A Laboratory Manual for

Computer Troubleshooting and Maintenance

(2022673(022))

Semester– VI

Department of Computer Science & Engineering

Chhattisgarh Institute of Technology, Jashpur

Prepared by
Manish Dongre
Lecturer, Computer Science
Chhattisgarh Institute of Technology, Jashpur

🧪 Experiment 1: Identify Computer Hardware and Its Type

🎯 Objective

To identify various computer hardware components and classify them into appropriate types such as input devices, output devices, storage devices, and processing units.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop computer / Laptop
- Keyboard, Mouse
- Monitor
- Internal components (CPU cabinet with motherboard, RAM, HDD/SSD, SMPS)

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- System Information Tool (e.g., Device Manager, System Information)

📘 Theory

Computer hardware refers to the **physical components** of a computer system that can be seen and touched. These components work together to perform computing tasks.
Hardware is broadly classified into the following categories:

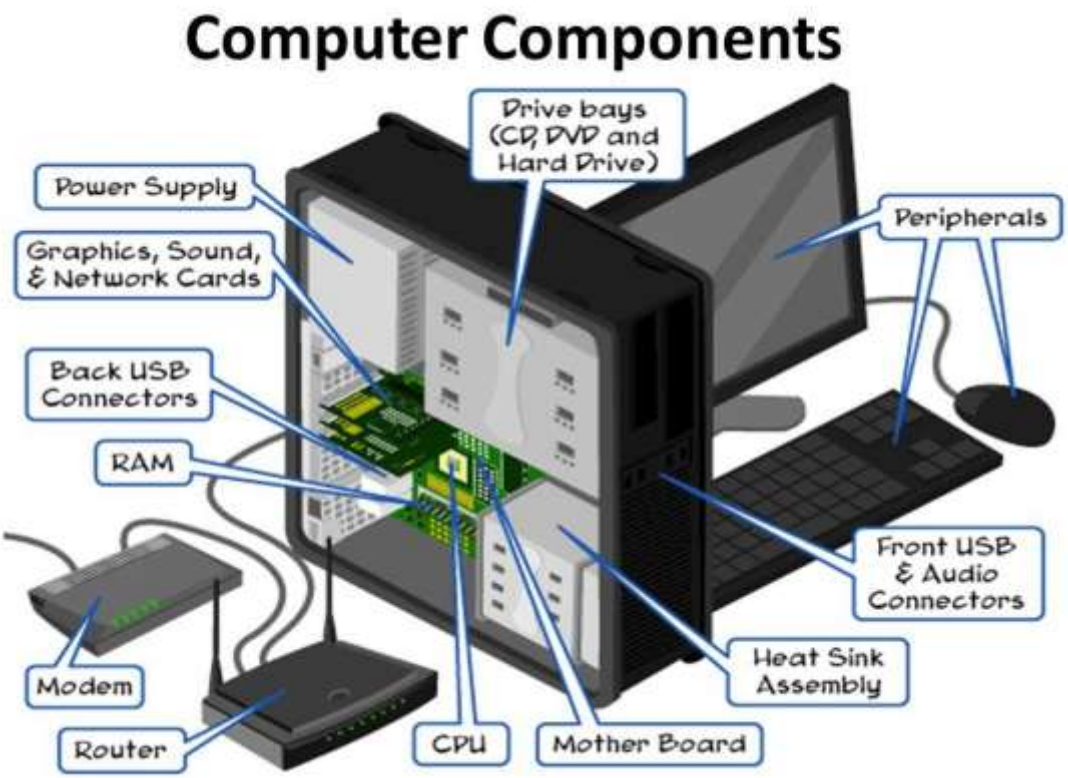
1. **Input Devices** – Used to enter data into the computer
   Examples: Keyboard, Mouse, Scanner
2. **Output Devices** – Used to display results
   Examples: Monitor, Printer, Speakers
3. **Processing Devices** – Perform computation and control operations
   Examples: CPU (Central Processing Unit), GPU
4. **Storage Devices** – Store data permanently or temporarily
   Examples: Hard Disk Drive (HDD), Solid State Drive (SSD), RAM
5. **Communication Devices** – Enable data transfer between systems
   Examples: Network Card, Modem

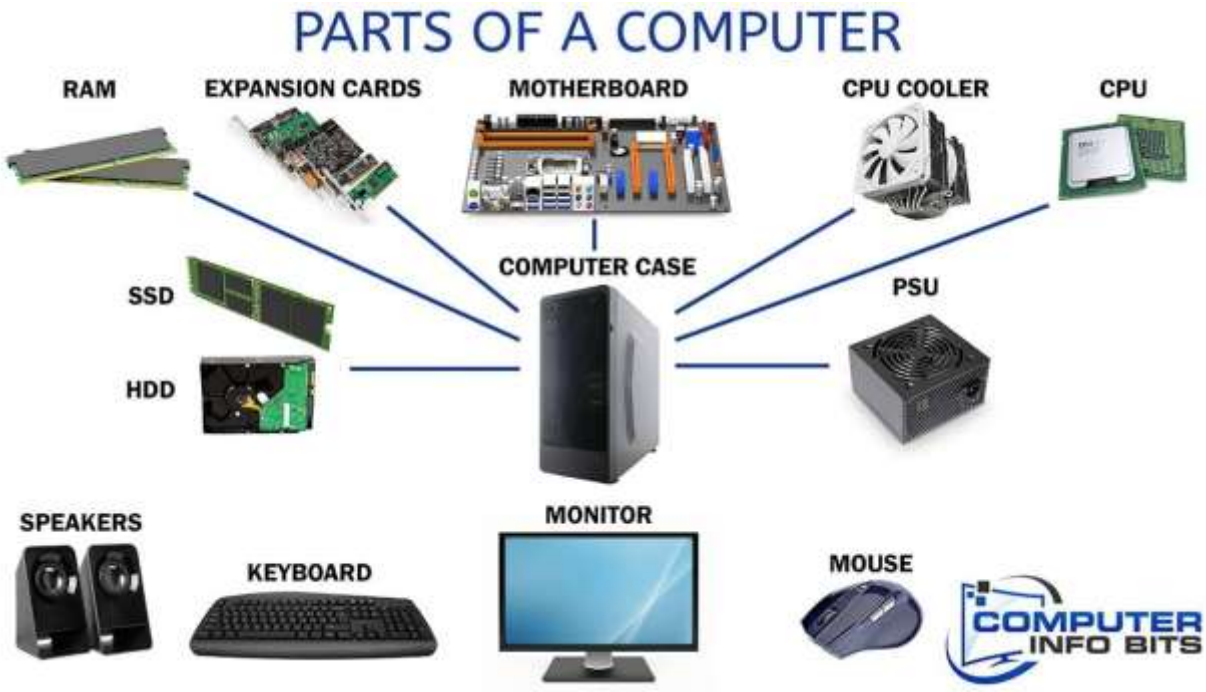
⚙️ Working Principle

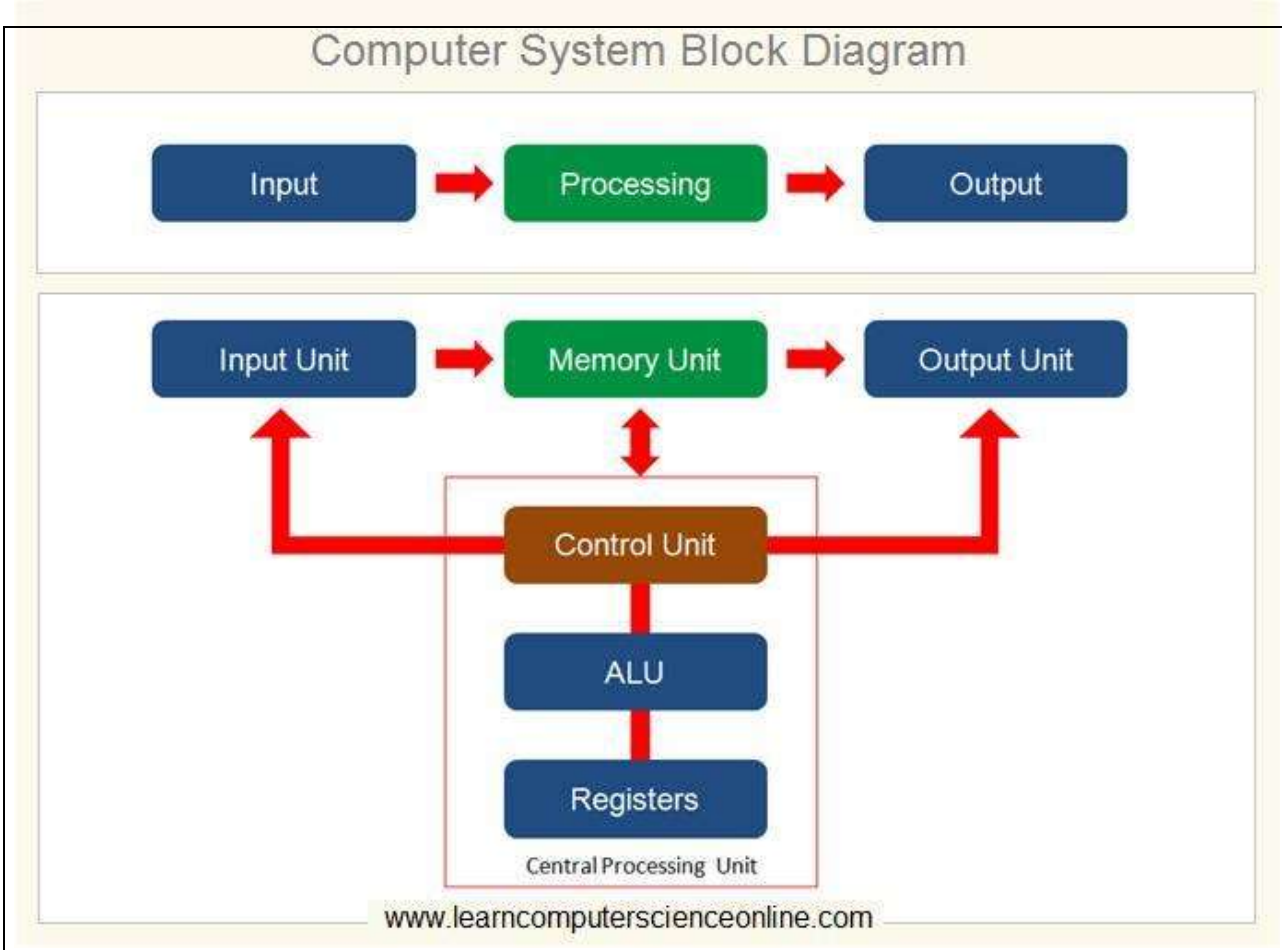
A computer system works on the **IPO Cycle (Input → Process → Output):**

1. **Input Stage:**
   Data is entered using input devices like keyboard or mouse.
2. **Processing Stage:**
   The CPU processes the data using instructions stored in memory.
3. **Output Stage:**
   The processed data is displayed through output devices like monitor.
4. **Storage Stage:**
   Data is saved in storage devices for future use.

◆ **Basic Computer Hardware Components**







□ Procedure

1. Switch on the computer system.
2. Observe external hardware components (keyboard, mouse, monitor, CPU cabinet).
3. Open the CPU cabinet carefully (if permitted).
4. Identify internal components such as:
    - Motherboard
    - RAM
    - Storage device (HDD/SSD)
    - Power Supply (SMPS)
5. Open **Device Manager / System Information** in OS to view hardware details.
6. Classify each component into its respective category (Input, Output, Storage, Processing).
7. Record observations.

Observation Table

Component	Type (Input/Output/Storage/Processing)
Keyboard	Input Device
Monitor	Output Device
CPU	Processing Device
RAM	Storage (Primary Memory)
Hard Disk	Storage (Secondary Memory)

✓ Conclusion

In this experiment, various hardware components of a computer system were successfully identified and classified. Understanding hardware types is fundamental for troubleshooting, maintenance, and efficient system usage.

🧪 Experiment 2: Illustrate Examples of Hardware and Software Faults

---

🎯 Objective

To identify and illustrate common examples of hardware and software faults in a computer system for effective troubleshooting and maintenance.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop / Laptop Computer
- Peripheral devices (Keyboard, Mouse, Monitor)

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Diagnostic Tools (Task Manager, Device Manager, Disk Utility)

📘 Theory

A **fault** in a computer system refers to any abnormal condition that disrupts normal operation. Faults are broadly classified into:

◆ 1. Hardware Faults

These occur due to physical damage or malfunction of components.

Examples:

- RAM failure → system crashes / blue screen
- Hard disk failure → data loss / slow performance
- Overheating CPU → automatic shutdown
- Faulty power supply → system not turning on
- Keyboard/mouse not working

◆ 2. Software Faults

These occur due to errors in programs or operating systems.

Examples:

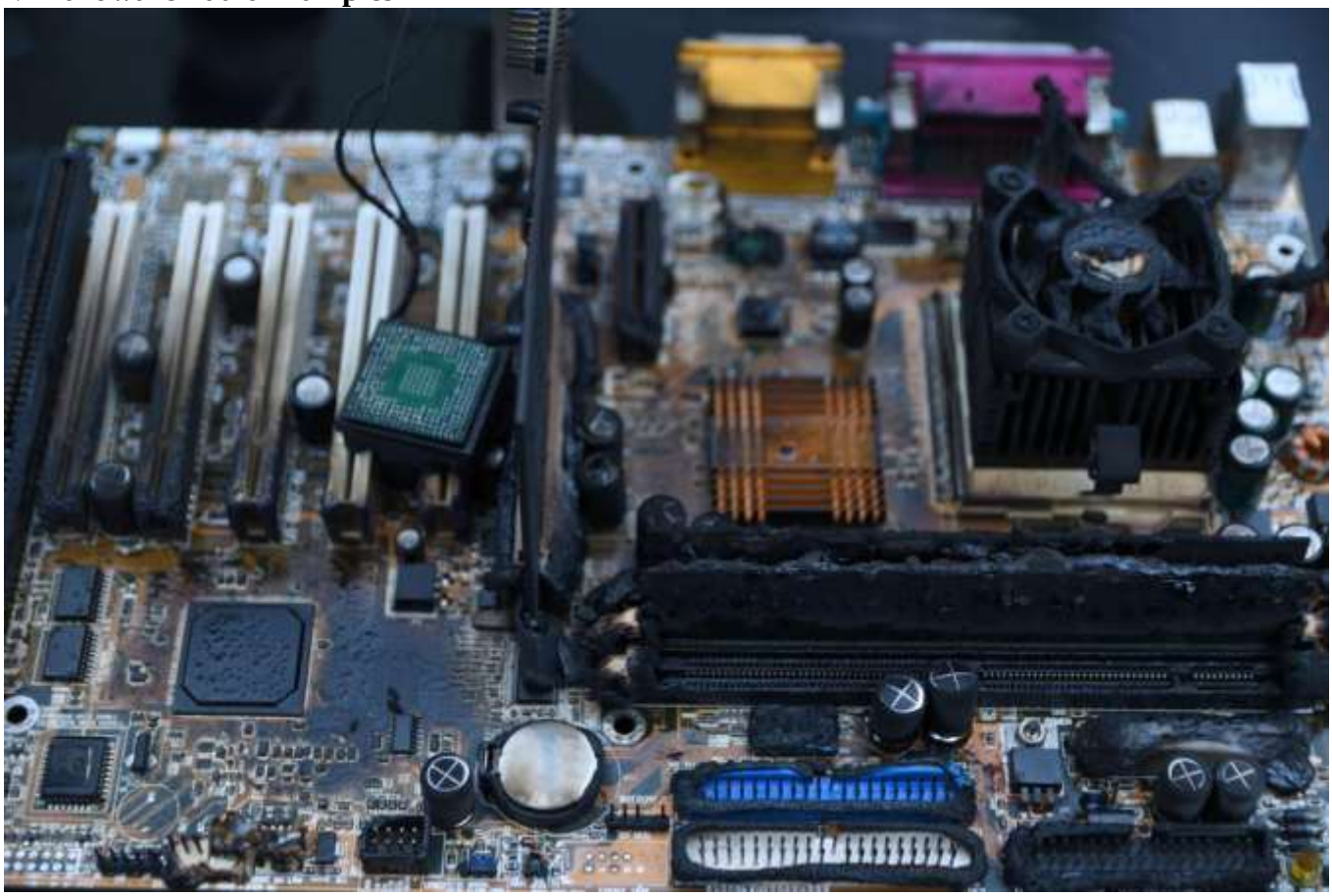
- Operating system crash
- Virus or malware infection
- Application not responding
- Driver issues (device not recognized)
- File corruption

⚙️ Working Principle

Fault identification follows a **systematic troubleshooting model**:

1. **Symptom Identification**
   Observe error messages, unusual behavior, or failure.
2. **Fault Classification**
   Determine whether the issue is hardware or software.
3. **Diagnosis**
   - Hardware: physical inspection, component testing
   - Software: logs, error codes, system tools
4. **Resolution**
   - Replace/repair hardware
   - Reinstall/update software
5. **Verification**
   Ensure system returns to normal operation.

◆ **Hardware Fault Examples**



SMART Hard Disk Error

The SMART hard disk check has detected an imminent failure. To ensure no data loss, please backup the content immediately and run the Hard Disk Test in System Diagnostics.

