



Gyanmanjari
Innovative University

Syllabus
Gyanmanjari Diploma Engineering College
Semester-I (Diploma)

Subject: Computer Hardware and Troubleshooting- DET2CE10101

Type of course:

Prerequisite: Basic programming fundamentals, logical and problem-solving skills, mathematical logic and a general understanding of computer components.

Rationale:

A solid foundation in programming, logic, and mathematical reasoning is essential for understanding the structure and function of computer systems, enabling effective diagnosis and resolution of hardware issues through systematic analysis and troubleshooting techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks		Total Marks
CI	T	P	C	SEE	CCE	
0	0	4	2	50	50	100

Legends: CI-Class Room Instructions; T – Tutorial; P - Practical; C – Credit; SEE - Semester End Evaluation; CCE-Continuous and Comprehensive Evaluation.



Course Content:

Sr. No	Course Content	Hrs.	% Weightage
1	Computer Fundamentals, Hardware Architecture and System Assembly <u>Theory Topics:</u> Computers through Generations, Basic Computer Hardware Structure, Hardware and Software, Different types of Computers, Features of Computer Systems, Safety Information, Front Panel View, Rear Panel View, Internal Arrangements, Disassembling the Computer. <u>Practical:</u> 1. Identify and explain the components and connectors of an SMPS by observing internal power supply design. 2. Classify and compare different generations of computers based on technology, processing speed, and size. 3. Identify and describe basic computer hardware components such as CPU, RAM, motherboard, and storage devices. 4. Distinguish between hardware and software by listing real-world examples and their functions. 5. Explore and categorize different types of computers like desktops, laptops, tablets, and servers through observation. 6. List and describe key features of modern computers including processor type, memory capacity, and connectivity. 7. Identify front panel ports such as USB, audio jack, and power button through physical inspection of the cabinet. 8. Identify rear panel ports and connectors including HDMI, VGA, Ethernet, and power input. 9. Observe and explain internal arrangement and cabling inside a computer cabinet, including SATA and power cables. 10. Disassemble and reassemble a computer system by removing and reinstalling components correctly. 11. List and follow essential safety measures and best practices to be maintained in a computer lab environment.	12	20%



Examination Method:

Sr. No.	Evolution Methods	SEE	CCE
1	Computer System Disassembly and Internal Component Identification Disassemble and reassemble the computer system, identify internal hardware components, explain their functions, and follow appropriate safety procedures.	10	-
2	Active Learning Activity (ALA) – Front and Rear Panel Observation, Port Classification and Functional Analysis Observe, sketch, label, classify, and explain the functions of ports, connectors, buttons, and indicators available on the front and rear panels of a computer cabinet.*	-	10
Total		10	10

Examination Style:**1. Computer System Disassembly and Internal Component Identification (10 Marks):**

- Students will carefully disassemble the system unit and identify any five internal components, such as the motherboard, processor, RAM, storage device, SMPS, cooling fan, expansion card, or connecting cables. They must explain the name and function of each identified component and, wherever applicable, mention the generation of computers in which the component or its underlying technology became prominently used. Students must also follow appropriate safety precautions, remove and reinstall the components correctly, manage the internal cables, and reassemble the computer system properly. The completed work will be evaluated through practical performance in the computer hardware laboratory. Each debugging question carries 05 marks to help the examiner assess code quality and correctness.



	2. Active Learning Activity (ALA) – Front and Rear Panel Observation, Port Classification and Functional Analysis (10 Marks): In this activity, students will physically observe the front and rear panels of a computer cabinet and prepare clear and properly labelled sketches of both views. They must identify and label at least five ports, connectors, buttons, or indicators, such as USB ports, audio jacks, power button, reset button, HDMI port, VGA port, Ethernet port, and power input connector. Students must explain the function of each identified feature and classify it as an input, output, display, audio, communication, networking, or power-related interface. The PDF must include front and rear panel sketches, proper labels, functionality explanations, classification, and relevant observation evidence. The completed PDF must be submitted individually through the GMIU Web Portal.		
2	Motherboard Architecture, Configuration and Troubleshooting <u>Theory Topics:</u> Features of Motherboards, Components of Motherboard, Processor Support, Motherboard Controller, Memory Support, Graphics Support, BIOS, IDE and SATA Connectors, Power Supply Connectors, External Devices Interfaces, Buses and Expansion Slots, Front Panel Headers, I/O Addresses and Interrupts, Selection of Motherboards, Using Modem Cards, External Interfaces and Connectors, Troubleshooting and Maintenance of Motherboards, Motherboard: Common Problems and Solutions. <u>Practical:</u> - Identify various motherboard features such as chipset, slots, ports, and explain different motherboard form factors like ATX, Micro-ATX, and Mini-ITX. - Demonstrate the installation of a processor on a motherboard and verify socket compatibility for different CPU models. - Check memory support on a motherboard and configure dual channel RAM installation for optimized performance. - Identify available graphics support options and expansion slots (PCI, PCIe) on a motherboard and explain their uses.	12	20%



