

Module 5: Troubleshooting & Maintenance (Classes 15–20)

Module Duration: 12 Hours (6 Classes × 2 Hours)

Required Equipment: Desktop Computer, Laptop, Screwdriver Set, Anti-static Wrist Strap (ESD), Thermal Paste, Cleaning Brush, Compressed Air Can, Isopropyl Alcohol (90%+), Microfiber Cloth, USB Flash Drive, Windows 10/11 Installation Media, External Hard Drive

Software & Utilities: Windows 10/11, Device Manager, Event Viewer, Task Manager, Resource Monitor, Windows Security, CrystalDiskInfo, MemTest86, HWMonitor, CPU-Z, Rufus, Windows Backup and Restore

Module Learning Objectives

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

- Diagnose common hardware and software problems.
 - Interpret POST messages and BIOS beep codes.
 - Troubleshoot startup and boot failures.
 - Resolve Blue Screen of Death (BSOD) and system performance issues.
 - Detect and remove viruses and malware.
 - Perform backup and recovery operations.
 - Upgrade and maintain laptop hardware.
 - Apply preventive maintenance techniques to improve system reliability and lifespan.
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Class 15 (2 Hours)

Startup Troubleshooting & Hardware Diagnostics

Learning Outcomes

After completing this class, students will be able to:

- Explain the Power-On Self-Test (POST) process.

- Identify common boot errors.
 - Interpret BIOS beep codes.
 - Perform basic hardware diagnostics.
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15.1 POST (Power-On Self-Test)

POST is a diagnostic process performed by the BIOS/UEFI when the computer is powered on. It checks whether essential hardware is functioning correctly before loading the operating system.

POST Checks

- CPU
- RAM
- Graphics Adapter
- Keyboard
- Storage Devices
- BIOS/UEFI
- CMOS Settings

POST Sequence

1. Power On
 2. BIOS/UEFI Starts
 3. Hardware Check
 4. Detect Boot Device
 5. Load Operating System
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15.2 Common Boot Errors

Examples include:

- No Bootable Device Found
- Operating System Not Found
- Disk Boot Failure
- Missing Boot Manager
- Boot Device Not Detected
- Invalid System Disk

Possible Causes

- Incorrect Boot Order

- Damaged Boot Files
 - Loose SATA/NVMe Connection
 - Failed Hard Drive or SSD
 - Corrupted Operating System
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15.3 BIOS Beep Codes

When hardware fails during POST, the BIOS may generate beep codes. The exact meaning depends on the BIOS manufacturer (AMI, Award, Phoenix).

Common examples:

Beep Pattern	Possible Problem
1 Short Beep	POST Successful
Continuous Beeps	RAM Error
1 Long, 2 Short	Graphics Card Error
Continuous Long Beeps	Memory Not Detected
No Beep	Power Supply, Motherboard, or CPU Issue

15.4 Hardware Diagnostics

Diagnostic tools include:

- Device Manager
- BIOS Hardware Monitor
- Windows Memory Diagnostic
- MemTest86
- CrystalDiskInfo
- SMART Status
- HWMonitor
- CPU-Z

Troubleshooting Procedure

1. Check power supply.
2. Verify cable connections.
3. Test RAM modules.
4. Check storage devices.
5. Verify CPU cooling.
6. Review BIOS settings.

Practical Exercise

Students will:

- Identify startup problems.
- Interpret BIOS beep codes.
- Check BIOS hardware information.
- Diagnose a computer that fails to boot.

Assignment

Prepare a troubleshooting flowchart for startup and boot problems.

Class 16 (2 Hours)

Performance Troubleshooting & Optimization

Learning Outcomes

Students will be able to:

- Diagnose Blue Screen (BSOD) errors.
- Improve computer performance.
- Identify overheating issues.
- Optimize Windows for better speed.

16.1 Blue Screen of Death (BSOD)

A BSOD occurs when Windows encounters a critical system error and must stop to prevent damage.