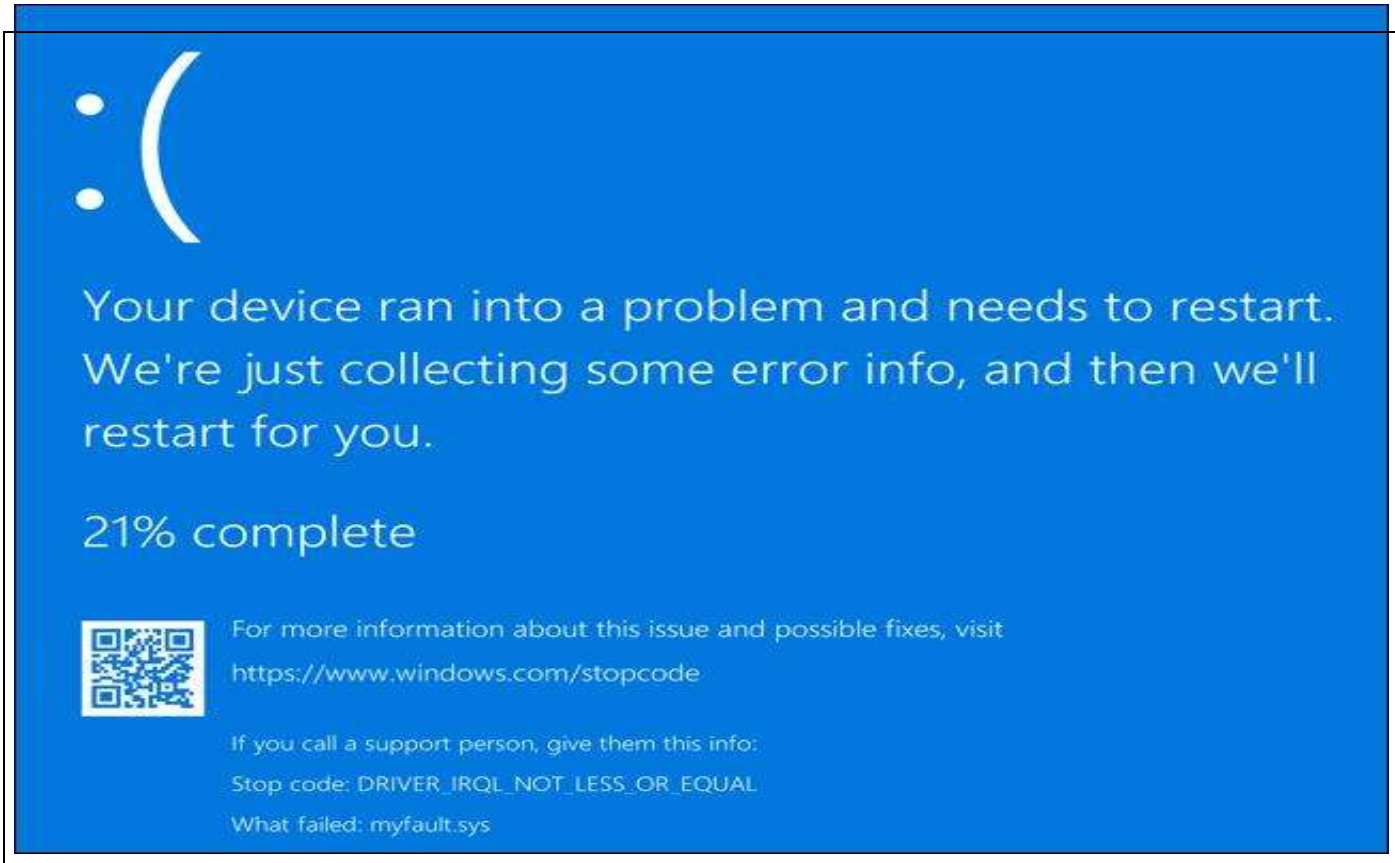
Hard Disk 1 (301)

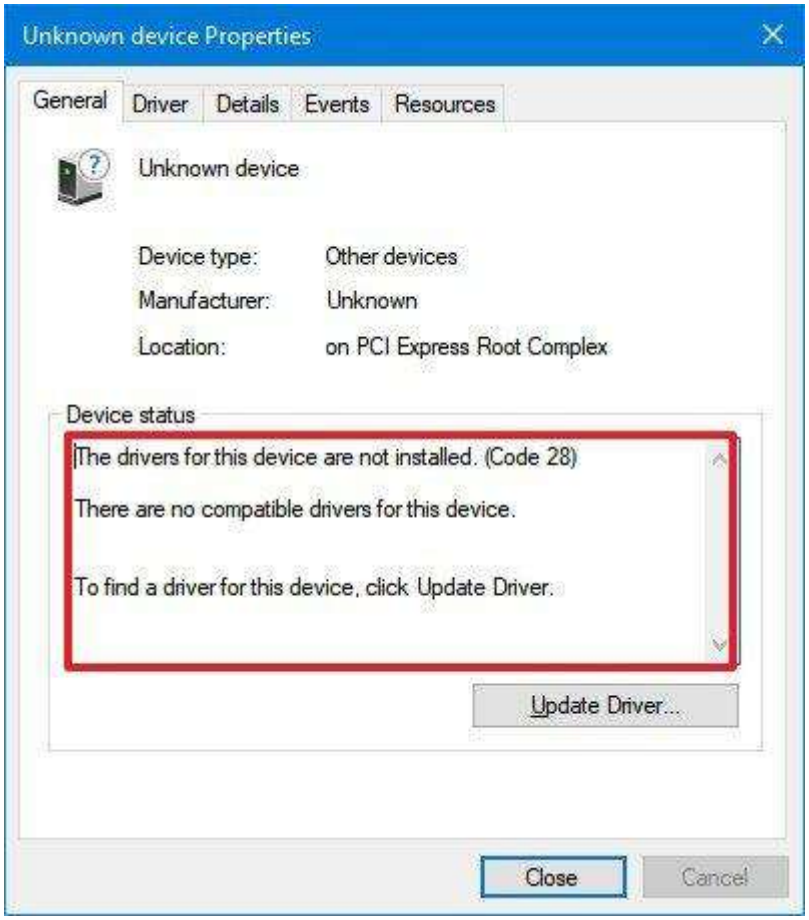
F2 – System Diagnostics

ENTER – Continue Startup

For more information, please visit: http://www.hp.com/go/300harddiskerror

◆ **Software Fault Examples**





□ Procedure

1. Start the computer system.
2. Simulate or observe faults (if available):
   - Disconnect keyboard/mouse (hardware fault)
   - Open multiple applications to freeze system (software fault)
3. Use tools like:
   - Task Manager → check performance/issues

- Device Manager → check driver problems

4. Note symptoms and identify fault type.
5. Record examples of both hardware and software faults.

📊 Observation Table

Fault Type	Example	Symptoms
Hardware	RAM failure	System crash / restart
Hardware	Hard disk failure	Data not accessible
Software	OS crash	Blue screen error
Software	Virus infection	Slow performance, pop-ups
Software	Driver issue	Device not detected

✅ Conclusion

This experiment demonstrated various hardware and software faults along with their symptoms. Understanding fault types helps in quick diagnosis and effective troubleshooting, reducing system downtime and improving reliability.

🧪 Experiment 3: Study of Anti-Virus Programs and Installation

🎯 Objective

To study different anti-virus programs and learn the procedure for installing and using antivirus software to protect a computer system.

💻 Hardware and Software Requirements

Hardware:

- Desktop / Laptop Computer
- Minimum 4 GB RAM recommended

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Antivirus Software (e.g., Quick Heal Antivirus, Avast Antivirus, Kaspersky Antivirus)

📚 Theory

An **antivirus program** is a software application designed to **detect, prevent, and remove malicious software (malware)** such as viruses, worms, trojans, ransomware, and spyware.

◆ Functions of Antivirus Software

- Real-time protection
- Virus scanning (Quick Scan / Full Scan)
- Malware removal
- Web protection
- Firewall integration

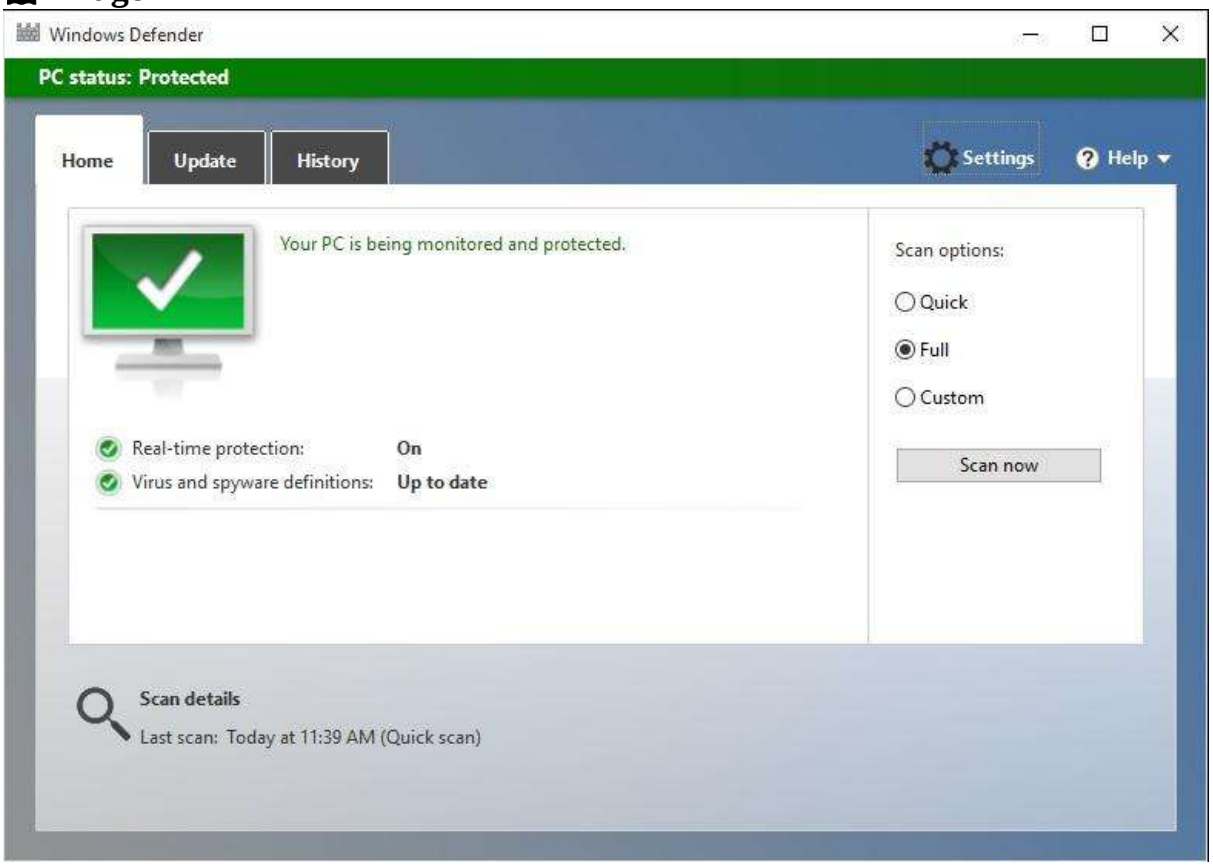
◆ Types of Antivirus Detection Techniques

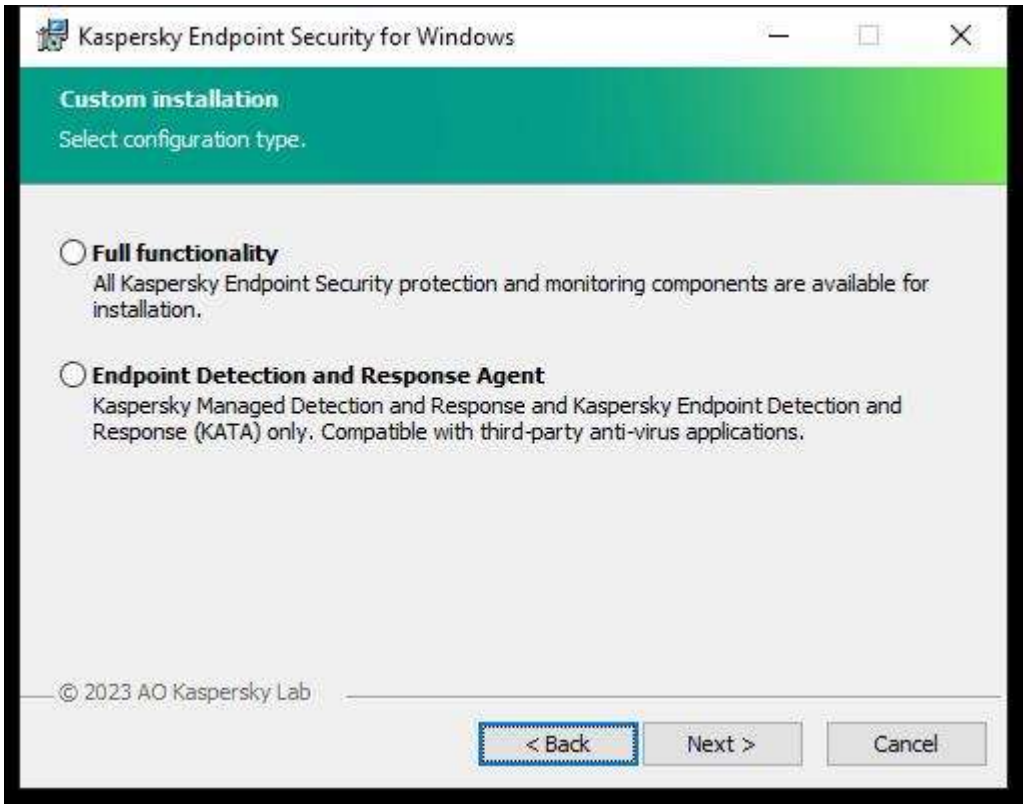
1. **Signature-Based Detection**
   Detects known viruses using a database of signatures
2. **Heuristic-Based Detection**
   Identifies unknown threats based on behavior
3. **Behavior-Based Detection**
   Monitors suspicious activities in real time

⚙ Working Principle

1. Antivirus scans files and programs in the system.
2. It compares file signatures with its virus database.
3. Suspicious files are flagged or quarantined.
4. User can delete or clean infected files.
5. Real-time protection continuously monitors system activity.

🖼 Image


Windows Defender
PC status: Protected
Home
Update
History
Settings
Help
Your PC is being monitored and protected.
Scan options:
Quick
Full
Custom
Real-time protection: On
Virus and spyware definitions: Up to date
Scan now
Scan details
Last scan: Today at 11:39 AM (Quick scan)


Kaspersky Endpoint Security for Windows
Custom installation
Select configuration type.
Full functionality
All Kaspersky Endpoint Security protection and monitoring components are available for installation.
Endpoint Detection and Response Agent
Kaspersky Managed Detection and Response and Kaspersky Endpoint Detection and Response (KATA) only. Compatible with third-party anti-virus applications.
© 2023 AO Kaspersky Lab
< Back
Next >
Cancel

□ Procedure (Installation of Antivirus Software)

1. Download antivirus software from official website
2. Double-click the setup file (.exe)
3. Follow installation wizard steps:
    - Accept license agreement
    - Choose installation type (Express/Custom)
4. Click **Install** and wait for completion
5. Restart system (if required)
6. Open antivirus program
7. Update virus definitions
8. Perform a **Full System Scan**

Observation Table

Antivirus Software	Type (Free/Paid)	Features Observed
Quick Heal	Paid	Real-time protection
Avast	Free/Paid	Web & malware protection
Kaspersky	Paid	Advanced threat detection

✓ Conclusion

This experiment provided knowledge about antivirus software and its role in protecting systems from malware. Installation and usage of antivirus programs ensure system security, data protection, and safe computing.

🧪 Experiment 4: Study the Various Components of Motherboard

🎯 Objective

To study and identify different components present on a motherboard and understand their functions.

🛠️ Hardware and Software Requirements

Hardware:

- Desktop Computer (CPU Cabinet)
- Motherboard (ATX / Micro-ATX)
- Screwdriver kit (for safe opening)

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- System Information Tools (CPU-Z, BIOS Setup)

📘 Theory

The **motherboard** is the main printed circuit board (PCB) of a computer that connects all components together. It acts as the **backbone of the system**, enabling communication between CPU, memory, storage, and peripheral devices.

