

HARDWARE WORKSHOP

COURSE CODE: BCA106

YEAR/SEMESTER: I/I

TOTAL CREDIT: 1

PRACTICAL HOURS: 2 HRS. PER WEEK

Course Description:

This course provides a hands-on foundation in computer hardware, electronics, and networking through practical exploration of system components and real-world troubleshooting. Students will learn to identify and test electronic components, assemble and disassemble desktops and laptops, and configure both wired and wireless networks. The training emphasizes diagnostic methods using tools like Multimeters, POST cards, and cable testers to resolve hardware and connectivity issues. Additionally, learners will gain experience in preventive maintenance and system upgrades, including RAM, storage, PSU, and BIOS configurations. The course concludes with a comprehensive practical assessment, equipping students with the skills needed for IT support and hardware technician roles.

Course objectives:

- To understand basic components of computer hardware and networking.
- To learn to assemble, disassemble, and troubleshoot both hardware and network setups.
- To gain hands-on experience in configuring and testing basic networks.
- To develop diagnostic and maintenance skills for common IT issues.
- To build foundational skills required for careers in IT support,
- To gain system administration role and network troubleshooting.

Course Outcomes:

1. Identify and describe the functions of key hardware and network components.
2. Assemble and configure basic PCs and networks.
3. Diagnose and troubleshoot common hardware and network problems.
4. Perform maintenance and apply preventive measures for IT systems.

Syllabus Breakdown:

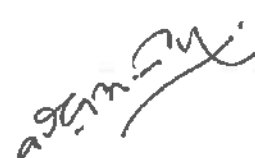
1. Introduction to Hardware (Electronic Components) -

5hr

1.1.Introduction to Electronics & Safety

- Lab safety demo, basic electronics kit introduction

1.2.Passive Components: Resistors, Capacitors, Inductors



- Identify by color code & markings, using multimeter

1.3.Active Components: Diodes, LEDs, Transistors, ICs

- Orientation, pinouts, forward/reverse bias testing
- MOSFET (NPN & PNP logic gate)

1.4.Connectors, Switches, Relays, Buzzers, Crystals

- Identification, test switching/buzzing circuits

1.5.Reading Datasheets and Packaging Types

- DIP, SMD, TO-92, TO-220, etc.

1.6.Testing and Troubleshooting Components

- Faulty vs working component tests, use of ESR meter
- Mini Project or Component Identification Test

Tools & Equipment Needed

- Digital Multimeter (DMM)
- Analog/Digital Component Tester
- Breadboards and jumper wires
- Assorted electronic component kits
- Datasheets and charts

2. Introduction of Networking components

2hrs

2.1.Overview of Network Devices

- Identify modem, NIC, router, switch, hub, access point

2.2.Cabling & Connectors

- Crimp RJ45, identify CAT5/6, Coaxial, Fiber-optic, Rollover, Ethernet crossover, Straight Through cable

2.3.Testing and troubleshooting Common physical Issues

- Simulate network faults, replace cables/devices
- Cable tester

Tools & Equipment Needed

- Wireless Router, Ethernet Switch, Hub
- RJ45 cables (CAT5/6), Crimping Tools
- LAN Tester, Multimeter
- Access Points, Extenders



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- e) PCs or Laptops for testing
 - f) Console cables (for Cisco/basic CLI config)
3. Desktop and Laptop Hardware Identification and Handling 6hrs
- 3.1. Introduction to PC Hardware
- Identify components: Case, motherboard, CPU, RAM, ROM, PSU
 - Demonstration different types of Case, motherboard, RAM (SD, DDR, DDR1234), ROM (PROM, EPROM, EEPROM), PSU.
 - Identify components front-panel and back-panel
- 3.2. Preparing the Workbench & Safety
- ESD safety, tool handling, workspace preparation
- 3.3. System Unit Components
- Motherboard, CPU, southbridge, Northbridge, RAM, Power Supply, BIOS/UEFI- Internal Buses and Slots
 - Identify components in a system- Label and describe functions
- 3.4. Storage Devices
- HDD, SSD, Optical Drives- Comparison and Interfaces (PATA, SATA, SSD, NVMe)
 - Remove & reinstall a drive- Show real vs fake SSD
- 3.5. Input/Output Devices
- Keyboard, Mouse, Monitor, Printer, Scanner
 - Connect and test devices- Discuss port types (USB, HDMI, etc.)
- 3.6. Understanding, role and Testing the Power Supply Unit (PSU)
- 3.6.1 PSU Overview (ATX, Modular, SMPS)
- Show different PSU models and internal parts
- 3.6.2 PSU Connectors and Their Purposes
- Hands-on with 24-pin, 4+4 CPU, SATA, PCIe
- 3.6.3 Voltage Standards (3.3V, 5V, 12V rails)
- Explain color-coded wires and voltages
- 3.6.4 Testing PSU with Multimeter
- Measure voltages at different outputs (live demo)
- 3.6.5 Common PSU Failures
- Show burnt connectors, fan failure, no power scenario