	16. Verify processor support with BIOS/UEFI version and update BIOS if required to ensure compatibility. 17. Check RAM compatibility (type, speed, voltage) and configure memory settings in BIOS for stable operation. 18. Identify and explain the use of various graphics interfaces and available expansion slots for additional hardware. 19. Locate IDE, SATA data, and power connectors on the motherboard and explain their purpose in storage configuration. 20. Identify front-panel headers (power, reset, LEDs) and understand I/O address assignments for peripheral control. 21. Install modem and external interface cards on expansion slots and verify detection in Device Manager or BIOS. 22. Trace bus lines and signals on the motherboard layout to understand data flow and device communication. 23. Perform basic troubleshooting on motherboard-related issues and conduct routine maintenance checks. 24. Select an appropriate motherboard based on a given PC build requirement considering CPU, RAM, GPU, and connectivity needs. Examination Method: <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evolution Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>SATA Storage Connection and CMOS BIOS Reset — Connect a SATA hard disk to the motherboard and power supply, verify its detection, and reset the BIOS using the CMOS jumper by following appropriate safety procedures.</td><td>10</td><td>-</td></tr> <tr> <td>2</td><td>Active Learning Activity (ALA) — Motherboard Component Identification and Labelling — Identify, label, and explain the functions of important components, slots, connectors, and headers available on a desktop motherboard.</td><td>-</td><td>10</td></tr> <tr> <td colspan="2">Total</td><td>10</td><td>10</td></tr> </tbody> </table>	Sr. No.	Evolution Methods	SEE	CCE	1	SATA Storage Connection and CMOS BIOS Reset — Connect a SATA hard disk to the motherboard and power supply, verify its detection, and reset the BIOS using the CMOS jumper by following appropriate safety procedures.	10	-	2	Active Learning Activity (ALA) — Motherboard Component Identification and Labelling — Identify, label, and explain the functions of important components, slots, connectors, and headers available on a desktop motherboard.	-	10	Total		10	10		
Sr. No.	Evolution Methods	SEE	CCE																
1	SATA Storage Connection and CMOS BIOS Reset — Connect a SATA hard disk to the motherboard and power supply, verify its detection, and reset the BIOS using the CMOS jumper by following appropriate safety procedures.	10	-																
2	Active Learning Activity (ALA) — Motherboard Component Identification and Labelling — Identify, label, and explain the functions of important components, slots, connectors, and headers available on a desktop motherboard.	-	10																
Total		10	10																

	Examination Style: 1. SATA Storage Connection and CMOS BIOS Reset (10 Marks): - Students will complete two compulsory practical tasks carrying 5 marks each. In the first task, students will power off and unplug the computer system, connect the SATA data cable between the motherboard and hard disk, connect the SATA power cable from the SMPS to the hard disk, secure the connections, and verify hard-disk detection through BIOS or UEFI. In the second task, students will locate the CMOS jumper on the motherboard and perform the BIOS reset procedure correctly by following appropriate safety precautions. The completed work will be evaluated through practical performance, connection accuracy, correct procedure, safety practices, and successful verification of the required results. Each question carries 10 marks to help the examiner assess quality and correctness. 2. Active Learning Activity (ALA) – Motherboard Component Identification and Labelling (10 Marks): - In this activity, students will observe a real, unpowered desktop motherboard placed on a static-safe surface and identify at least eight important components directly on the board. The identified components may include the processor socket, RAM slots, chipset, SATA connectors, ATX power connector, CPU power connector, PCIe slots, CMOS battery, BIOS or UEFI chip, front-panel headers, and external I/O ports. Students must clearly label each identified component and briefly explain its function and importance in the computer system. The PDF must include a labelled motherboard diagram or photograph, component names, functions, and relevant observation evidence. The completed PDF must be submitted individually through the GMIU Web Portal.		
3	Processor and GPU Architecture, Installation and Troubleshooting <u>Theory Topics:</u> Processor Feature, Developmental Staged of CPU, Multiple Core Processors, Processor Architectural Details, Processor Specifications, Installing and Uninstalling CPU, CPU	12	20%