Common Causes

- Faulty RAM
 - Driver Issues
 - Corrupted System Files
 - Hard Disk Failure
 - Overheating
 - Hardware Incompatibility
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16.2 Slow Computer

Common Causes

- Too Many Startup Programs
 - Low RAM
 - Full Storage Drive
 - Malware Infection
 - Outdated Drivers
 - Background Applications
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16.3 Performance Optimization

Methods include:

- Disable unnecessary startup applications.
 - Uninstall unused software.
 - Update Windows and drivers.
 - Free disk space.
 - Upgrade RAM.
 - Replace HDD with SSD.
 - Scan for malware.
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16.4 Overheating

Causes

- Dust accumulation
- Failed cooling fan
- Dried thermal paste
- Poor airflow
- High CPU workload

Symptoms

- Random shutdowns
 - System freezing
 - Loud fan noise
 - Performance throttling
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16.5 Monitoring System Health

Useful software:

- Task Manager
 - Resource Monitor
 - HWMonitor
 - CPU-Z
 - CrystalDiskInfo
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Practical Exercise

Students will:

- Monitor CPU temperature.
 - Identify high CPU and memory usage.
 - Disable unnecessary startup programs.
 - Improve system performance.
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Assignment

Prepare a report comparing system performance before and after optimization.

Class 17 (2 Hours)

Virus, Malware & System Security

Learning Outcomes

Students will be able to:

- Identify different types of malware.
 - Use antivirus software effectively.
 - Protect Windows systems.
 - Secure user data.
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17.1 What is Malware?

Malware is malicious software designed to damage systems or steal information.

Types of Malware

- Virus
 - Worm
 - Trojan Horse
 - Spyware
 - Adware
 - Ransomware
 - Rootkit
 - Keylogger
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17.2 Antivirus Software

Functions

- Real-time Protection
- Virus Scanning
- Threat Detection
- Quarantine
- Automatic Updates

Examples

- Microsoft Defender
- Avast
- Bitdefender
- ESET
- Kaspersky

17.3 Windows Security

Features include:

- Virus & Threat Protection
- Firewall
- Device Security
- App & Browser Control
- Family Options

17.4 Data Protection

Best Practices

- Strong Passwords
- Multi-Factor Authentication (MFA)
- Regular Updates
- Backup Important Data
- Avoid Unknown Downloads
- Use Licensed Software

17.5 Safe Internet Practices

- Verify website authenticity.
- Avoid suspicious email attachments.
- Download software from trusted sources.
- Use HTTPS websites.
- Keep browsers updated.

Practical Exercise

Students will:

- Run a full antivirus scan.
- Update antivirus definitions.
- Remove detected threats.

- Enable Windows Security features.
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Assignment

Research one type of malware and explain how it spreads and how to prevent it.

Class 18 (2 Hours)

Backup & Recovery

Learning Outcomes

Students will be able to:

- Create backups.
 - Restore files and folders.
 - Use System Restore.
 - Create a recovery drive.
 - Understand disk imaging.
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18.1 Importance of Backup

Reasons for backup:

- Hardware Failure
 - Virus Attack
 - Accidental Deletion
 - Natural Disaster
 - System Corruption
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18.2 Backup Methods

- Full Backup
- Incremental Backup

- Differential Backup
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18.3 Windows Backup

Windows provides tools to:

- Backup Files
 - Backup System Image
 - Restore Files
 - Schedule Automatic Backups
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18.4 System Restore

System Restore returns Windows settings to an earlier restore point without affecting personal files.

Uses

- Driver Problems
 - Software Installation Issues
 - System Instability
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18.5 Recovery Drive

A Recovery Drive allows Windows repair if the operating system cannot boot.

18.6 Disk Imaging

A disk image is an exact copy of a storage device.

Common software:

- Macrium Reflect
- Clonezilla
- Acronis True Image

Practical Exercise

Students will:

- Create a restore point.
- Backup personal files.
- Create a recovery drive.
- Restore files from backup.

Assignment

Prepare a backup plan for a small office with five computers.

Class 19 (2 Hours)

Laptop Hardware & Upgrades

Learning Outcomes

Students will be able to:

- Identify laptop components.
- Safely disassemble a laptop.
- Replace common laptop parts.
- Upgrade RAM and SSD.