3.6.6 Safety Tips for Handling PSUs

- Do's and Don'ts (e.g., discharge capacitors)

4. PC and Laptop Assembly

6hrs

- Safety precautions- Step-by-step assembly of a PC
- Group hands-on assembly task- Boot to BIOS

4.1. Installing Motherboard, CPU, and RAM

- Mount motherboard, RAM, Install CPU, apply thermal paste

4.2. Connecting PSU, Storage, and Cables

- Connect SATA, power cables, front panel ports

4.3. BIOS/UEFI Configuration & POST Checks

- Access BIOS, set boot order, set password, run POST tests

4.4. Troubleshooting Basics

- POST, Beep Codes- Common errors and solutions
- Use diagnostic tools (multimeter, POST card)- Simulate hardware errors

4.5. Installing Operating System (Optional)

- Boot from USB/DVD, install Windows/Linux
- BIOS updates, driver updates, disk cleanup, antivirus scan
- Virtual/real printer installation
- Smart and Useful commands of OS
- Cross-Platform Useful Commands

4.6. Troubleshooting & Diagnostics

- Simulate no boot, no power, display error, beep codes
- Simulate boot failure, no power, overheating, connectivity issues

4.7. Final Practical Assessment

- Complete PC build, POST, and viva questions

Tools & Equipment Required:

- a) ATX-compatible PC components (CPU, RAM, PSU, Motherboard, Storage, Case)
- b) ESD wrist straps, screwdrivers, thermal paste
- c) Monitor, keyboard, mouse, USB OS boot media
- d) Diagnostic cards, multimeter, BIOS reset jumpers



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- e) ATX Power Supply (working and faulty units)
- f) Desktop and Laptop Motherboard (for demo)
- g) PSU Tester and Multimeter
- h) Dummy Load or Old PC for testing
- i) Screwdrivers and safety gear

5. Basic Network Device and Deployment

2hrs

5.1. Identification of Different Network devices. (Modem, NIC, Hub, Switch, Router, AP)

- Configure topology
- Configure crossover/ straight through cable with devices

5.2. Sharing

- Printer Technologies
- Install, Configure, and Maintain Printers
- File/Folder

6. Basic Networking Configuration

2hrs

6.1. IP Addressing, Subnetting

- IP class, Subnet Mask, Gateway, DNS

6.2. Router & Switch Configuration

- Configure IP address, test connectivity, console setup

6.3. Wireless Access Points (AP) & Extenders

- Setup SSID, password, MAC filtering, signal test

6.4. Network Design and Topologies

- Build and test star, bus topologies using real devices

6.5. Testing & Diagnostics

- Use ping, tracert, ipconfig, netstat, arp, nslookup, route, netsh etc.
- cable testers

6.6. Troubleshooting Common Issues

- Simulate network faults, replace cables/devices
- Mini LAN/WLAN setup task with demo and viva

7. Problem Solving Techniques

2hrs

- 7.1. Start with visual inspection: loose cables, damaged ports.
- 7.2. Use elimination method: test one part at a time.
- 7.3. Check for BIOS/UEFI messages and beep codes.
- 7.4. Use ping, ipconfig/ifconfig, and network tester tools for network issues.
- 7.5. Maintain a troubleshooting log for repeated issues.
- 7.6. Follow a systematic approach: Identify → Test → Isolate → Fix → Verify.

8. Maintenance & Upgrade

5hrs

8.1. Hardware Upgrade Tips

8.1.1 Upgrade Planning & Compatibility Checks

- Check motherboard compatibility for CPU, RAM, and GPUs.
- Verify laptop upgrade limitations (RAM max, NVMe slots, etc.).
- Use manufacturer's documentation & tools like (CPU-Z, Speccy, Crucial System Scanner)

8.1.2 Memory (RAM) Upgrades

- Match speed, voltage, and form factor (SO-DIMM for laptops, DIMM for desktops).
- Dual-channel RAM installation for performance boost.
- BIOS/UEFI settings for recognizing upgraded RAM.

8.1.3 Storage Upgrades

- Compare SSD vs HDD vs NVMe (speeds, durability, boot time).
- Use cloning tools for OS/data migration.
- Align partitions properly for SSDs.

8.1.4 Graphics Card (GPU) Upgrade (Desktop)

- Check PSU wattage and physical space inside the case.
- Verify PCIe slots and cooling requirements.
- Install latest drivers after upgrade.