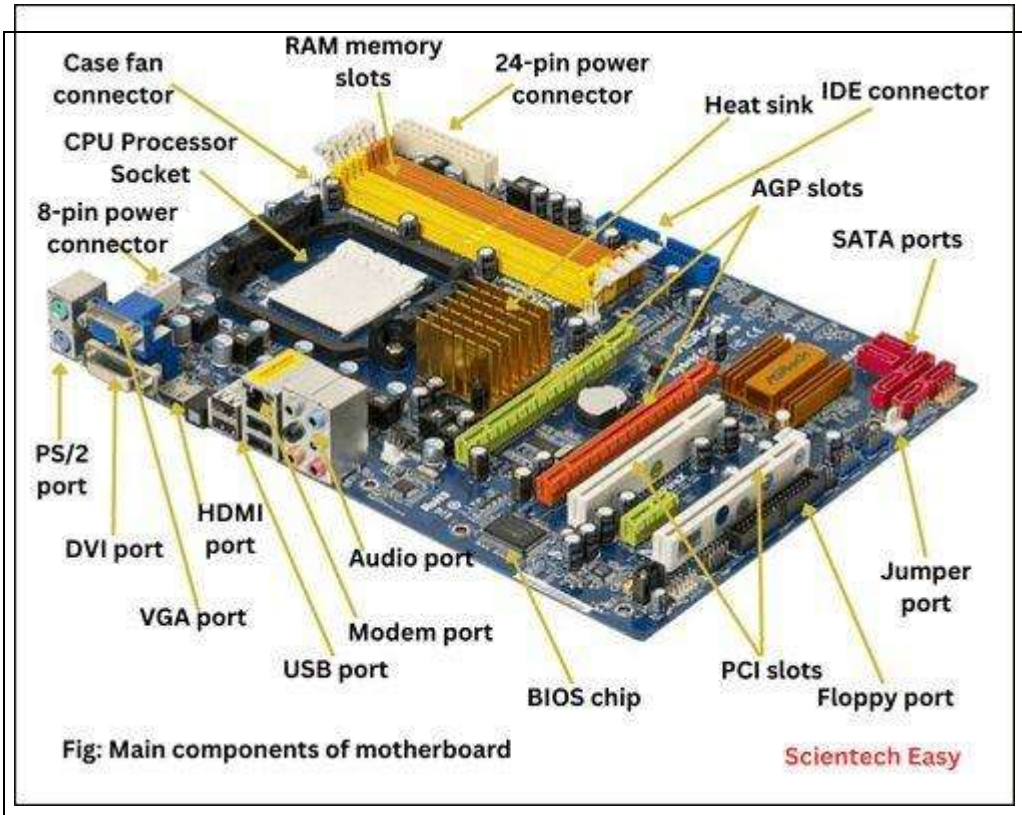
◆ Major Components of Motherboard

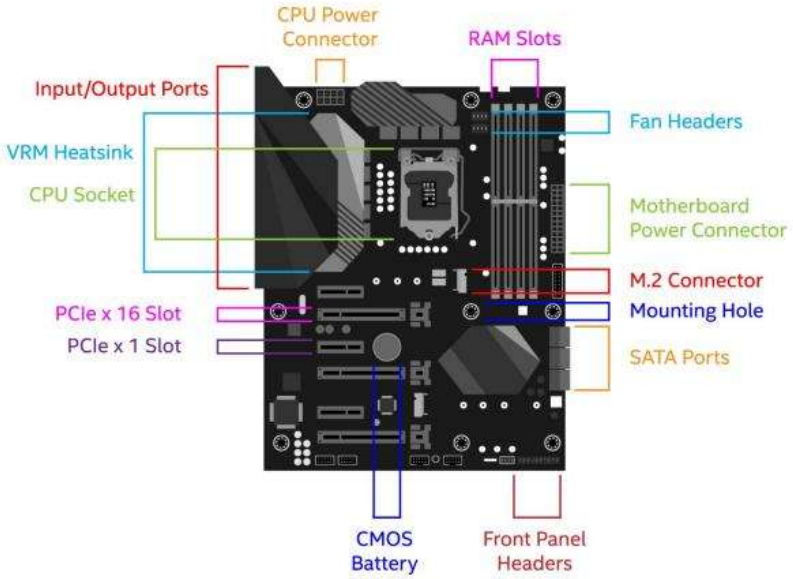
1. **CPU Socket**
   Holds the processor and connects it electrically to the system
2. **RAM Slots (DIMM Slots)**
   Used to install primary memory (RAM)
3. **Chipset**
   Controls communication between CPU, RAM, and peripherals
4. **BIOS/UEFI Chip**
   Stores firmware used to boot the system
5. **Expansion Slots (PCIe)**
   For adding graphics cards, network cards, etc.
6. **Power Connectors (24-pin, 4/8-pin)**
   Supply power from SMPS to motherboard
7. **Storage Connectors (SATA / NVMe)**
   Connect HDD/SSD
8. **I/O Ports**
   USB, HDMI, Audio ports for external devices

⚙️ Working Principle

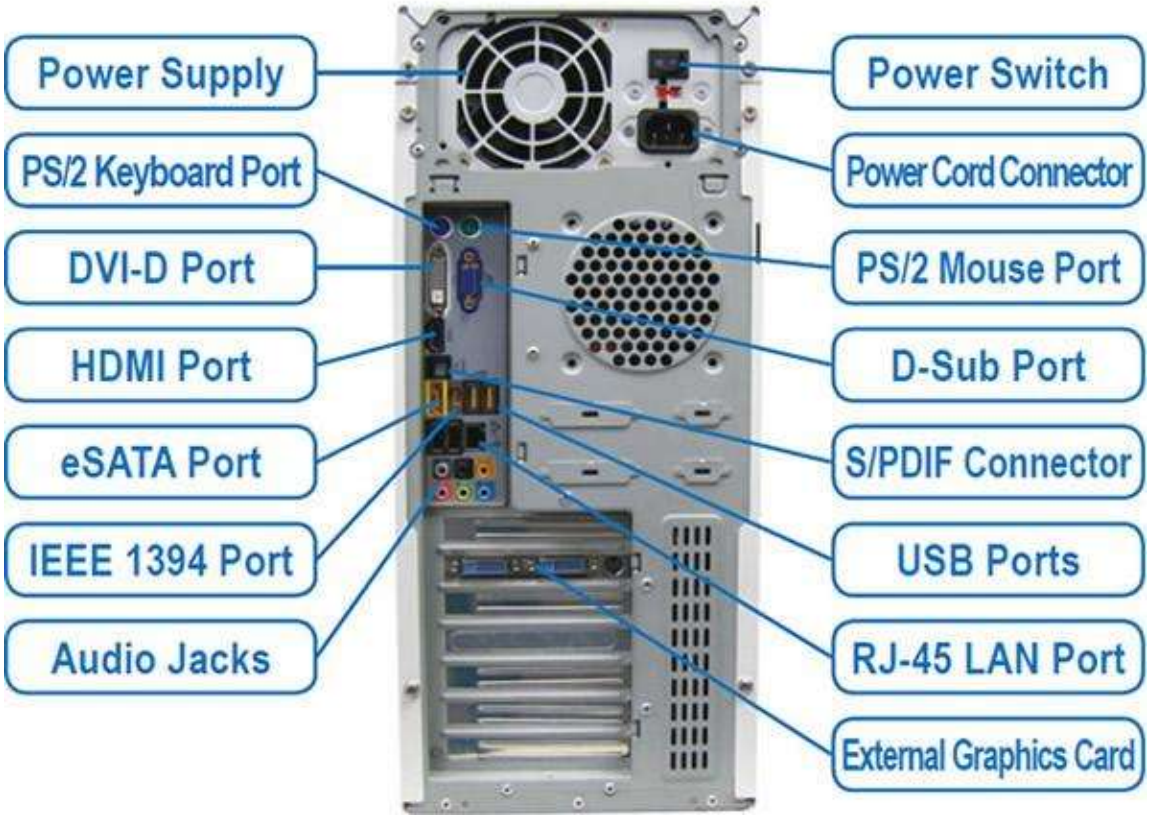
1. The motherboard distributes power to all components.
2. CPU processes instructions and communicates via chipset.
3. RAM temporarily stores data for quick access.
4. BIOS initializes hardware during booting.
5. Data flows between components through buses embedded in the motherboard.

🖼️ Relevant Image


Case fan connector
RAM memory slots
24-pin power connector
Heat sink
IDE connector
CPU Processor Socket
AGP slots
8-pin power connector
SATA ports
PS/2 port
HDMI port
DVI port
Audio port
Jumper port
VGA port
Modem port
USB port
PCI slots
BIOS chip
Floppy port
Fig: Main components of motherboard
Scientech Easy


CPU Power Connector
RAM Slots
Input/Output Ports
Fan Headers
VRM Heatsink
CPU Socket
Motherboard Power Connector
M.2 Connector
PCIe x 16 Slot
Mounting Hole
PCIe x 1 Slot
SATA Ports
CMOS Battery
Front Panel Headers

Back Panel of the Case



□ Procedure

1. Switch off and unplug the computer.
2. Open the CPU cabinet carefully.
3. Locate the motherboard inside the cabinet.
4. Identify and observe key components:
    - CPU socket
    - RAM slots
    - Expansion slots
    - Power connectors
    - Storage connectors
5. Start the system and enter BIOS/UEFI setup.
6. Observe hardware details using system tools.
7. Record all identified components.

📊 Observation Table

Component	Function
CPU Socket	Holds and connects processor
RAM Slots	Install memory modules
Chipset	Manages data flow
BIOS Chip	Boot firmware
PCIe Slot	Expansion cards
SATA Connector	Connect storage devices

✓ Conclusion

In this experiment, various motherboard components were identified and their functions understood. Knowledge of motherboard architecture is essential for troubleshooting, upgrading, and maintaining computer systems.

🧪 Experiment 5: Run Diagnostic Programs to Detect System Faults

🎯 Objective
To learn how to use diagnostic programs to identify and analyze hardware and software faults in a computer system.

🖥️ Hardware and Software Requirements
Hardware:
- Desktop / Laptop Computer

Software:
- Operating System (e.g., Windows 10 / Ubuntu)
- Diagnostic Tools:
  - Windows Memory Diagnostic
  - CHKDSK
  - Task Manager
  - CPU-Z

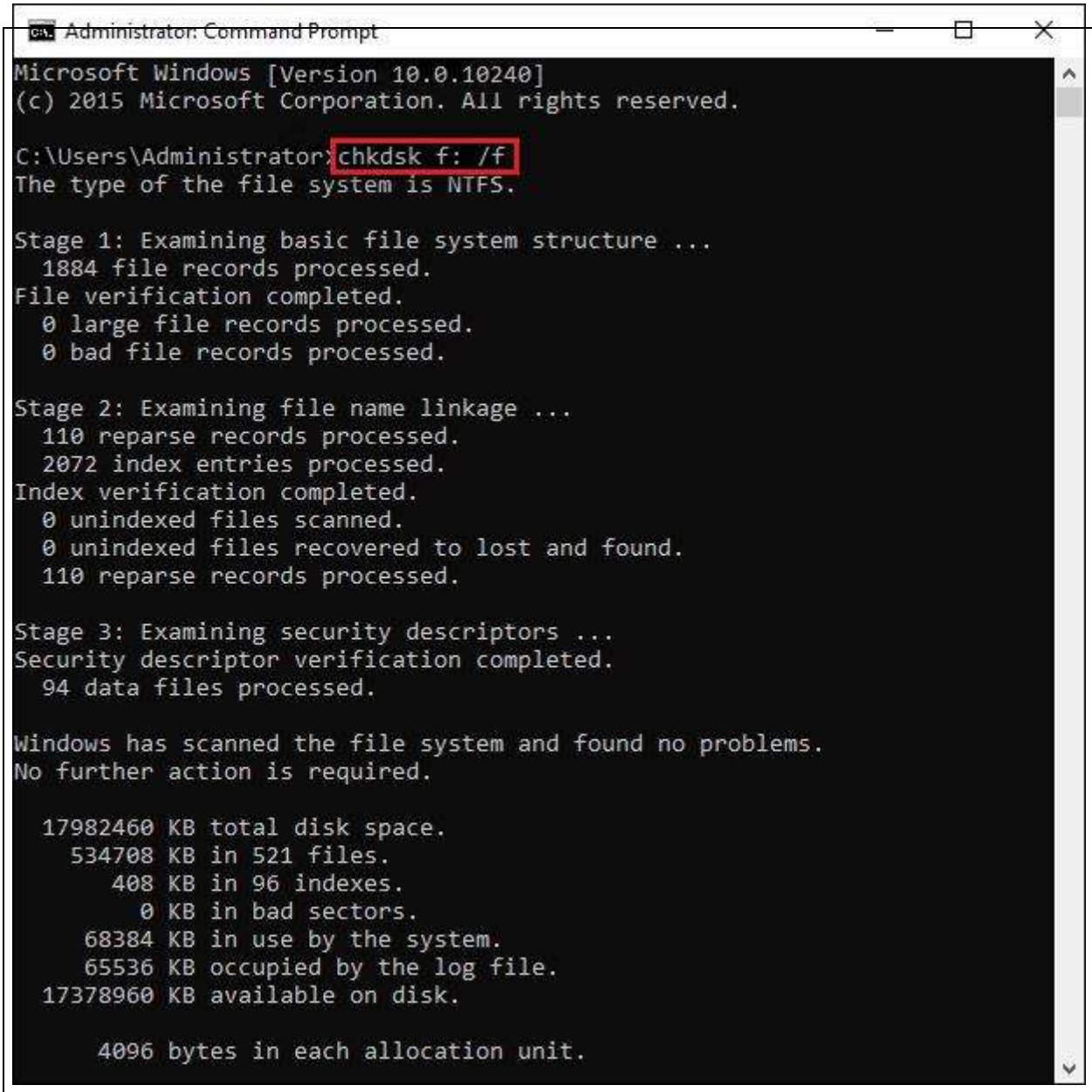
📘 Theory
Diagnostic programs are software tools used to **detect, analyze, and report faults** in computer systems. They help in identifying issues related to hardware performance, memory errors, disk failures, and system resource usage.

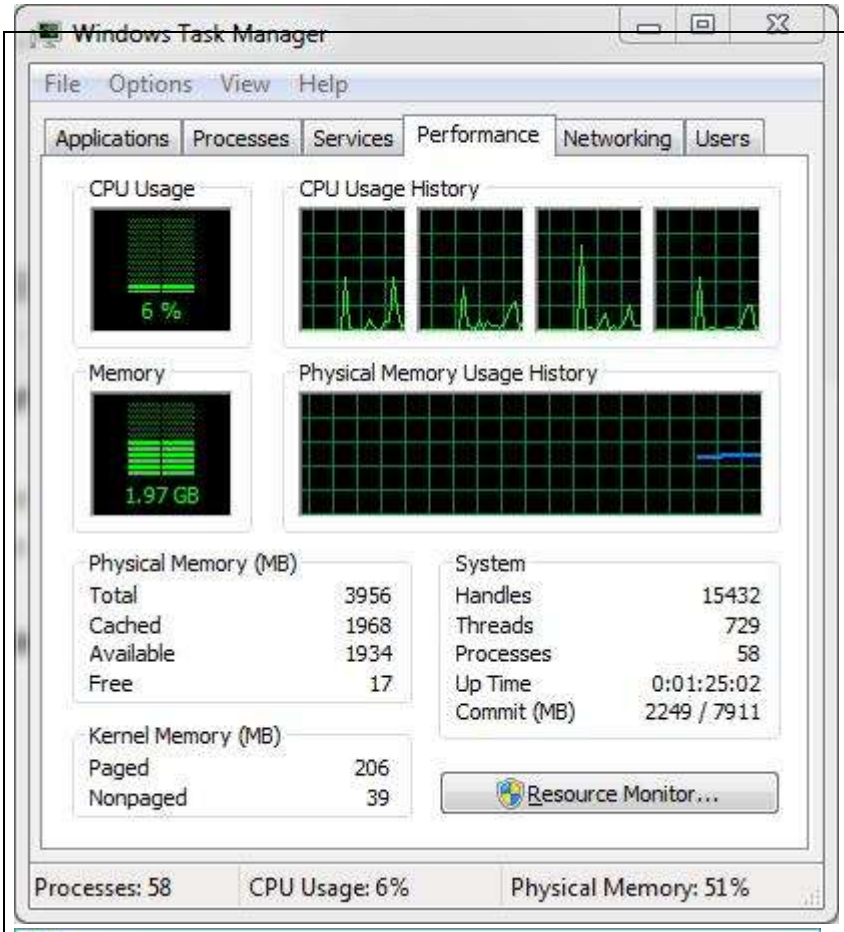
◆ Types of Diagnostic Tools
1. **Hardware Diagnostics**
   - Memory testing (RAM errors)
   - Disk checking (bad sectors)
   - CPU performance monitoring
2. **Software Diagnostics**
   - Process monitoring
   - Error logs and crash reports
   - Driver status checking

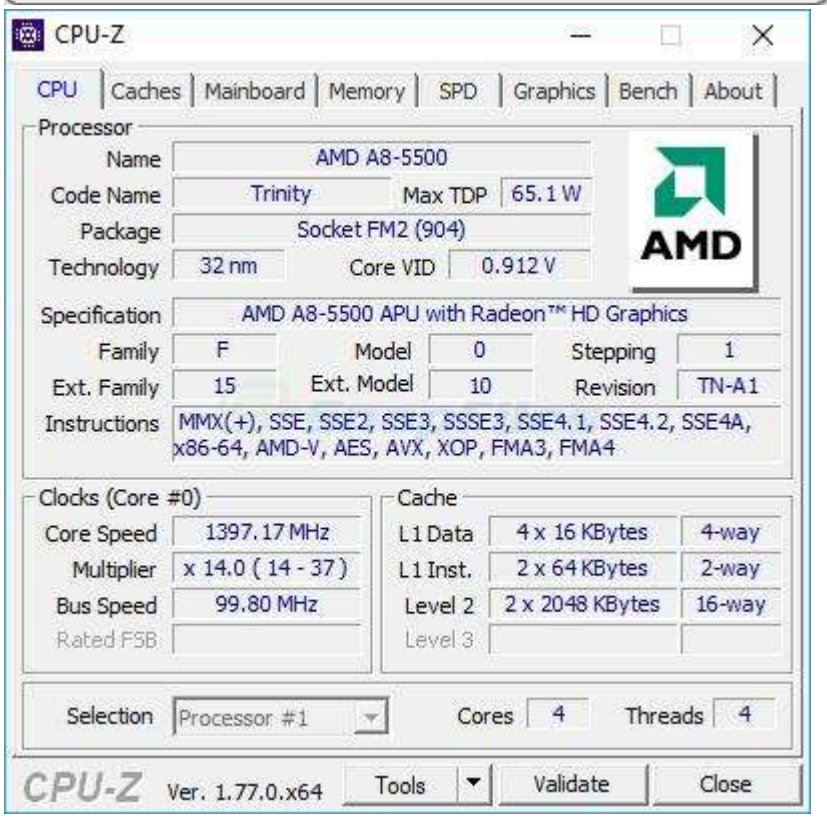
◆ Importance
- Early fault detection
- Prevent system failure
- Improve performance
- Reduce downtime

⚙️ Working Principle
1. Diagnostic tools scan system components.
2. They perform tests (memory test, disk scan, CPU monitoring).
3. Errors are detected and reported.
4. User analyzes results and takes corrective action.