19.1 Laptop Hardware Components

- Motherboard
- CPU
- RAM
- SSD/HDD
- Battery
- Keyboard

- Touchpad
 - Cooling Fan
 - Display Panel
 - Wireless Card
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19.2 Laptop Disassembly

Safety Steps

1. Shut down the laptop.
 2. Disconnect the charger.
 3. Remove the battery (if removable).
 4. Wear an ESD wrist strap.
 5. Organize screws carefully.
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19.3 Keyboard Replacement

Steps

- Remove the keyboard bezel.
 - Disconnect the ribbon cable.
 - Install the replacement keyboard.
 - Test functionality.
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19.4 Battery Replacement

- Remove the old battery.
 - Install the new battery.
 - Verify charging and battery health.
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19.5 RAM Upgrade

Benefits

- Improved multitasking
- Faster application performance

- Better overall responsiveness
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19.6 SSD Upgrade

Advantages

- Faster boot times
 - Faster application loading
 - Improved system responsiveness
 - Lower power consumption
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Practical Exercise

Students will:

- Open a laptop safely.
 - Identify internal components.
 - Upgrade RAM or SSD.
 - Test the upgraded system.
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Assignment

Prepare a comparison between desktop and laptop hardware components.

Class 20 (2 Hours)

Preventive Maintenance

Learning Outcomes

Students will be able to:

- Perform preventive maintenance.
- Clean computer components safely.

- Replace thermal paste.
 - Improve cooling efficiency.
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20.1 Preventive Maintenance

Preventive maintenance helps reduce hardware failures and extends the life of computer systems.

Benefits

- Better Performance
 - Lower Temperature
 - Increased Reliability
 - Longer Hardware Lifespan
 - Reduced Repair Costs
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20.2 Cleaning Computer Components

Components to clean:

- CPU Cooler
- Case Fans
- Graphics Card
- Power Supply Air Vents
- Motherboard
- RAM Contacts
- Keyboard
- Monitor

Cleaning Tools

- Compressed Air
 - Soft Brush
 - Microfiber Cloth
 - Isopropyl Alcohol
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20.3 Dust Removal

Dust can:

- Block airflow
 - Increase temperatures
 - Cause fan noise
 - Reduce performance
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20.4 Thermal Paste Replacement

Thermal paste should be replaced when:

- CPU temperatures remain unusually high.
- The CPU cooler has been removed.
- The existing thermal paste has dried out.

Replacement Steps

1. Remove the CPU cooler.
 2. Clean old thermal paste with isopropyl alcohol.
 3. Apply a pea-sized amount of new thermal paste.
 4. Reinstall the CPU cooler.
 5. Monitor CPU temperatures after installation.
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20.5 Maintenance Schedule

Task	Frequency
Dust Cleaning	Every 3–6 Months
Antivirus Scan	Weekly
Windows Update	Monthly
Driver Updates	As Needed
Backup Important Data	Weekly
Check Storage Health	Monthly
Replace Thermal Paste	Every 2–3 Years (or as required)

Practical Exercise

Students will:

- Clean a desktop computer safely.
- Remove dust from fans and air vents.

- Replace thermal paste on the CPU.
 - Reassemble the computer.
 - Verify cooling performance after maintenance.
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Module Project

Students will complete a **Complete Computer Troubleshooting & Maintenance Project**, which includes:

- Diagnosing POST and boot errors.
 - Resolving BSOD and performance issues.
 - Detecting and removing malware.
 - Creating backups and restoring files.
 - Upgrading laptop RAM or SSD.
 - Performing complete preventive maintenance.
 - Verifying system stability after repairs.
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Module Assessment

Assessment	Marks
Troubleshooting & Maintenance Quiz	10
Practical Exercises	20
Assignments	20
Comprehensive Troubleshooting & Maintenance Project	40
Viva & Practical Demonstration	10
Total	100

Module Learning Outcomes

After completing **Module 5: Troubleshooting & Maintenance**, students will be able to:

- Diagnose startup failures using POST messages, BIOS beep codes, and hardware diagnostic tools.
- Resolve common operating system issues, including BSODs, slow performance, and overheating.
- Detect, remove, and prevent viruses and malware using antivirus software and Windows Security.

- Create and restore backups using Windows Backup, System Restore, recovery drives, and disk imaging tools.
- Safely disassemble laptops, replace keyboards and batteries, and upgrade RAM and SSD storage.
- Perform preventive maintenance, including cleaning components, removing dust, replacing thermal paste, and monitoring system health.
- Apply systematic troubleshooting techniques to maintain reliable and high-performing computer systems in home, office, and educational environments.