	Overheating Issues, Processor: Common Problems and Solutions, Graphics Processing Units. <u>Practical:</u> 25. Explore the evolution of processor features by comparing historical and modern CPUs in terms of speed, architecture, and instruction sets. 26. Demonstrate staged CPU development through hands-on observation of early, mid, and modern processors to understand generational improvements. 27. Work with multi-core processors to understand core counts, threading, and performance benefits in real-world applications. 28. Dissect processor microarchitecture by identifying key components such as ALU, control unit, cache levels, and instruction pipeline stages. 29. Read and compare processor specifications like clock speed, cache size, thermal design power (TDP), and socket type using official datasheets. 30. Perform installation and uninstallation of a CPU onto a motherboard, ensuring proper alignment, socket handling, and thermal paste application. 31. Diagnose CPU overheating issues by monitoring temperature using software tools and inspecting cooling system setup. 32. Identify and troubleshoot common CPU problems such as no POST, overheating, or system freezes, and suggest appropriate solutions. 33. Introduce the concept of GPUs and parallel processing by comparing CPU vs GPU roles in computation and visualization. 34. Install a GPU into a system, configure drivers, and verify successful setup using device manager or GPU diagnostic software.		
--	--	--	--



Examination Method:			
Sr. No.	Evolution Methods	SEE	CCE
1	CPU Installation, Cooling Setup and System Verification — Install a compatible CPU on the motherboard, apply thermal paste, configure the cooling system, and verify successful processor detection and system operation.	10	-
2	Active Learning Activity (ALA) – CPU Performance Monitoring and Overheating Diagnosis — Monitor processor temperature and performance, identify overheating symptoms and causes, and recommend appropriate troubleshooting solutions.	-	10
Total		10	10
Examination Style:			
1. CPU Installation, Cooling Setup and System Verification (10 Marks): - Students will complete two compulsory practical tasks carrying 5 marks each. In the first task, students will verify processor and motherboard socket compatibility, align and install the CPU correctly, secure it within the socket, and apply an appropriate quantity of thermal paste. In the second task, students will install the heatsink and cooling fan, connect the CPU fan header, start the computer system, and verify processor detection through BIOS/UEFI or suitable system-information software. Students must follow appropriate safety precautions and ensure that no processor pins, socket contacts, or motherboard components are damaged. The completed work will be evaluated through practical performance, installation accuracy, cooling-system setup, processor detection, and successful system verification. 2. Active Learning Activity (ALA) – CPU Performance Monitoring and Overheating Diagnosis (10 Marks): - In this activity, students will monitor CPU temperature, clock speed, utilization, and system behaviour under normal and workload conditions using suitable diagnostic software. Students must identify symptoms			