8.1.5 CPU Upgrade Tips (Desktop)

- Check socket type, chipset support, and BIOS compatibility.
- Apply thermal paste correctly and test with stress tools (Prime95, AIDA64).

8.2. Preventive Maintenance Tips

8.2.1 Cleaning Internal Components

- Use compressed air, soft brushes, and isopropyl alcohol.
- Clean fans, heat sinks, and power supplies every 6 months.
- For laptops, carefully clean vents and fans without damaging small connectors.

8.2.2 Thermal Paste Replacement (Advanced Task)

- Remove old thermal paste from CPU/GPU using alcohol.
- Apply a small pea-sized drop of thermal paste before mounting cooler.
- Monitor temperatures post-application using HWMonitor or CoreTemp.

8.2.3 Battery Care for Laptops

- Avoid overcharging or deep discharges frequently.
- Calibrate battery every 3-6 months (full charge and discharge cycle).
- Replace swollen or degraded batteries immediately.

8.2.4 BIOS/UEFI & Firmware Updates

- Update only if needed (security patch, hardware support).
- Follow manufacturer instructions strictly to avoid “bricking” the system.
- Backup settings before flashing BIOS.

8.2.5 Cable Management & Airflow Optimization

- Route cables away from fans and components to improve airflow.
- Use cable ties, Velcro straps, or case grommets.
- Keep air intakes and exhausts free from obstructions.

8.2.6 Health Monitoring & Diagnostics

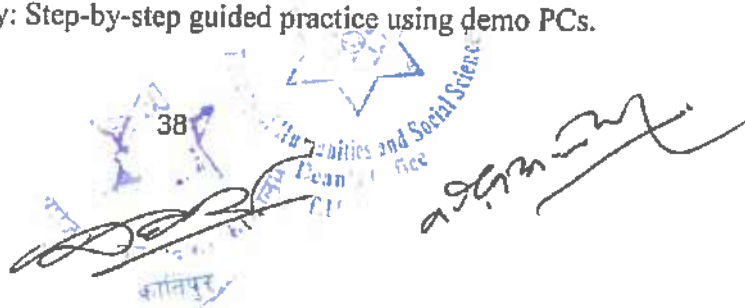
- Regularly check SMART status of drives.
- Run memory diagnostics every few months (MemTest86+).
- Monitor CPU/GPU temperatures under normal and load conditions

9. Final Practical Assessment

2hrs

9.1. Hardware Identification and Handling: Label parts, explain function, use anti-static measures.

9.2. PC Assembly/Disassembly: Step-by-step guided practice using demo PCs.



9.4. Troubleshooting Simulations: Use POST card, interpret beep codes, fix connectivity issues.

9.5. Maintenance Tasks: Clean internal components, apply thermal paste, verify power supply.

Internal Assessment Breakdown for (40 marks)

- Attendance & Participation – 10%
- Daily Lab Performance – 20%
- Practical Test – 50%
- Viva/Oral Exam – 20%

Methodologies for Delivery:

- The course must be conducted regularly and intensively to effectively accomplish the learning objectives of the subject matter.
- **Demonstration-Based Learning:** Live setup of hardware and networking devices.
- **Hands-On Practice:** Students carry out assembly, configuration, and troubleshooting tasks.
- **Interactive Discussions:** Q&A sessions to support conceptual clarity.
- **Group Work:** Pair-based assembly and networking tasks.
- **Case-Based Problem Solving:** Realistic scenarios for diagnosis and resolution.
- **Simulation Tools:** Optional use of Packet Tracer or VirtualBox.
- **Checklists and Worksheets:** To support step-by-step execution.

Examination Scheme

This Course doesn't need final Examination. The evaluation will be based on:

Internal Assessment	External Assessment	Total Marks
Theory + Practical	Viva/Oral	100 marks
20+60 marks	20 marks	

Required readings:

Gookin, D. (2017). *Troubleshooting & maintaining your PC all-in-one for dummies®* (3rd ed.). John Wiley & Sons, Inc.

Halsey, M. (2022). *Troubleshooting and supporting Windows*. Apress.

Mueller, S. (2005). *Upgrading and repairing laptops* (2nd ed.). Que Publishing.

Roberts, R. M. (2010). *Networking fundamentals* (2nd ed.).

Goodheart-Willcox Publisher.

Singh, V. P. (2025). *Laptop repairing course* (with Windows 8). Computech Publications.

Yusufi, A. M. (2014). *A guide to electronic maintenance and repairs*. Partridge Singapore.

Zacker, C., & Rourke, J. (2001). *PC Hardware: The Complete Reference* (Illustrated ed.).

Osborne/McGraw-Hill.



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