🖼️ Image


Administrator: Command Prompt
Microsoft Windows [Version 10.0.10240]
(c) 2015 Microsoft Corporation. All rights reserved.
C:\Users\Administrator>chkdsk f: /f
The type of the file system is NTFS.
Stage 1: Examining basic file system structure ...
1884 file records processed.
File verification completed.
0 large file records processed.
0 bad file records processed.
Stage 2: Examining file name linkage ...
110 reparse records processed.
2072 index entries processed.
Index verification completed.
0 unindexed files scanned.
0 unindexed files recovered to lost and found.
110 reparse records processed.
Stage 3: Examining security descriptors ...
Security descriptor verification completed.
94 data files processed.
Windows has scanned the file system and found no problems.
No further action is required.
17982460 KB total disk space.
534708 KB in 521 files.
408 KB in 96 indexes.
0 KB in bad sectors.
68384 KB in use by the system.
65536 KB occupied by the log file.
17378960 KB available on disk.
4096 bytes in each allocation unit.





□ Procedure

1. Start the computer system.
2. **Run Memory Diagnostic Tool:**
   - Press *Windows + R* → type `mdsched.exe`
   - Restart and check for RAM errors
3. **Run Disk Check Utility:**
   - Open Command Prompt
   - Type: `chkdsk /f /r`
   - Scan and repair disk errors

-
4. **Use Task Manager:**
    - Press *Ctrl + Shift + Esc*
    - Monitor CPU, Memory, Disk usage
5. **Use CPU-Z:**
    - Install and open CPU-Z
    - View system hardware details
6. Record detected faults (if any).

📊 Observation Table

Tool Used	Component Tested	Result/Observation
Windows Memory Diagnostic	RAM	No errors / Errors detected
CHKDSK	Hard Disk	Bad sectors / Healthy disk
Task Manager	CPU/Memory	High/Normal usage
CPU-Z	System Info	Hardware configuration details

✅ Conclusion

This experiment demonstrated the use of diagnostic tools to detect system faults. These tools help in identifying issues early and play a crucial role in troubleshooting and maintaining system performance and reliability.

🧪 Experiment 6: Identification of Motherboard-Related Problems, Causes, and Resolution

---

🎯 Objective

To identify common motherboard-related problems, analyze their possible causes, and apply appropriate troubleshooting and resolution techniques.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop Computer (CPU Cabinet)
- Motherboard (ATX / Micro-ATX)
- SMPS (Power Supply Unit)
- RAM Modules, Processor

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- BIOS/UEFI Firmware Interface
- Diagnostic Tools (Beep Codes, System Logs)

📘 Theory

The **motherboard** is the central circuit board that interconnects all hardware components. Any malfunction in the motherboard can lead to system instability, failure to boot, or complete system breakdown.

Motherboard problems can arise due to:

- Electrical faults
- Physical damage
- Overheating
- Component failure
- BIOS corruption

⚙️ Working Principle

1. The motherboard distributes power from SMPS to all components.
2. It enables communication between CPU, RAM, storage, and peripherals.
3. BIOS/UEFI initializes hardware during boot.
4. If any component or circuit fails, the system generates **error signals (beep codes / no display / restart loops)**.

🖼 Image

Beep Code	Description	Document
No Beeps	No Power, Loose Card, or Short.	CH000312
1 Short Beep	Normal POST, computer is ok.	No problem
2 Short Beep	POST error, review screen for error code.	See screen
Continuous Beep	No Power, Loose Card, or Short.	CH000607
Repeating Short Beep	No Power, Loose Card, or Short.	CH000607
One Long and one Short Beep	Motherboard issue.	CH000607
One Long and Two Short Beeps	Video (Mono/CGA Display Circuitry) issue.	CH000607
One Long and Three Short Beeps.	Video (EGA) Display Circuitry.	CH000607
Three Long Beeps	Keyboard / Keyboard card error.	CH000304
One Beep, Blank or Incorrect Display	Video Display Circuitry.	CH000607

□ Procedure

1. Switch off and unplug the system.

2. Open CPU cabinet carefully.
3. Inspect motherboard visually:
    - Check for burnt components
    - Look for swollen capacitors
    - Check loose connections
4. Reconnect RAM, power cables, and components.
5. Start system and observe:
    - Beep sounds
    - Display status
6. Enter BIOS/UEFI to check hardware detection.
7. Identify fault, cause, and apply corrective action.

📊 Observation Table

Problem	Possible Cause	Resolution
No power	Faulty SMPS / motherboard short	Replace SMPS / repair motherboard
No display	GPU/CPU/RAM issue	Reseat components / replace faulty
Continuous beep sound	RAM failure	Replace or clean RAM
System overheating	Cooling failure	Clean fan / apply thermal paste
USB ports not working	Port damage / driver issue	Replace port / reinstall drivers
Random restarts	Voltage fluctuation / capacitor issue	Check SMPS / replace motherboard

---

✅ Conclusion

This experiment helped in identifying common motherboard-related problems along with their causes and solutions. Proper diagnosis and systematic troubleshooting improve system reliability and reduce hardware failure risks.

Experiment 7: Identification of Processor-Related Problems, Causes, and Resolution

Objective
To identify common processor (CPU)-related problems, analyze their causes, and apply appropriate troubleshooting and resolution techniques.

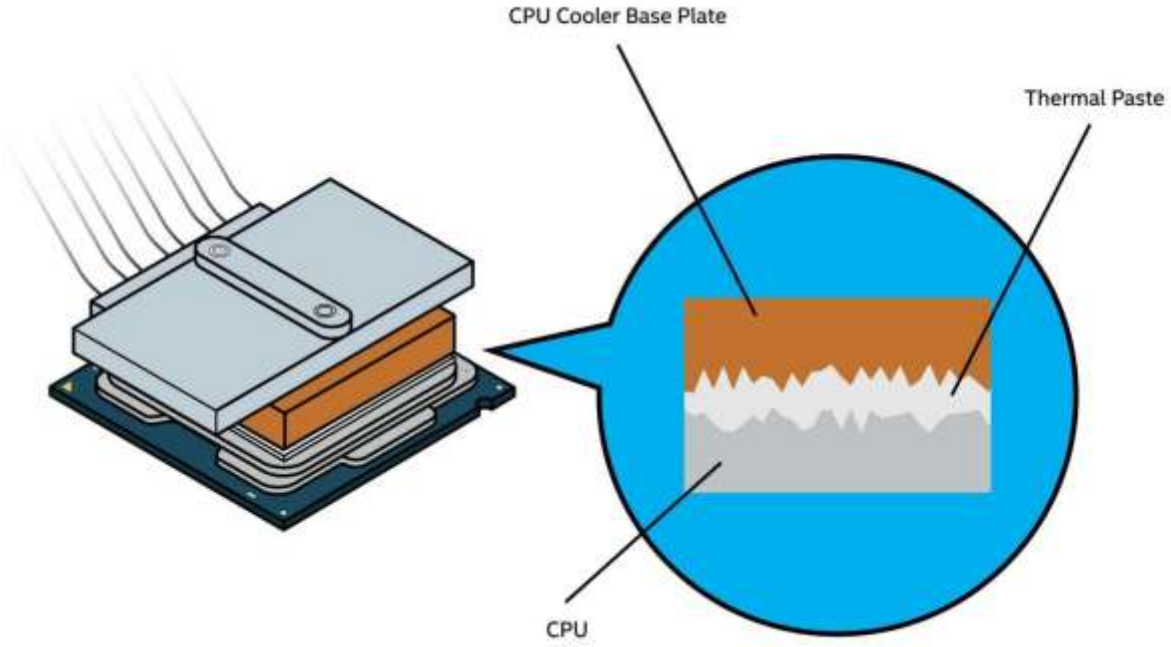
Hardware and Software Requirements
Hardware:
- Desktop Computer (CPU Cabinet)
- Processor (CPU) with heat sink & fan
- Thermal paste
- Motherboard

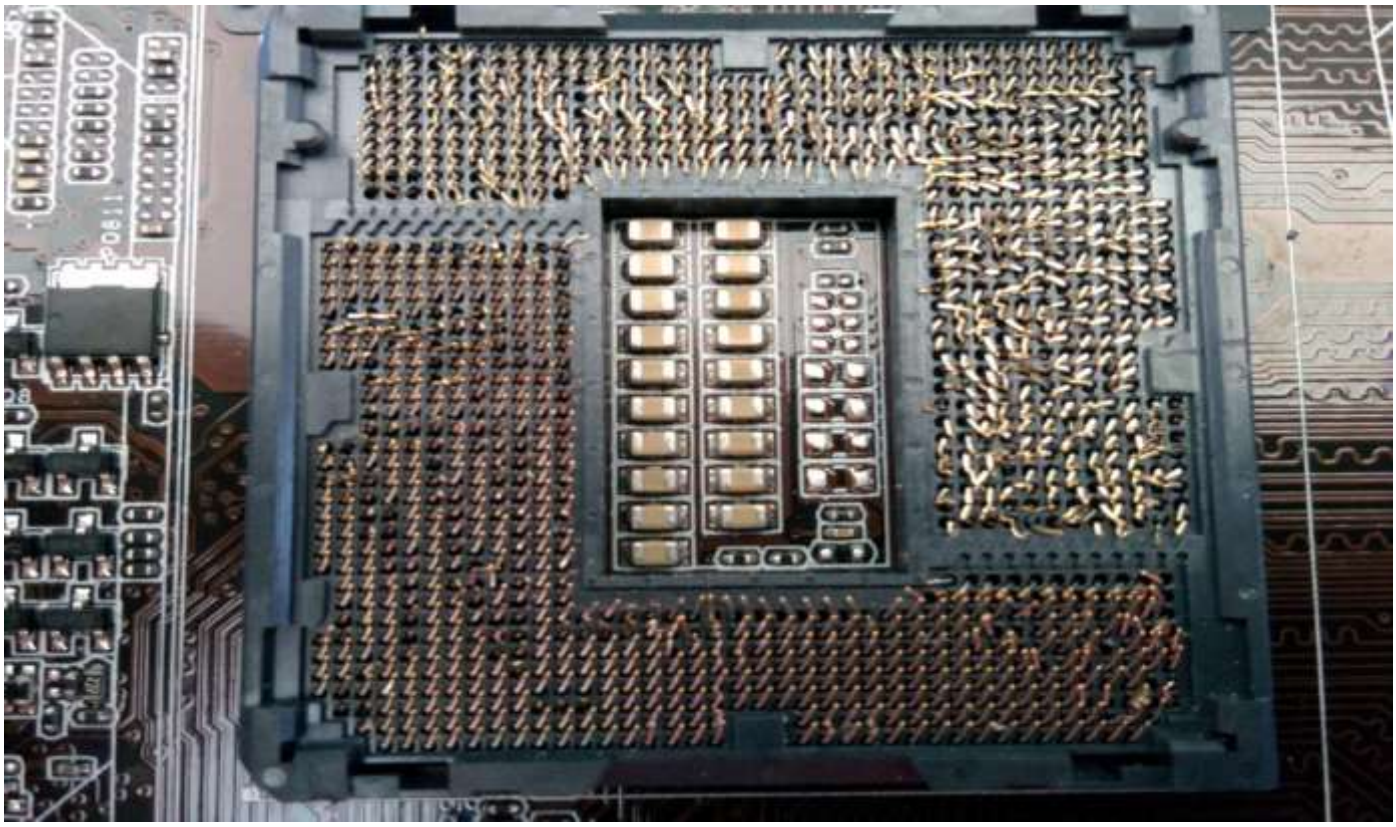
Software:
- Operating System (e.g., Windows 10 / Ubuntu)
- Monitoring Tools:
  - Task Manager
  - Core Temp
  - CPU-Z

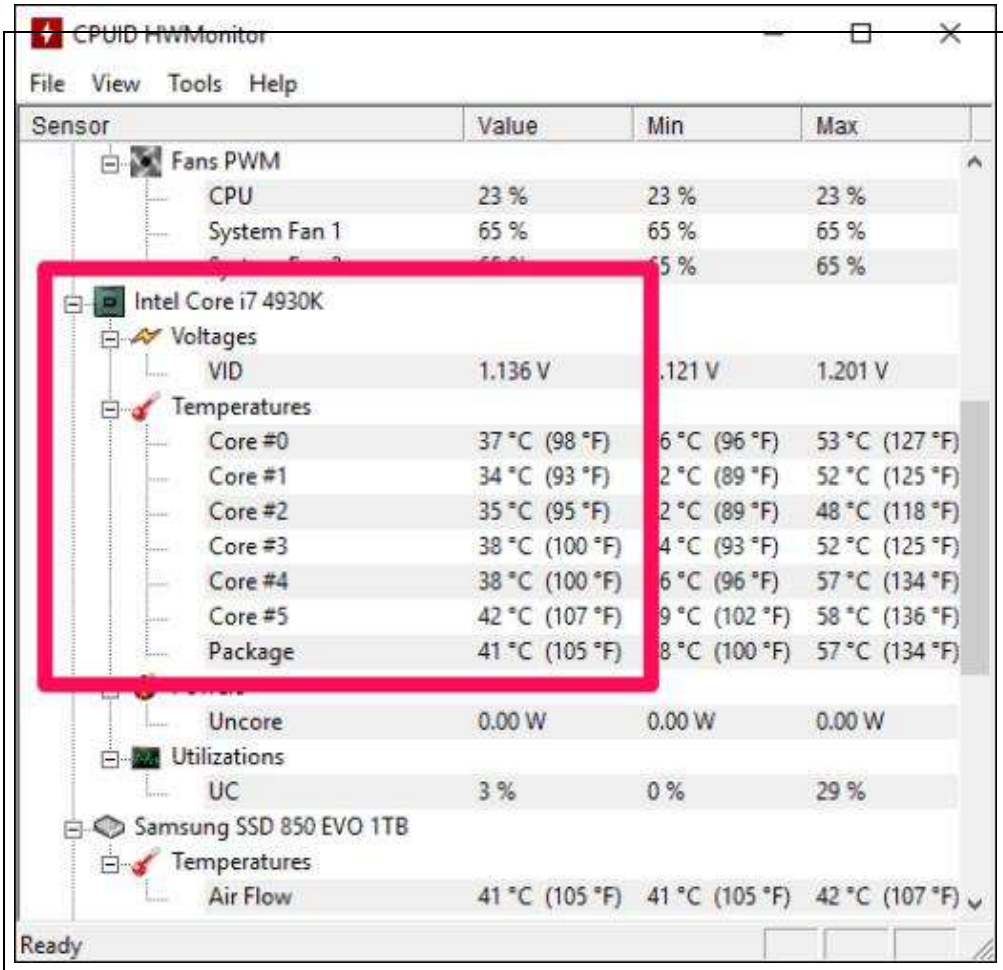
Theory
The **processor (CPU)** is the brain of the computer responsible for executing instructions and controlling all operations. CPU-related issues can significantly impact system performance, stability, and functionality. Common causes of CPU problems include:
- Overheating
- Improper installation
- Insufficient cooling
- Power issues
- Physical damage or manufacturing defects

Working Principle
1. The CPU executes instructions fetched from memory.
2. It performs arithmetic and logical operations.
3. Heat is generated during processing, managed by heat sink and fan.
4. If CPU temperature exceeds safe limits, the system may throttle performance or shut down to prevent damage.

Relevant Image


CPU Cooler Base Plate
Thermal Paste
CPU





□ Procedure

1. Switch off and unplug the system.
2. Open CPU cabinet.
3. Inspect CPU area:
   - Check heat sink and fan condition
   - Verify proper mounting
4. Clean dust from fan and heat sink.
5. Apply thermal paste if required.
6. Reassemble and start system.
7. Use monitoring tools to check:
   - CPU temperature
   - CPU usage
8. Identify symptoms and diagnose the problem.

Observation Table

Problem	Possible Cause	Resolution
System overheating	Faulty fan / dried thermal paste	Replace fan / apply new thermal paste
System shutdown suddenly	CPU overheating	Improve cooling system
Slow performance	High CPU usage / background processes	End tasks / optimize software
No boot	Improper CPU installation	Reinstall CPU correctly
System hangs/freezes	CPU overload / overheating	Check cooling / reduce load
Abnormal noise	Faulty CPU fan	Replace fan

✓ Conclusion

This experiment helped in identifying processor-related problems along with their causes and solutions. Proper CPU maintenance and monitoring are essential for system performance, stability, and longevity.

? Experiment 8: List the Steps to Perform Booting Process

Objective
To understand and list the step-by-step process of booting in a computer system.