	such as thermal throttling, abnormal temperature readings, reduced performance, system freezing, restart, or sudden shutdown. They must analyse possible causes, including improper thermal-paste application, incorrect heatsink installation, cooling-fan failure, dust accumulation, restricted airflow, excessive workload, or unsuitable BIOS settings, and recommend suitable corrective measures. The PDF must include processor specifications, monitoring-tool details, temperature observations, identified symptoms, possible causes, troubleshooting solutions, supporting screenshots or photographs, and conclusion. The completed PDF must be submitted individually through the GMIU Web Portal.		
4	Computer Memory and Storage Devices – Installation, Configuration and Troubleshooting <u>Theory Topics:</u> Features of Computer Memory, Types of Computer Memory, Working of Computer Memory, Memory Map, Installing and Uninstalling Memory Modules, Maintenance and Troubleshooting, Memory: Common Problems and Solutions, Hard Disks Details, Installing Hard Disks, Hard Disk Specifications, Partitioning and Formatting Hard Disks, Maintenance and Troubleshooting Hard Disks, Hard Disk: Common Problems and Solutions, Optical Storage Devices Features, Disc Burning Software, Troubleshooting and Maintenance, Blu-ray Discs, External Storage Devices. <u>Practical:</u> 35. Install and test RAM modules to understand memory types, installation procedure, and system detection. 36. Create and analyze a memory map using BIOS or system tools to explore how memory is allocated. 37. Install a hard disk drive (HDD) and configure BIOS settings to verify hardware recognition and boot priority. 38. Partition and format a hard disk using Disk Management to prepare it for data storage or OS installation. 39. Burn data to a CD/DVD using disc burning software and verify the content to understand optical storage usage and maintenance.	12	20%

Examination Method:			
Sr. No.	Evolution Methods	SEE	CCE
1	Hard Disk Partitioning, Formatting and Optical Disc Burning — Create and format hard-disk partitions, burn the provided data to an optical disc, and verify successful storage and retrieval.	10	-
2	Active Learning Activity (ALA) – RAM Installation, Dual-Channel Configuration and Troubleshooting — Install compatible RAM modules, configure dual-channel memory, perform diagnostic testing, and identify faulty modules or slots.	-	10
Total		10	10
Examination Style:			
1. Hard Disk Partitioning, Formatting and Optical Disc Burning (10 Marks): - Students will complete two compulsory practical tasks carrying 5 marks each. In the first task, students will use Disk Management or a suitable disk utility to create the required partition, assign an appropriate size and drive letter, select a suitable file system such as NTFS or FAT32, format the partition, and verify that it is properly mounted and accessible. In the second task, students will use suitable disc-burning software to write the provided files to a blank CD or DVD and verify that the burned data can be accessed and opened successfully. The completed work will be evaluated through practical performance, correct partitioning and formatting, successful disc burning, and verification of stored data. 2. Active Learning Activity (ALA) – RAM Installation, Dual-Channel Configuration and Troubleshooting (10 Marks): - In this activity, students will identify compatible RAM modules and install two identical DIMMs in the appropriate motherboard slots to configure dual-channel memory while following ESD and hardware-safety precautions. Students must verify memory			



	detection and dual-channel configuration through BIOS/UEFI or suitable system-information software. They will safely remove and reinstall the modules, inspect the RAM contacts and slots, and perform memory diagnostic testing using MemTest86, Windows Memory Diagnostic, or another suitable tool. Students must analyse the diagnostic results and identify whether a RAM module or memory slot is faulty, wherever applicable. The PDF must include RAM and motherboard specifications, slot configuration, installation procedure, diagnostic evidence, identified problems, troubleshooting findings, and conclusion. The completed PDF must be submitted individually through the GMIU Web Portal.		
5	Power Supply, Input Devices, BIOS Configuration and System Troubleshooting <u>Theory Topics:</u> Computer Power Supply Units, Features of SMPS, Maintenance and Troubleshooting, UPS: Common Problems and Solutions. Types and Features of Keyboards, Keyboards Interfaces, Keyboard: Common Problems and Solutions, Different Mouse Types, Mouse: Common Problems and Solutions. Safety Precautions, Configuring Using BIOS Parameters, Power on Self-Test, Devices and Drivers, Performance Improving Steps, Diagnosing General Problems, Computer System: Common Problems and Solutions, Flashing BIOS. <u>Practical:</u> 1. Demonstrate the internal components and connectors of an SMPS by identifying each part and explaining its function. 2. Measure and record PSU output voltages using a multimeter to ensure proper power delivery to the system. 3. Perform a UPS battery replacement and test the backup duration using connected load. 4. Access BIOS/UEFI settings to configure power management options such as sleep, wake, and AC recovery. 5. Simulate Power on Self-Test (POST) and interpret beep codes to diagnose hardware issues. 6. Perform a BIOS or UEFI firmware update (flashing) and verify successful installation.	12	20%



