Title: Computer Hardware Engineering

Code Number: MD1102

Credit Hours: 3 (3+0)

Prerequisites: None

Semester: 1st

Course Objectives
The course will enable students to:
1. Identify and describe the core components of a computer system, including CPU, RAM and ROM.
2. Describe the construction and functioning of Storage Devices and Motherboard

Course Content:
Unit 1: Introduction to Computers and System Software vs Application Software
1. Overview of Computing and its Evolution
2. System Software vs Application Software
3. Understanding Operating Systems
4. Introduction to Components of Computing Devices

Unit 2: Data Representation and Logic Gates
1. Concepts of Bits and Bytes
2. Binary and Hexadecimal Numbers
3. Logic Gates and Boolean Logic
4. Logical Operations in Computing

Unit 3: Digital Foundations: Analog vs Digital, Continuous vs Discrete
1. Analog vs Digital Signals
2. Continuous vs Discrete Data Representation
3. AC vs DC Power Sources
4. Sampling Rate and Frequency in Digital Processing

Unit 4: Core Components of Computing Devices
1. Central Processing Unit (CPU)
2. Input/Output Devices (I/O)
3. Memory (RAM)
4. Storage Devices and Read-Only Memory (ROM)

Unit 5: Memory Types and Speed
1. Memory vs Speed Trade-offs
2. SRAM vs DRAM Technologies
3. Construction of Cells in SRAM and DRAM
4. Levels of SRAM: L1, L2, L3 Cache

Unit 6: Dynamic Random-Access Memory (DRAM)
1. Types of DRAM: SDRAM, DDR, DDR2, DDR3, DDR4
2. Internal Clock Speed, I/O Clock Speed, Bus Size
3. Pre-fetch per Cycle, Synchronous vs Asynchronous Communication

4. Parts and Generations of DRAM

Unit 7: BIOS and Motherboard Introduction

1. BIOS (Basic Input/Output System)
2. Legacy BIOS vs UEFI
3. CMOS (Complementary Metal-Oxide-Semiconductor)
4. Construction and Functioning of BIOS
5. Introduction to Motherboard, Chipset, Ports, Slots

Unit 8: Central Processing Unit (CPU)

1. Construction and Architecture of CPU
2. Parts and Components of CPU
3. Working Principles of CPU
4. Generations of Intel CPUs
5. Concepts of Cores and Hyperthreading

Unit 9: Storage Devices

1. Hard Disk Drives (HDD)
2. Construction, Read/Write Process
3. Cylinders, Sectors, Tracks
4. Seek Time, Rotational Latency, Access Time, Transmission Time

Unit 10: Solid State Drives (SSD) and Compact Disks (CDs)

1. Construction of SSD
2. Charge Trap Cell, String, Row, Page, Bit-line, Control Gate
3. Construction of CDs
4. Read/Write Process, Sectors, Tracks

Teaching-Learning Strategies:

The pedagogical approach to this course relies on face-to-face teaching in a university classroom environment. The lectures are delivered using multimedia support and on white board. Students are engaged and encouraged to solve real world problems using computer-aided tools.

Assignments/Types and Number with calendar:

A minimum of four assignments to be submitted before the written exams for each term.

Assessment and Examinations:

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	It takes place at the mid-point of the semester.
2.	Sessional Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.

3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Recommended Books:

1. Wilson, K. "Exploring computer hardware: The illustrated guide to understanding computer hardware, components, peripherals & networks" (Exploring Tech), 2022 edition. (2022).
2. Brian Williams and Stacey Sawyer, "Using Information Technology", McGraw-Hill, 11thedition (2014).
3. Patt and Patel, "Introduction to Computing Systems from Bits and Gates to C and Beyond", McGraw-Hill, 2nd edition (2004).