Hardware and Software Requirements
Hardware:
- Desktop / Laptop Computer

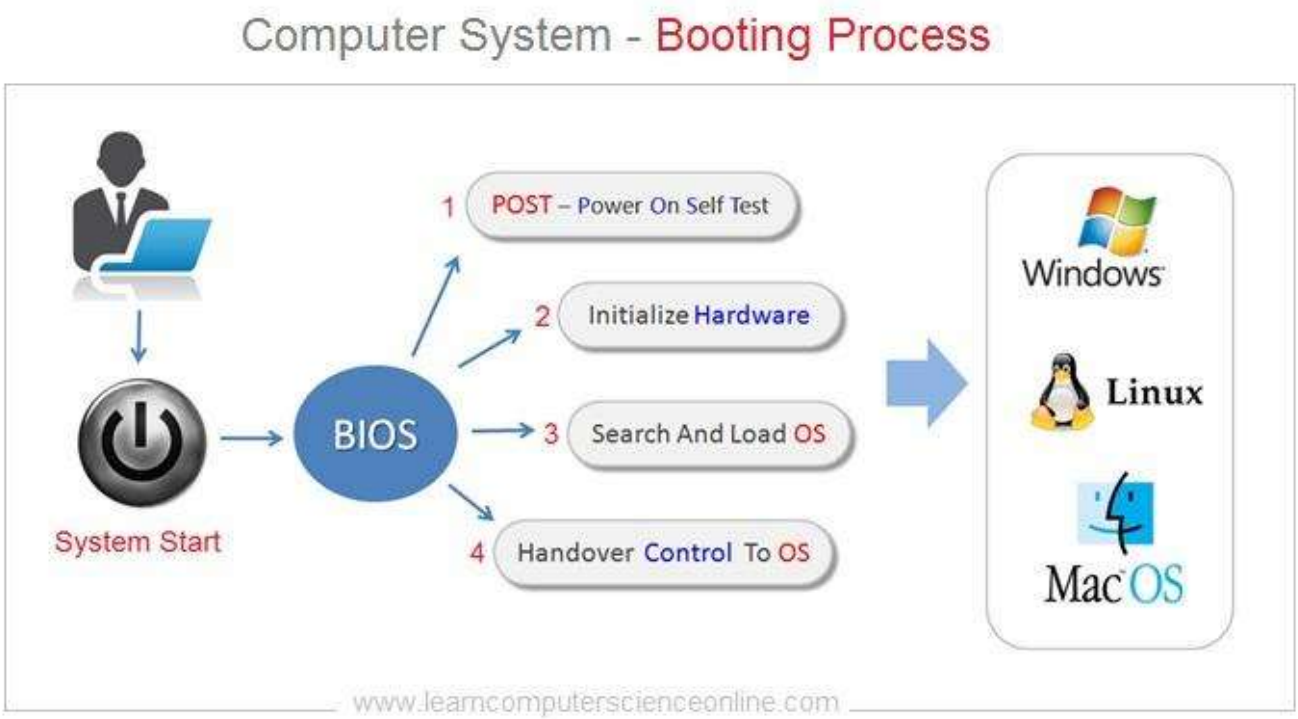
Software:
- Operating System (e.g., Windows 10 / Ubuntu)
- BIOS/UEFI Firmware

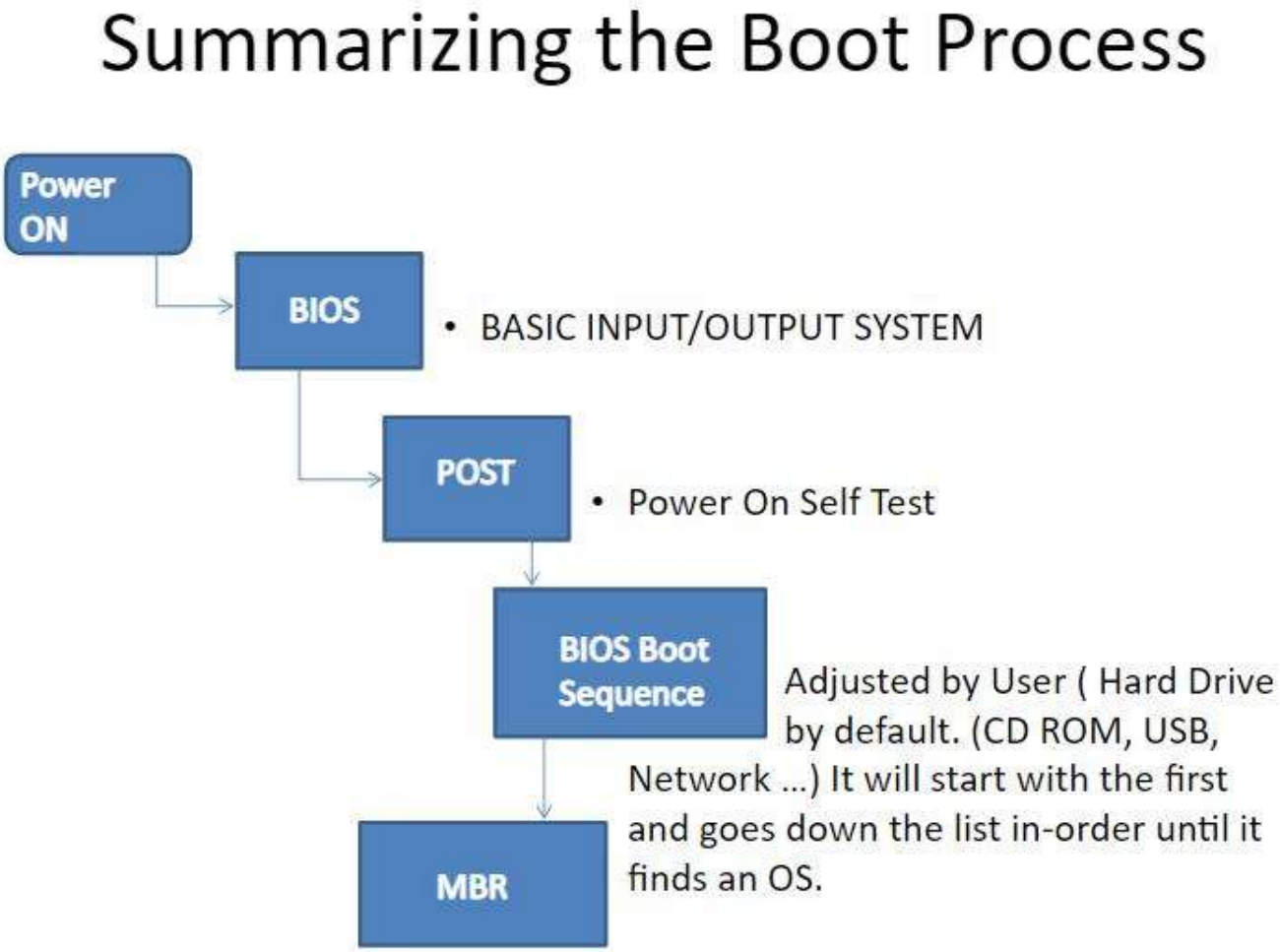
Theory
Booting is the process of starting a computer and loading the operating system into memory. It initializes hardware and prepares the system for use.

◆ Types of Booting
1. **Cold Booting (Hard Boot):**
   Starting the computer from a powered-off state
2. **Warm Booting (Soft Boot):**
   Restarting the computer without turning off power

⚙ Working Principle (Booting Process Steps)
1. **Power ON**
   User presses the power button
2. **POST (Power-On Self Test)**
   BIOS checks hardware components (RAM, CPU, keyboard, etc.)
3. **BIOS/UEFI Initialization**
   Firmware loads basic system settings
4. **Boot Device Selection**
   System searches for bootable device (HDD/SSD/USB)
5. **Boot Loader Execution**
   Boot loader (e.g., Windows Boot Manager / GRUB) loads
6. **Operating System Loading**
   OS kernel is loaded into RAM
7. **System Initialization**
   Drivers and services start
8. **User Login Screen**
   System becomes ready for user interaction

🖼 Image





□ Procedure

1. Switch on the computer system.
2. Observe the initial screen (manufacturer logo / BIOS screen).
3. Note POST messages or beep sounds.

4. Observe OS loading screen.
5. Wait for login screen.
6. Restart system to observe warm boot.
7. Record each step of the booting process.

📊 Observation Table

Step No.	Booting Stage	Observation
1	Power ON	System starts
2	POST	Hardware checking
3	BIOS/UEFI	System initialization
4	Boot Loader	OS loading begins
5	OS Loading	OS screen appears
6	Login Screen	System ready for use

✅ Conclusion

This experiment explained the complete booting process of a computer system. Understanding boot stages helps in diagnosing startup problems and improving system troubleshooting skills.

🧪 Experiment 9: Identify BIOS Error Messages, Beep Codes, Causes, and Resolution

---

🎯 Objective

To identify common BIOS-related error messages and beep codes, understand their causes, and apply appropriate troubleshooting techniques.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop Computer with motherboard speaker (buzzer)
- RAM, CPU, SMPS

Software:

- BIOS/UEFI Firmware
- Operating System (e.g., Windows 10 / Ubuntu)

📘 Theory

The **BIOS (Basic Input/Output System)** is firmware stored on the motherboard that initializes hardware during the boot process.
If any hardware fault occurs during startup, BIOS generates:

- **Error messages (on screen)**
- **Beep codes (audio signals)**

These signals help in diagnosing hardware issues even before the OS loads.

◆ Common BIOS Error Messages

- "CMOS Checksum Error"
- "Keyboard Not Detected"
- "No Boot Device Found"
- "Memory Error"

◆ Beep Codes Concept

- Short/long beeps indicate different faults
- Patterns vary by BIOS manufacturer (AMI, Award, Phoenix)
- Useful when display is not working

⚙️ Working Principle

1. When the system starts, BIOS performs **POST (Power-On Self Test)**.
2. It checks CPU, RAM, keyboard, and other hardware.
3. If an error is found:
    - Displays message OR
    - Produces beep code
4. User interprets error and performs corrective action.

🖼 Image

"AMI (American Megatrends International) BIOS Beep Codes."

BEEP CODE	MEANING	POSSIBLE CAUSE
1 Beep (No video)	Memory refresh failure	Bad memory
2 Beeps	Memory parity error	Bad memory
3 Beeps	Base 64K mem failure	Bad memory
4 Beeps	Timer not operational	Bad motherboard
5 Beeps	Processor error	Bad processor
6 Beeps	8042 Gate A20 failure	Bad CPU or Motherboard
7 Beeps	Processor exception	Bad processor
8 Beeps	Video memory error	Bad video card or memory
9 Beeps	ROM checksum error	Bad BIOS
10 Beeps	CMOS checksum error	Bad motherboard
11 Beeps	Cache memory bad	Bad CPU or motherboard

"Award BIOS Beep Codes"

BEEP CODE	MEANING	POSSIBLE CAUSE
1 Long, 2 Short	Video adapter failure	Bad video adapter
Repeating (Endless loop)	Memory error	Bad memory or bad connection
1 Long, 3 Short	Video adapter failure	Bad video adapter or memory
High freq. beeps (while running)	CPU is overheating	CPU fan failure
Repeating High, Low beeps	CPU failure	Bad processor

"Phoenix BIOS Beep Codes"

BEEP CODE	MEANING	POSSIBLE CAUSE
1 - 1 - 2	CPU / motherboard failure	Bad CPU / motherboard
1 - 1 - 3	CMOS read/write failure	Bad motherboard
1 - 1 - 4	BIOS ROM failure	Bad BIOS chip
1 - 2 - 1	Timer failure	Bad motherboard
1 - 2 - 2	DMA failure	Bad motherboard
1 - 2 - 3	DMA failure	Bad motherboard
1 - 3 - 1	Memory refresh failure	Bad memory
1 - 3 - 2	64K memory failure	Bad memory
1 - 3 - 3	64K memory failure	Bad memory
1 - 3 - 4	64K memory failure	Bad memory
1 - 4 - 1	Address line failure	Bad memory
1 - 4 - 2	Parity error	Bad memory
1 - 4 - 3	Timer failure	Bad motherboard
1 - 4 - 4	NMI port failure	Bad motherboard
2 - 1 - 1	64K memory failure	Bad memory
2 - 1 - 2	64K memory failure	Bad memory
2 - 1 - 3	64K memory failure	Bad memory
2 - 1 - 4	64K memory failure	Bad memory
2 - 2 - 1	64K memory failure	Bad memory
2 - 2 - 2	64K memory failure	Bad memory
2 - 2 - 3	64K memory failure	Bad memory
2 - 2 - 4	64K memory failure	Bad memory
2 - 3 - 1	64K memory failure	Bad memory

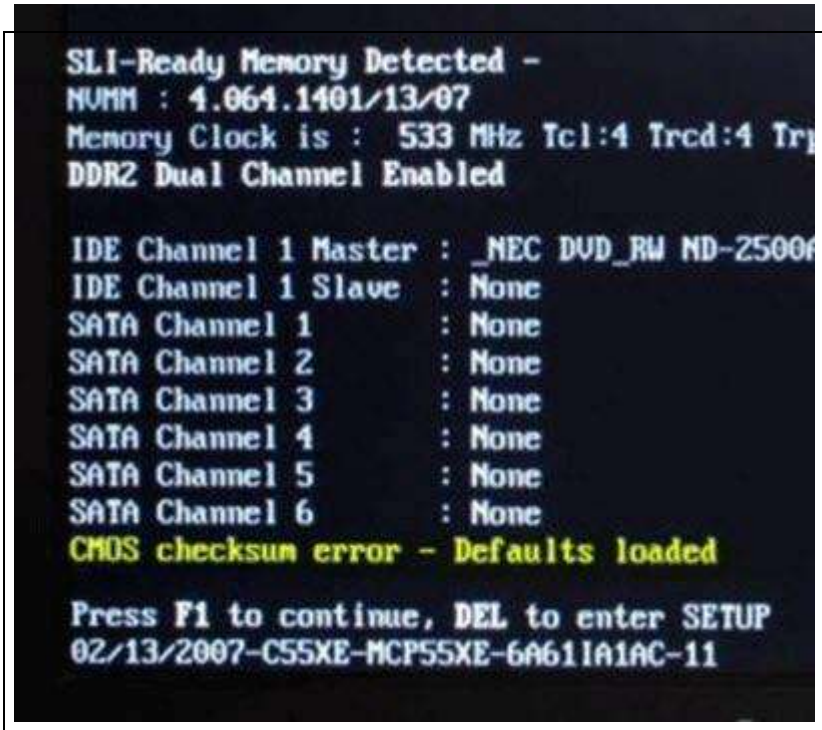


Table A-1.
Beep/Power LED Codes

Beeps	Power LED	Probable Cause
None	Blinks red 2 times @ 1 Hz	Processor thermal shut down. Check air flow, fan operation, and CPU heat sink
None	Blinks red 3 times @ 1 Hz	Processor not installed. Install or reseat CPU.
None	Blinks red 4 times @ 1 Hz	Power failure (power supply is overloaded). Check voltage selector (if applicable), stroage devices, expansion cards and/or system board.
5 beeps	Blinks red 5 times @ 1 Hz	Pre-video memory error. Incompatible or incorrectly seated DIMM.
6 beeps	Blinks red 6 times @ 1 Hz	Pre-video graphics error. On system with integrated graphics, check/replace system board. On system with graphics card, check/replace graphics card.
7 beeps	Blinks red 7 times @ 1 Hz	PCA failure. Check/replace system board.
8 beeps	Blinks red 8 times @ 1 Hz	Invalid ROM (checksum error). Reflash ROM using CD or replace system board.
9 beeps	Blinks red 9 times @ 1 Hz	System powers on but fails to boot. Check power supply, CPU, system board.
None	Blinks red 10 times @ 1 Hz	Bad option card.

□ Procedure

1. Switch on the computer system.
2. Observe POST process.
3. Listen carefully for beep sounds.
4. Note any error messages displayed on screen.

5. Compare beep patterns with BIOS manual/chart.
6. Identify faulty component.
7. Apply corrective measures.

📊 Observation Table

Error/Beep Code	Possible Cause	Resolution
No beep, no display	Power supply/motherboard fault	Check SMPS / motherboard
Continuous beeps	RAM issue	Reseat/replace RAM
1 long, 2 short beeps	Graphics card problem	Check/replace GPU
CMOS checksum error	Battery failure	Replace CMOS battery
Keyboard error	Keyboard not connected	Reconnect/replace keyboard
No boot device	Missing OS / disk issue	Check HDD/SSD / reinstall OS

✅ Conclusion

This experiment demonstrated how BIOS error messages and beep codes help in early fault detection. Understanding these signals allows quick identification and resolution of hardware issues before the operating system loads.

🧪 Experiment 10: Identification of Memory-Related Problems, Causes, and Resolution

---

🎯 Objective

To identify common memory (RAM)-related problems, analyze their possible causes, and apply suitable troubleshooting and resolution techniques.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop / Laptop Computer
- RAM Modules (DDR3/DDR4/DDR5)
- Motherboard

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Diagnostic Tools:
  - Windows Memory Diagnostic
  - MemTest86

📘 Theory

Memory (RAM – Random Access Memory) is a primary storage device used to temporarily store data and instructions required by the CPU during execution.

RAM is volatile in nature, meaning data is lost when power is turned off. Faults in memory can cause system instability, crashes, or failure to boot.

