - Audio Jack
 - Wi-Fi
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9.10 Device Drivers

Drivers allow the operating system to communicate with hardware devices.

Examples

- Printer Driver
 - Graphics Driver
 - Audio Driver
 - Scanner Driver
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Practical Exercise

Students will:

- Connect a monitor.
 - Install a keyboard and mouse.
 - Configure a printer.
 - Install a webcam.
 - Test speakers and microphone.
 - Verify all devices in Device Manager.
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Assignment

Create a table showing the purpose, connection type, and driver requirements of each peripheral device.

Class 10 (2 Hours)

Graphics Card & Expansion Cards

Learning Outcomes

Students will be able to:

- Explain the purpose of expansion cards.
 - Install a graphics card safely.
 - Identify PCIe slots.
 - Install sound and network cards.
 - Configure expansion devices.
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10.1 Expansion Cards

Expansion cards add extra functionality to a computer by connecting through motherboard expansion slots.

10.2 Graphics Processing Unit (GPU)

The GPU processes graphics, images, and video.

Uses

- Gaming
- Video Editing
- Graphic Design
- 3D Modeling
- Artificial Intelligence
- Machine Learning

Types

- Integrated Graphics
 - Dedicated Graphics Card
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10.3 GPU Specifications

- VRAM
 - CUDA/Stream Processors
 - Core Clock
 - Memory Bus Width
 - HDMI/DisplayPort Outputs
 - Power Requirements
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10.4 Installing a Graphics Card

Installation Steps

1. Power off the computer.
2. Remove the side panel.
3. Locate the PCIe x16 slot.
4. Insert the graphics card.
5. Secure it with screws.
6. Connect PCIe power cables if required.
7. Install graphics drivers.

10.5 Sound Card

Functions

- Audio Processing
- Recording
- Surround Sound
- Professional Audio Applications

Connection Types

- PCIe
- USB (External)

10.6 Network Interface Card (NIC)

A NIC enables network communication.

Types

- Ethernet Card
- Wi-Fi Adapter
- Bluetooth Adapter

Common Speeds

- 100 Mbps
 - 1 Gbps
 - 2.5 Gbps
 - 10 Gbps
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10.7 Expansion Slots

Common Motherboard Slots

- PCI
 - PCI Express x1
 - PCI Express x4
 - PCI Express x8
 - PCI Express x16
 - M.2 Slot
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10.8 Installing Expansion Cards

General Steps

1. Turn off the computer.
 2. Disconnect power.
 3. Open the case.
 4. Insert the card into the appropriate slot.
 5. Secure the card with screws.
 6. Connect any required cables.
 7. Install drivers.
 8. Test functionality.
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10.9 Driver Installation

Install drivers for:

- Graphics Card
- Sound Card
- Network Card
- Wi-Fi Adapter
- Bluetooth Adapter

Verify installation using **Device Manager**.

Practical Exercise

Students will:

- Install a graphics card.
 - Install a network interface card.
 - Install a sound card.
 - Install device drivers.
 - Test graphics output, audio, and network connectivity.
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Module Project

Students will complete a **Storage & Expansion Hardware Lab** by:

- Installing HDD, SATA SSD, and NVMe SSD.
 - Benchmarking storage performance.
 - Connecting and configuring all peripheral devices.
 - Installing a graphics card, sound card, and network card.
 - Installing required drivers and verifying hardware functionality.
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Module Assessment

Assessment	Marks
Storage & Peripheral Devices Quiz	10
Practical Exercises	20
Assignments	20
Storage & Expansion Hardware Project	40
Viva & Demonstration	10
Total	100

Module Learning Outcomes

After completing **Module 3: Storage & Peripheral Devices**, students will be able to:

- Compare HDD, SATA SSD, and NVMe SSD technologies and recommend appropriate storage solutions.

- Calculate storage capacities and explain common RAID levels.
- Install, configure, and benchmark internal and external storage devices.
- Identify, connect, and troubleshoot common computer peripherals, including monitors, printers, scanners, webcams, and speakers.
- Install and configure graphics cards, sound cards, and network interface cards.
- Recognize motherboard expansion slots and safely install compatible expansion cards.
- Verify hardware functionality through proper driver installation and system testing.