	7. Explain keyboard interfacing and demonstrate how different protocols like USB and PS/2 function. 8. Install a new keyboard and troubleshoot non-functioning keys or interface issues. 9. Compare various types of mice and test DPI settings using control panel or gaming software. 10. Install appropriate device drivers for input devices and perform basic performance tuning to ensure responsiveness. Examination Method: <table border="1"> <thead> <tr> <th>Sr. No.</th><th>Evolution Methods</th><th>SEE</th><th>CCE</th></tr> </thead> <tbody> <tr> <td>1</td><td>BIOS Configuration and POST Diagnostics — Configure BIOS/UEFI parameters, save and verify the applied settings, observe the Power-On Self-Test process, and diagnose hardware problems using beep codes or error messages.</td><td>10</td><td>-</td></tr> <tr> <td>2</td><td>Active Learning Activity (ALA) – PSU Testing and BIOS/UEFI Firmware Update — Measure PSU output voltages using a multimeter, verify power delivery through different connectors, perform a compatible BIOS/UEFI firmware update, and confirm successful installation.</td><td>-</td><td>10</td></tr> <tr> <td colspan="2">Total</td><td>10</td><td>10</td></tr> </tbody> </table> Examination Style: 1. BIOS Configuration and POST Diagnostics (10 Marks): Students will complete two compulsory practical tasks carrying 5 marks each. In the first task, students will access the BIOS/UEFI interface and configure the specified parameters, such as boot sequence, power-management options, system date and time, hardware monitoring, sleep settings, wake settings, or AC power recovery. They must save the changes and verify that the configured settings remain applied after restarting the computer. In the second task, students will observe the Power-On Self-Test process and interpret the displayed error message, status indicator, or beep code generated	Sr. No.	Evolution Methods	SEE	CCE	1	BIOS Configuration and POST Diagnostics — Configure BIOS/UEFI parameters, save and verify the applied settings, observe the Power-On Self-Test process, and diagnose hardware problems using beep codes or error messages.	10	-	2	Active Learning Activity (ALA) – PSU Testing and BIOS/UEFI Firmware Update — Measure PSU output voltages using a multimeter, verify power delivery through different connectors, perform a compatible BIOS/UEFI firmware update, and confirm successful installation.	-	10	Total		10	10		
Sr. No.	Evolution Methods	SEE	CCE																
1	BIOS Configuration and POST Diagnostics — Configure BIOS/UEFI parameters, save and verify the applied settings, observe the Power-On Self-Test process, and diagnose hardware problems using beep codes or error messages.	10	-																
2	Active Learning Activity (ALA) – PSU Testing and BIOS/UEFI Firmware Update — Measure PSU output voltages using a multimeter, verify power delivery through different connectors, perform a compatible BIOS/UEFI firmware update, and confirm successful installation.	-	10																
Total		10	10																



	during system startup. They must identify the possible faulty component, explain the reason for the error, and recommend an appropriate troubleshooting solution. The completed work will be evaluated through BIOS navigation, configuration accuracy, successful setting verification, POST observation, and hardware fault diagnosis. 2. BIOS Configuration & POST Diagnostics (10 Marks): In this activity, students will identify the major PSU connectors, such as the 24-pin ATX connector, 4/8-pin processor connector, SATA power connector, and Molex connector. They will measure and record the output voltages using a multimeter while following appropriate electrical and hardware-safety precautions. Students must compare the measured values with the expected voltage levels and determine whether the PSU is supplying power correctly. They will also identify the current BIOS/UEFI version, verify motherboard and firmware compatibility, perform the firmware update using the approved update file and procedure under faculty supervision, and confirm the updated version after restarting the system. The PDF must include PSU connector identification, expected and measured voltage values, testing observations, existing and updated BIOS/UEFI details, firmware-update procedure, verification evidence, safety precautions, and conclusion. The completed PDF must be submitted individually through the GMIU Web Portal.		
--	--	--	--

Suggested Specification table with Marks (Theory): 100

Distribution of Theory Marks (Revised Bloom's Taxonomy)						
Level	Remembrance (R)	Understanding (U)	Application (A)	Analyze (N)	Evaluate (E)	Create (C)
Weightage %	NA	NA	NA	NA	NA	NA



Course Outcome:

After learning the course the students should be able to:	
CO1	Identify and explain the basic structure and components of computer hardware.
CO2	Understand processor, memory, graphics, and BIOS support provided by modern motherboards.
CO3	Interpret processor specifications and identify suitable processors for specific needs.
CO4	Describe the features of optical and external storage devices and use disc burning software effectively.
CO5	Apply safety precautions while working with computer hardware components and peripherals.