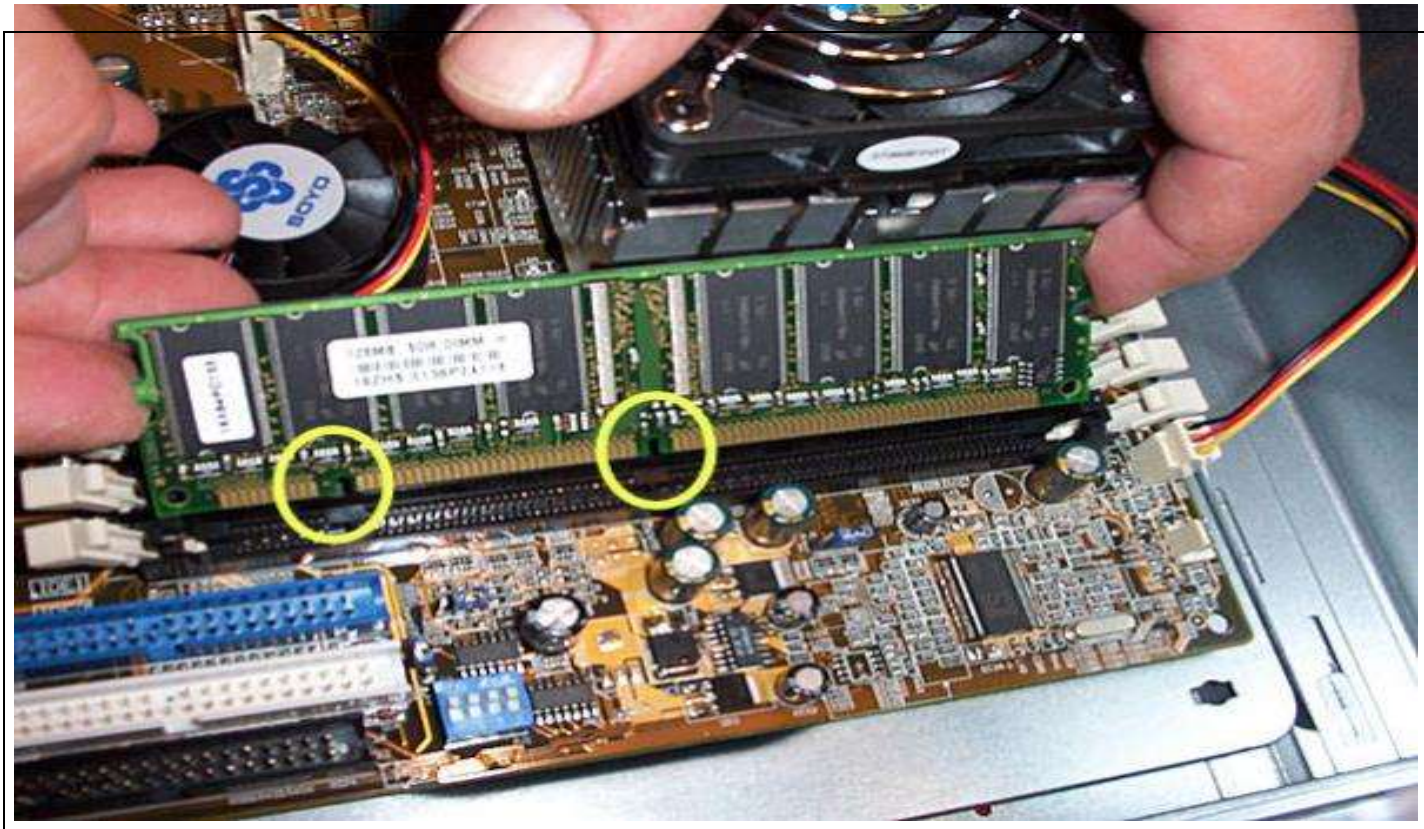
🔹 Common Memory Problems

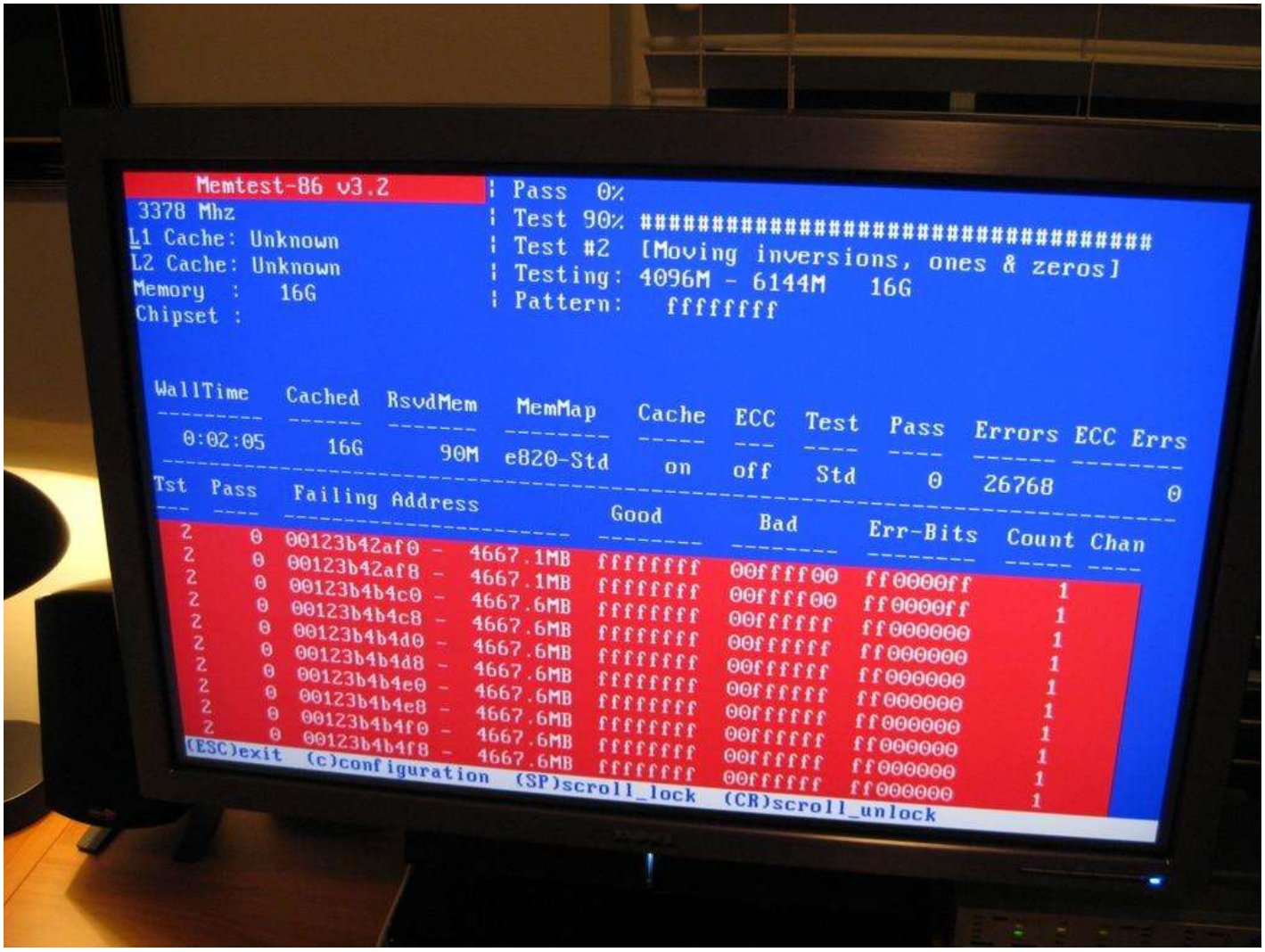
- System not booting
- Frequent system crashes / Blue Screen
- Slow performance
- Beep codes during startup
- Applications freezing

⚙️ Working Principle

1. RAM stores temporary data required by CPU.
2. CPU continuously reads/writes data from RAM.
3. Faulty RAM causes incorrect data access → system errors.
4. Diagnostic tools test memory by writing and reading data patterns to detect errors.

🖼️ Image





□ Procedure

1. Switch off and unplug the system.
2. Open CPU cabinet.

3. Remove RAM module carefully.
4. Clean RAM contacts using a soft cloth/eraser.
5. Reinsert RAM properly into slot.
6. Start system and observe behavior.
7. Run memory diagnostic tools:
    - `mdsched.exe` (Windows Memory Diagnostic)
    - MemTest86
8. Record errors and analyze results.

📊 Observation Table

Problem	Possible Cause	Resolution
No boot / continuous beep	RAM not properly inserted	Reseat RAM properly
System crash (BSOD)	Faulty RAM	Replace RAM
Slow performance	Insufficient RAM	Upgrade RAM
Random restart	Memory errors	Run diagnostic and replace RAM
System hangs	RAM overheating/damage	Improve cooling / replace RAM

✅ Conclusion

This experiment helped in identifying memory-related problems and their solutions. Proper handling, cleaning, and testing of RAM ensure system stability and performance.

🖥️ Experiment 11: Identification of Display Device–Related Problems, Causes, and Resolution

---

🎯 Objective

To identify common display device (monitor/GPU) problems, analyze their causes, and apply appropriate troubleshooting and resolution techniques.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop / Laptop Computer
- Monitor (LED/LCD)
- VGA/HDMI/DisplayPort cable
- Graphics Card (if available)

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Diagnostic Tools:
  - Device Manager
  - Display Settings

📘 Theory

A **display device (monitor)** is an output device used to visually present information from the computer. Display issues can arise from monitor faults, cable problems, graphics card issues, or software misconfiguration.

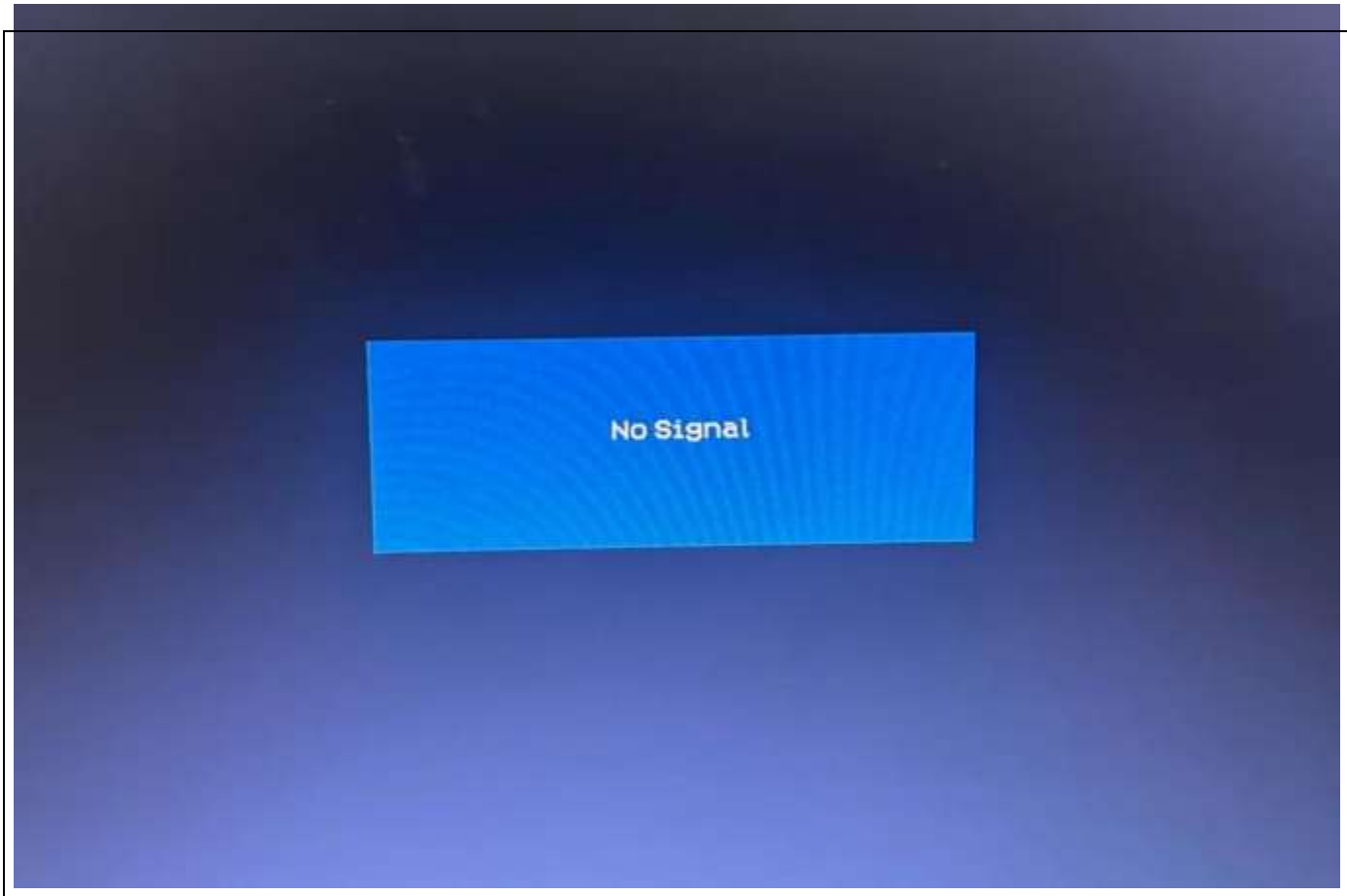
◆ Common Display Problems

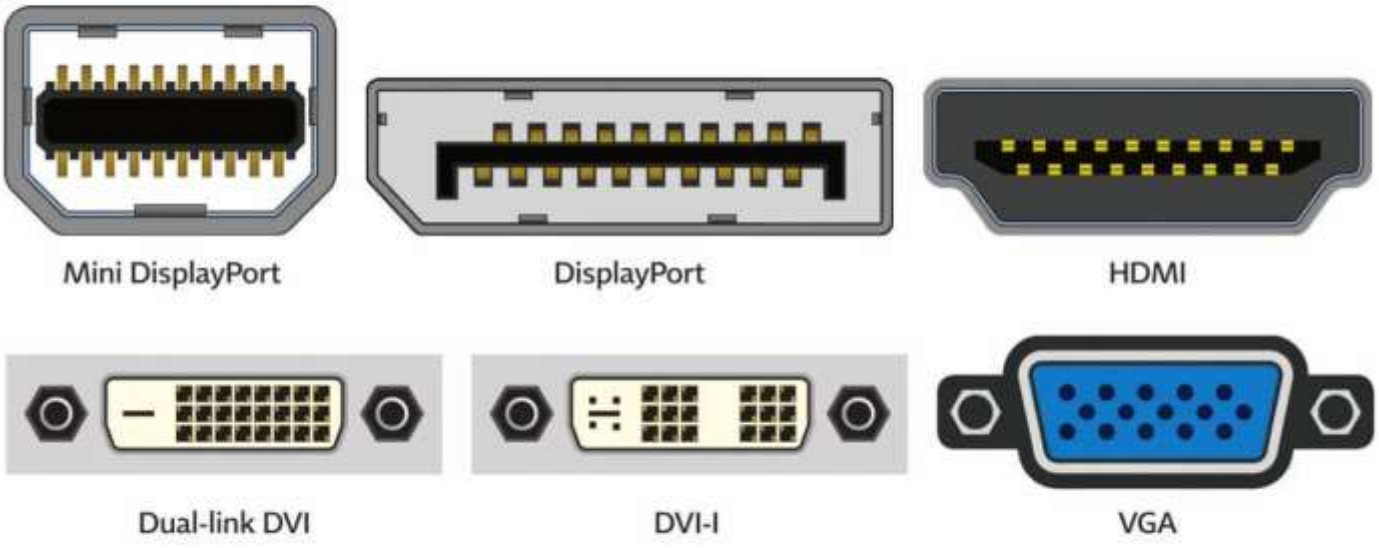
- No display / blank screen
- Flickering screen
- Distorted or blurred display
- Incorrect resolution
- “No Signal” message
- Screen freezing

⚙️ Working Principle

1. The CPU/GPU processes graphical data.
2. The graphics signal is transmitted via cable (HDMI/VGA/DP).
3. The monitor receives and displays the signal.
4. Any interruption in this chain (GPU → Cable → Monitor → Driver) causes display issues.

🖼️ Image





□ Procedure

1. Switch on the computer system.
2. Check monitor power (LED indicator).
3. Verify cable connections (HDMI/VGA/DP).
4. Restart system and observe display behavior.
5. Open **Display Settings** and adjust resolution.
6. Check **Device Manager** for display driver issues.
7. If needed:
    - Reconnect or replace cable

- Reseat graphics card
- Test with another monitor

📊 Observation Table

Problem	Possible Cause	Resolution
No display	Loose cable / faulty monitor	Check connections / replace monitor
“No Signal” message	Cable/GPU issue	Reconnect cable / check GPU
Flickering screen	Loose cable / refresh rate issue	Fix cable / adjust refresh rate
Distorted display	Graphics driver problem	Update/reinstall drivers
Wrong resolution	Incorrect settings	Adjust display settings
Screen freezing	GPU overheating/fault	Clean GPU / improve cooling

---

✅ Conclusion

This experiment helped in identifying display-related problems and their solutions. Proper diagnosis of monitor, cable, and GPU ensures effective troubleshooting and optimal display performance.

🧪 Experiment 12: Disk Formatting, Logical Drive Creation, and Device Driver Installation

---

🎯 Objective

To learn the process of disk formatting, creating logical disk drives (partitions), and installing device drivers in a computer system.

🖥️ Hardware and Software Requirements

Hardware:

- Desktop / Laptop Computer
- Hard Disk Drive (HDD) / Solid State Drive (SSD)

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Disk Management Tool
- Device Drivers (Graphics, Audio, Network)

📘 Theory

◆ 1. Disk Formatting

Disk formatting is the process of preparing a storage device for use by creating a file system such as NTFS, FAT32, or EXT4.

◆ 2. Logical Disk Drive (Partition)

A physical disk can be divided into multiple logical sections called partitions (C:, D:, etc.), allowing better data organization and management.

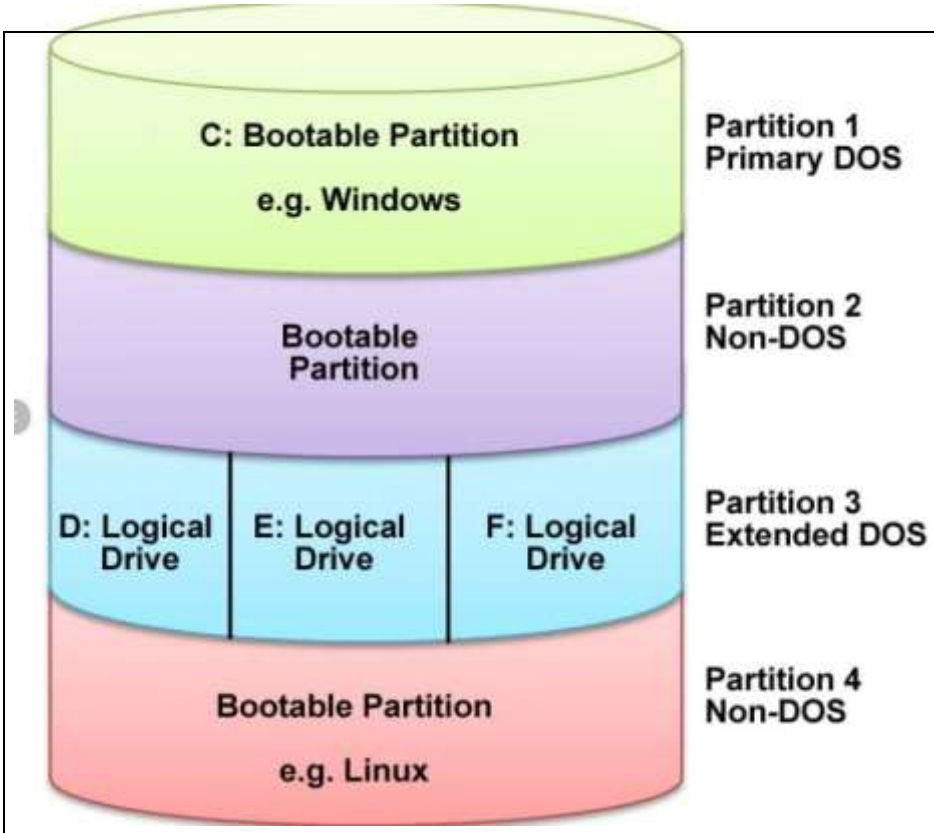
◆ 3. Device Driver

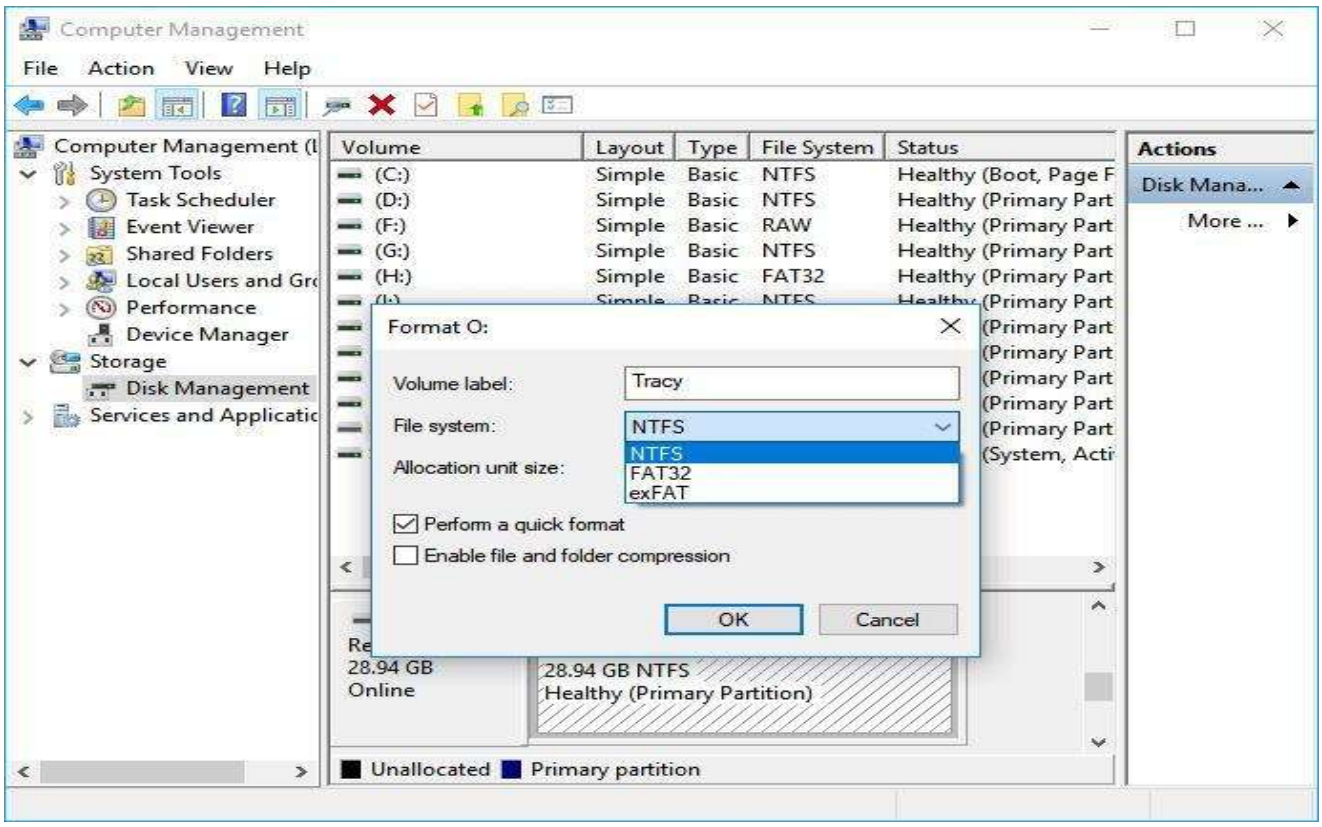
A device driver is software that allows the operating system to communicate with hardware devices (printer, graphics card, network adapter).

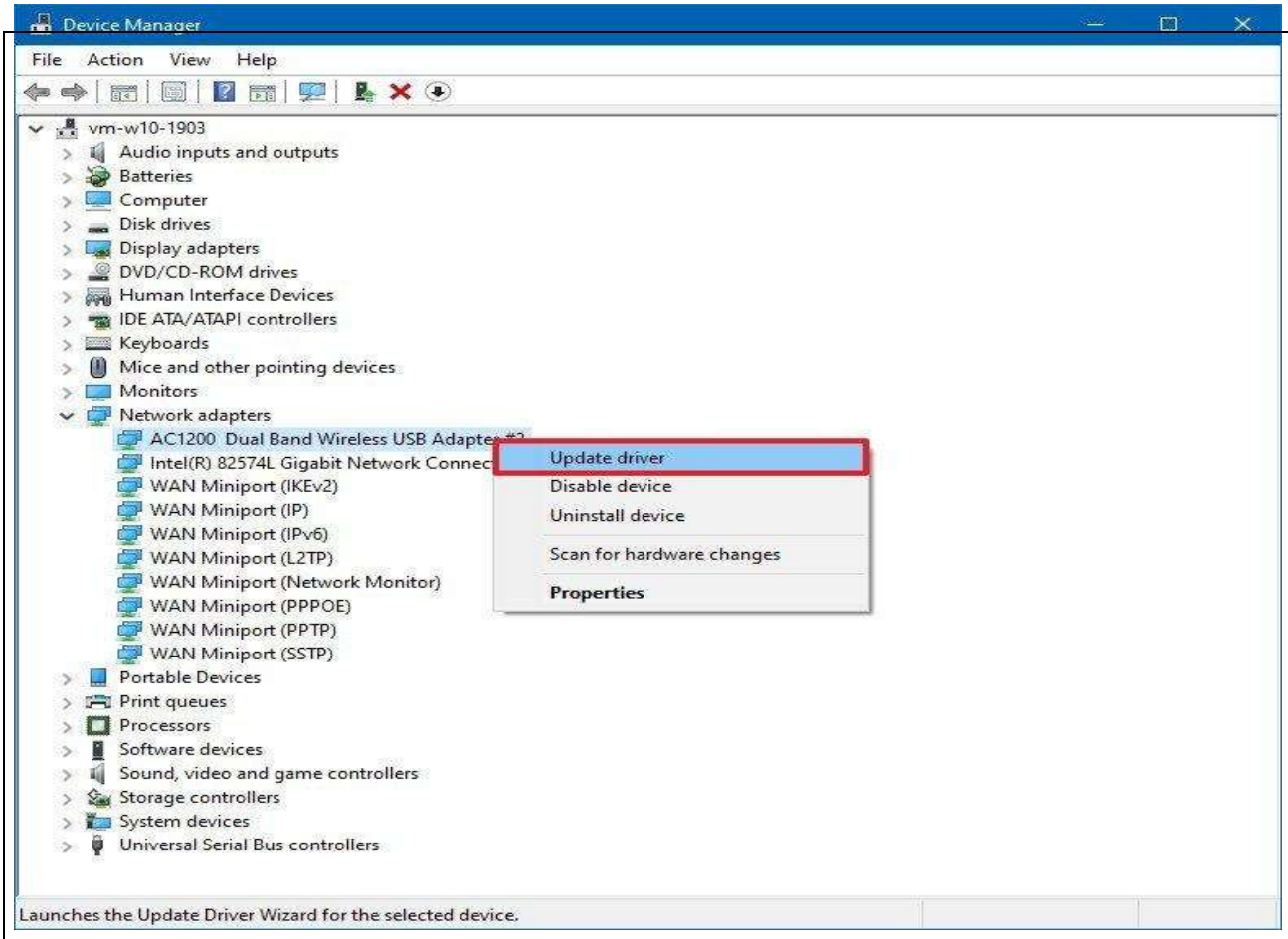
⚙️ Working Principle

1. **Disk Formatting:**
    - Creates file system structure
    - Removes old data and prepares disk for storage
2. **Partitioning:**
    - Divides disk into logical drives
    - Each partition acts as a separate storage unit
3. **Driver Installation:**
    - OS detects hardware
    - Driver enables communication between OS and hardware

🖼️ Image


C: Bootable Partition
e.g. Windows
Partition 1
Primary DOS
Bootable
Partition
Partition 2
Non-DOS
D: Logical
Drive
E: Logical
Drive
F: Logical
Drive
Partition 3
Extended DOS
Bootable Partition
e.g. Linux
Partition 4
Non-DOS


Computer Management
File Action View Help
Computer Management (l
System Tools
Task Scheduler
Event Viewer
Shared Folders
Local Users and Gr
Performance
Device Manager
Storage
Disk Management
Services and Applicatic
Volume Layout Type File System Status
(C:) Simple Basic NTFS Healthy (Boot, Page F
(D:) Simple Basic NTFS Healthy (Primary Part
(F:) Simple Basic RAW Healthy (Primary Part
(G:) Simple Basic NTFS Healthy (Primary Part
(H:) Simple Basic FAT32 Healthy (Primary Part
Actions
Disk Mana...
More ...
Format O:
Volume label: Tracy
File system: NTFS
NTFS
FAT32
exFAT
Allocation unit size:
Perform a quick format
Enable file and folder compression
OK
Cancel
28.94 GB
Online
28.94 GB NTFS
Healthy (Primary Partition)
Unallocated
Primary partition



□ Procedure

Part A: Disk Formatting & Partition Creation

1. Right-click **This PC → Manage → Disk Management**
2. Select unallocated space
3. Right-click → **New Simple Volume**
4. Specify size of partition
5. Assign drive letter (C:, D:, etc.)
6. Choose file system (NTFS/FAT32)
7. Click **Format** and complete process

Part B: Device Driver Installation

1. Open **Device Manager**
2. Identify devices with warning symbol (⚠)
3. Right-click → **Update Driver**
4. Choose:
    - Automatic search OR
    - Manual installation (from driver file)
5. Install driver and restart system

Observation Table

Task Performed	Result/Observation
Disk Formatting	Disk prepared with file system
Partition Creation	Logical drives (C:, D:) created
Driver Installation	Hardware working properly
Driver Update	Improved device performance

✓ Conclusion

This experiment demonstrated how to format disks, create logical partitions, and install device drivers. These processes are essential for system setup, storage management, and proper hardware functioning.

🧪 Experiment 13: Dismantle and Assemble Different Storage Devices

🎯 Objective
To learn how to safely dismantle and assemble different storage devices such as HDD and SSD, and understand their internal structure and connections.

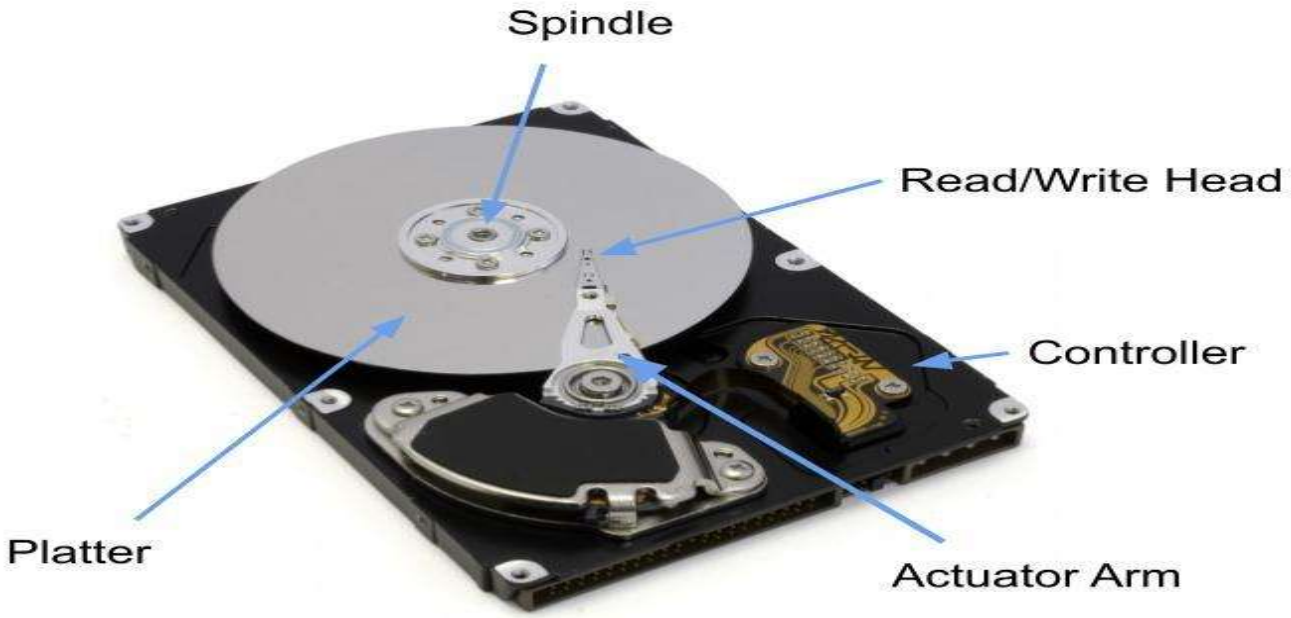
🖥️ Hardware and Software Requirements
Hardware:
- Desktop Computer / CPU Cabinet
- Hard Disk Drive (HDD)
- Solid State Drive (SSD)
- Screwdriver kit
- SATA cables and power cables

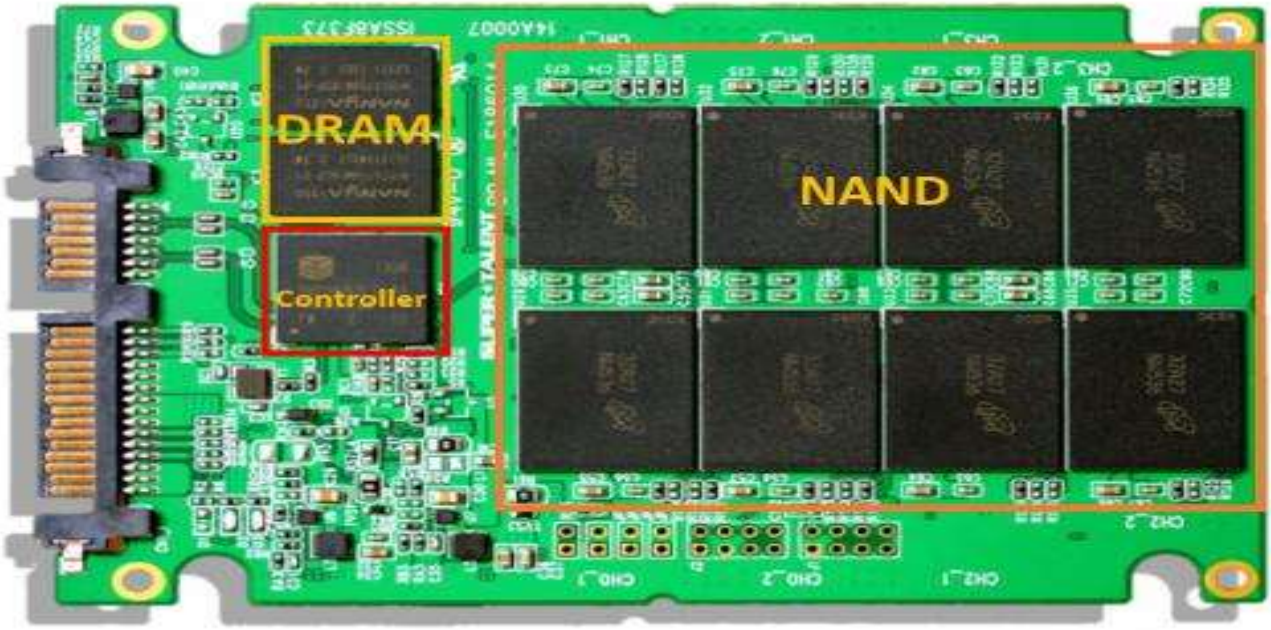
Software:
- Operating System (e.g., Windows 10 / Ubuntu)

📘 Theory
Storage devices are used to **store data permanently** in a computer system.