Instructional Method:

The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

From the content 10% topics are suggested for flipped mode instruction.

Students will use supplementary resources such as online videos, NPTEL/SWAYAM videos, e-courses, Virtual Laboratory.

The internal evaluation will be done on the basis of Active Learning Assignment.

Practical/Viva examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

Reference Books:

- [1] Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance, by K. L. James, PHI Learning.
- [2] Introduction to PC Hardware and Troubleshooting by Michael Meyers, Mike Meyers, McGraw-Hill/Osborne.
- [3] Computer Hardware and Troubleshooting by PROF. SHILPA, Notion Press.
- [4] Computer Hardware: Installation, Interfacing, Troubleshooting and Maintenance by K.L. James, PHI Learning.
- [5] Troubleshooting, Maintaining and Repairing PCs (Hardware) by Stephen J Bigelow.



Suggested Rubrics:

Suggested Assessment Guidelines

Module-1: Computer Fundamentals, Hardware Architecture and System Assembly

Computer System Disassembly and Internal Component Identification (10 Marks)		
Criteria	Description	Marks
Component Identification and Explanation	Correct identification of the required internal computer components with an accurate explanation of their functions and relevant generation details, wherever applicable.	05
Disassembly, Reassembly and Safety Procedure	Correct and systematic disassembly and reassembly of the computer system while following appropriate safety precautions, handling components carefully, and maintaining proper cable connections.	05
Total		10

Module-2: Motherboard Architecture, Configuration and Troubleshooting

SATA Storage Connection and CMOS BIOS Reset (10 Marks)		
Criteria	Description	Marks
SATA Storage Connection and Verification	Correctly connect the SATA data cable between the motherboard and hard disk, connect the SATA power cable from the SMPS, and verify successful hard-disk detection through BIOS/UEFI.	05
CMOS Jumper Identification and BIOS Reset	Correctly identify the CMOS jumper, perform the BIOS reset procedure safely, restore the jumper to its original position, and verify successful BIOS reset.	05
Total		10

Module-3: Processor and GPU Architecture, Installation and Troubleshooting

CPU Installation, Cooling Setup and System Verification (10 Marks)		
Criteria	Description	Marks
CPU Installation and Socket Handling	Verify processor and motherboard compatibility, align and install the CPU correctly, secure it in the socket, and handle processor pins or socket contacts safely.	05
Cooling Setup and System Verification	Apply thermal paste appropriately, install the heatsink and cooling fan, connect the CPU fan header, and verify successful processor detection and system operation through BIOS/UEFI.	05
Total		10



Module-4: Computer Memory and Storage Devices – Installation, Configuration and Troubleshooting

Hard Disk Partitioning, Formatting and Optical Disc Burning (10 Marks)		
Criteria	Description	Marks
Hard Disk Partitioning and Formatting	Correctly create the required hard-disk partition, assign an appropriate size and drive letter, select a suitable file system, format the partition, and verify successful storage access.	05
Optical Disc Burning and Data Verification	Correctly burn the provided data to a CD or DVD using suitable software and verify that the stored files are readable, complete, and accessible after the burning process.	05
Total		10

Module-5: Power Supply, Input Devices, BIOS Configuration and System Troubleshooting

BIOS Configuration and POST Diagnostics (10 Marks)		
Criteria	Description	Marks
BIOS/UEFI Configuration and Verification	Correctly access the BIOS/UEFI interface, configure the specified parameters such as boot sequence, power management, system date and time, or hardware monitoring, save the changes, and verify that the settings remain applied after reboot.	05
POST Observation and Hardware Fault Diagnosis	Correctly observe the Power-On Self-Test process, interpret the given beep code or error message, identify the possible faulty hardware component, and recommend an appropriate troubleshooting solution.	05
Total		10