◆ Types of Storage Devices
1. **Hard Disk Drive (HDD)**
   - Mechanical device with rotating platters
   - Uses magnetic storage
2. **Solid State Drive (SSD)**
   - Electronic device with no moving parts
   - Uses flash memory (faster and more reliable)

⚙️ Working Principle
- **HDD:**
  Data is stored magnetically on rotating disks (platters) and accessed by a read/write head.
- **SSD:**
  Data is stored in flash memory chips and accessed electronically, resulting in faster performance.

🖼️ Image




□ Procedure

Part A: Dismantling

1. Switch off and unplug the computer.
2. Open CPU cabinet.
3. Locate storage device (HDD/SSD).
4. Disconnect:
    - SATA data cable
    - Power cable
5. Unscrew and remove the storage device carefully.

Part B: Assembling

1. Place HDD/SSD in the drive bay.
2. Fix with screws securely.
3. Connect:
    - SATA data cable to motherboard
    - Power cable from SMPS
4. Close cabinet.
5. Switch on system and verify detection in BIOS/OS.

📊 Observation Table

Device Type	Action Performed	Result/Observation
HDD	Removed/Installed	Detected / Not detected
SSD	Removed/Installed	Faster boot / Proper detection
SATA Cable	Connected	Data transfer established

⚠ Precautions

- Do not touch internal circuits with bare hands
- Handle devices carefully (avoid shock/static)
- Ensure proper cable connections
- Do not open HDD casing (may damage platters)

✅ Conclusion

This experiment provided hands-on experience in dismantling and assembling storage devices. Understanding installation and connection of HDD/SSD is essential for system upgrading, maintenance, and troubleshooting.

Experiment 14: Identify Fault, Output Voltages, Cable Color Codes, and Connectors in SMPS

Objective
To study the SMPS (Switched Mode Power Supply), identify faults, measure output voltages, understand cable color codes, and recognize different connectors.

Hardware and Software Requirements
Hardware:
- Desktop Computer SMPS
- Multimeter (Digital/Analog)
- Motherboard
- Connecting cables

Software:
- Operating System (e.g., Windows 10 / Ubuntu) *(for system verification)*

Theory
The **SMPS (Switched Mode Power Supply)** converts AC power into regulated DC voltages required by computer components.

Main Functions of SMPS
- Converts AC → DC
- Supplies multiple voltage levels (+12V, +5V, +3.3V)
- Protects system from voltage fluctuations

Common Output Voltages
Voltage	Purpose
+12V	CPU, GPU, Motors (fans, HDD)
+5V	Logic circuits, USB
+3.3V	Motherboard, RAM
-12V	Serial communication

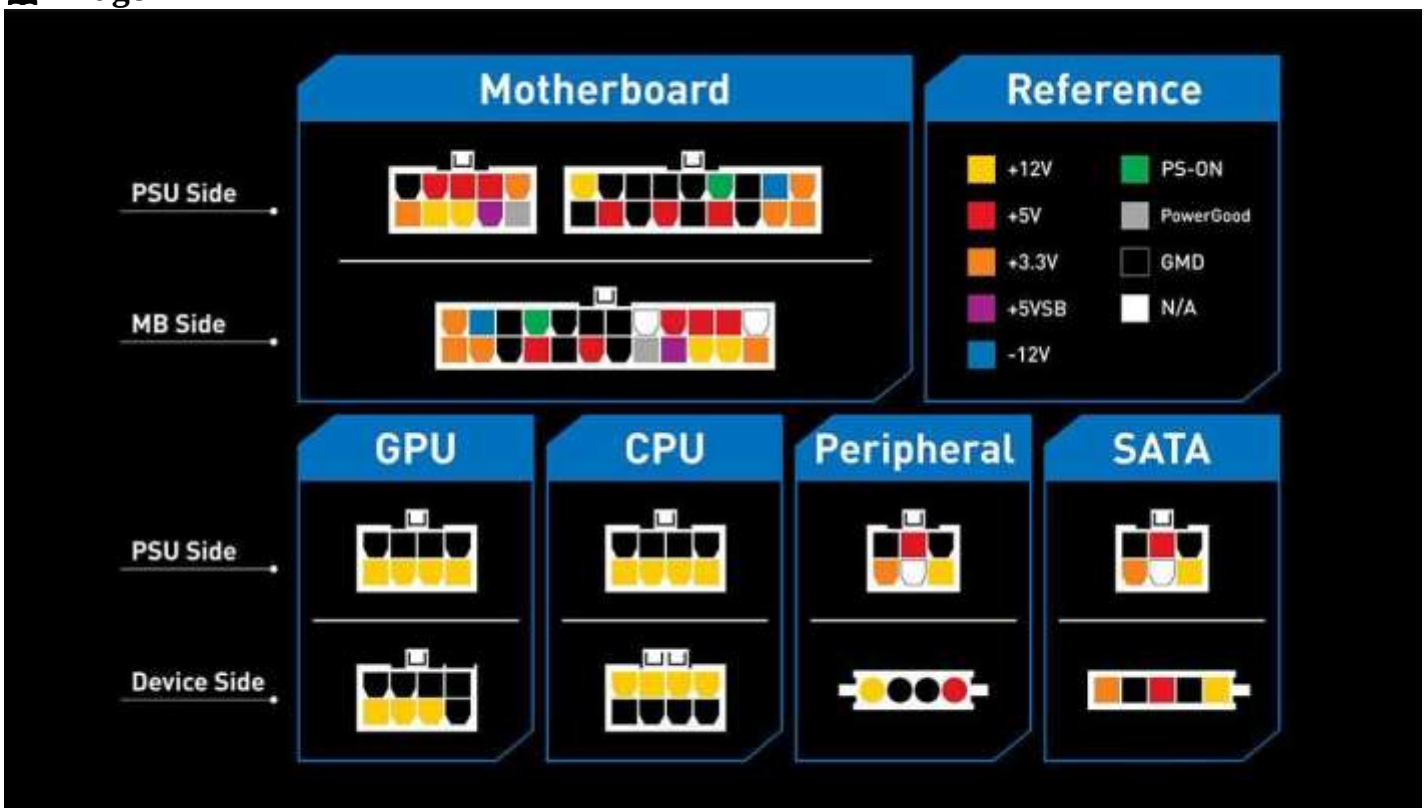
Cable Color Codes
Color	Voltage
Yellow	+12V
Red	+5V
Orange	+3.3V
Black	Ground
Blue	-12V
Green	Power ON
Purple	+5V Standby

Common Connectors
- 24-pin ATX connector (motherboard)
- 4/8-pin CPU connector
- SATA power connector (HDD/SSD)
- Molex connector (older devices)

Working Principle
1. AC input is rectified and converted into DC.
2. High-frequency switching regulates voltage output.
3. Transformer adjusts voltage levels.

4. Output is filtered and supplied to components.
5. Feedback circuit maintains stable voltage.

🖼 Image



□ Procedure

1. Switch off and unplug the system.
2. Open CPU cabinet and locate SMPS.
3. Identify different connectors (24-pin, SATA, CPU).
4. Use multimeter to measure output voltages:
    - Connect black probe to ground (black wire)
    - Measure voltage on colored wires
5. Note voltage readings.
6. Check for faults:
    - No power

- Fluctuating voltage
- Burning smell or noise

7. Record observations.

📊 Observation Table

Wire Color	Expected Voltage	Measured Voltage	Status
Yellow	+12V	_____	OK/Fault
Red	+5V	_____	OK/Fault
Orange	+3.3V	_____	OK/Fault
Black	Ground	0V	OK

⚠ Precautions

- Always switch off power before handling
- Use insulated tools
- Avoid touching live circuits
- Ensure proper grounding

✅ Conclusion

This experiment provided knowledge of SMPS operation, voltage outputs, cable color codes, and connectors. It also helped in identifying power-related faults, which is critical for system troubleshooting and maintenance.

□ Experiment 15: Perform Remote Desktop Access & Control and VoIP

🎯 Objective

To learn how to access and control a remote computer using remote desktop tools and understand the working of VoIP (Voice over Internet Protocol).

□ Hardware and Software Requirements

Hardware:

- Two Computers (Client & Remote System)
- Internet Connection
- Headset with microphone

Software:

- Operating System (e.g., Windows 10 / Ubuntu)
- Remote Access Tools:
  - Remote Desktop Connection
  - TeamViewer
- VoIP Applications:
  - Skype
  - Zoom

📘 Theory

◆ 1. Remote Desktop Access

Remote desktop allows a user to **access and control another computer over a network or the internet** as if physically present.

Uses:

- Remote troubleshooting
- System administration
- Remote work

◆ 2. VoIP (Voice over Internet Protocol)

VoIP is a technology that allows **voice communication over the internet** instead of traditional telephone lines.
Examples: Skype, Zoom

⚙ Working Principle

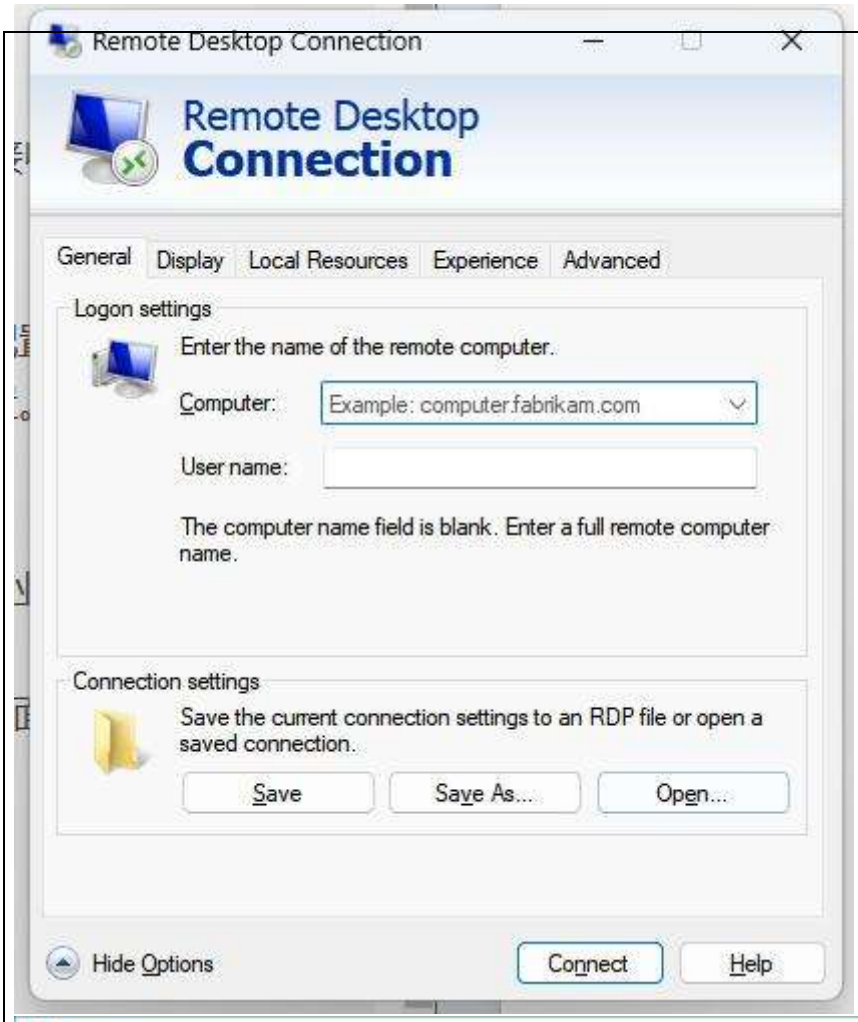
◆ Remote Desktop

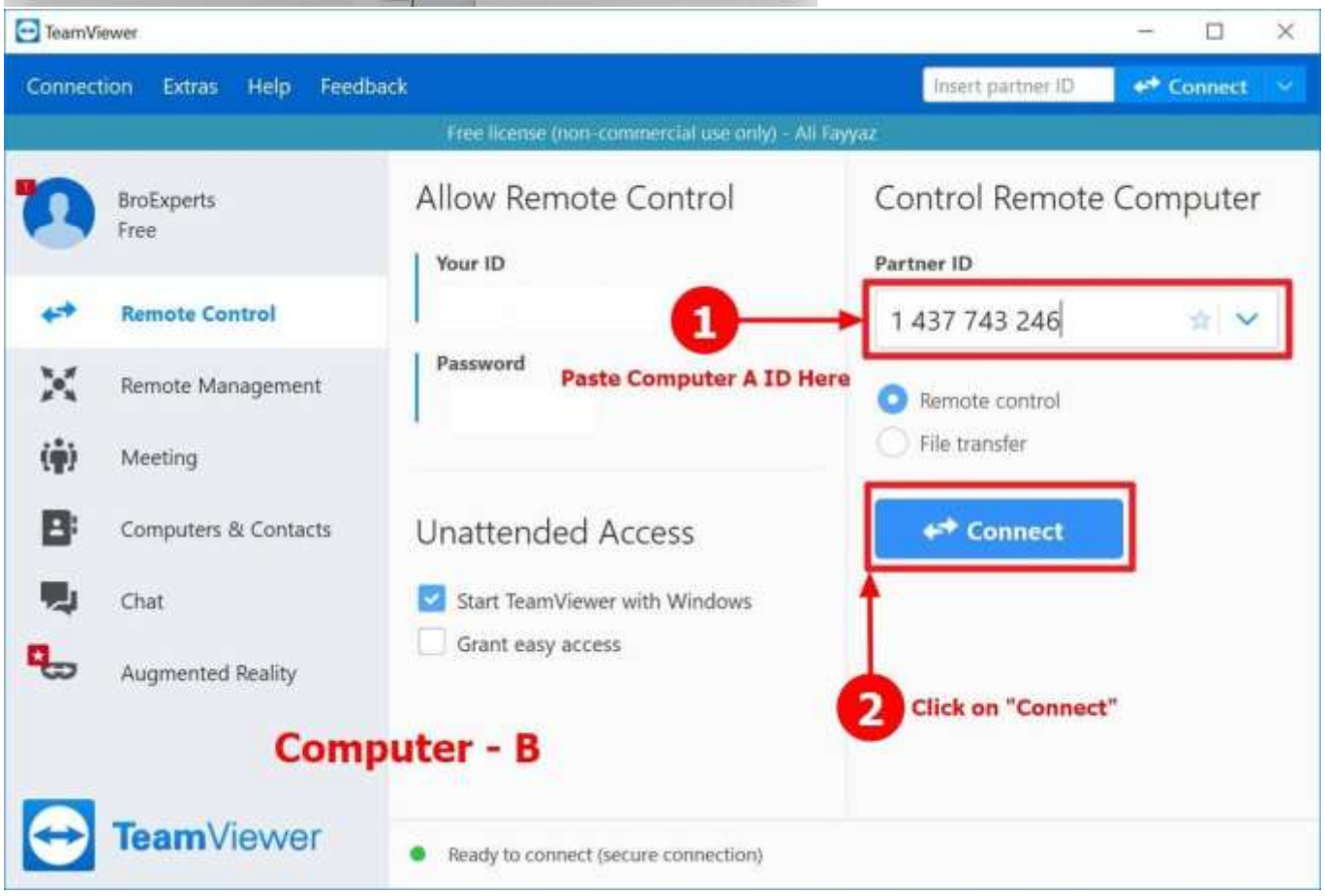
1. Remote system enables remote access service
2. Client enters IP address or ID
3. Secure connection is established
4. User controls remote system (keyboard/mouse)

◆ VoIP

1. Voice is converted into digital packets
2. Data is transmitted over the internet
3. Packets are reassembled at receiver
4. Converted back to audio

🖼 Image





□ Procedure

Part A: Remote Desktop Access

1. Enable Remote Desktop on remote computer
2. Note IP address / ID
3. Open Remote Desktop Connection / TeamViewer
4. Enter remote system credentials
5. Establish connection
6. Control remote system and perform basic tasks

Part B: VoIP Communication

1. Install VoIP application (Skype/Zoom)
2. Create/login to account
3. Add contact or join meeting
4. Start voice/video call
5. Test microphone and speaker

📊 Observation Table

Activity	Result/Observation
Remote connection	Successfully connected
Remote control	Able to access files/apps
VoIP call	Voice/video communication works
Network performance	Delay/lag observed (if any)

✅ Conclusion

This experiment demonstrated how remote desktop access enables system control over networks and how VoIP facilitates communication via the internet. These technologies are essential for modern IT infrastructure, remote support, and online collaboration.