CMPE 101- COMPUTER ENGINEERING AS A DISCIPLINE

Module 2: Overview of Computer Architecture and Hardware Components

Objectives:

- Understand the fundamental concepts of computer architecture.
- Identify the major hardware components in a computer system.

Content:

1. **Basic Computer Architecture**
    - Von Neumann vs. Harvard Architecture
    - CPU, Memory, Input/Output
2. **Hardware Components Overview**
    - Central Processing Unit (CPU)
    - Memory: RAM, ROM, Cache
    - Storage Devices (HDD, SSD, NVMe)
    - Peripherals and I/O Devices (Keyboard, Mouse, Display)
    - Power Supply, Motherboard

Activities:

- Diagram labeling of major hardware components.
- Hands-on identification of computer parts.

References:

1. Stallings, W. (2021). *Computer Organization and Architecture*. Pearson.
2. Patterson, D. A., & Hennessy, J. L. (2020). *Computer Organization and Design RISC-V Edition: The Hardware/Software Interface*. Morgan Kaufmann.
3. Brown, S., & Vranesic, Z. (2018). *Fundamentals of Digital Logic with VHDL Design*. McGraw-Hill Education.

Module 3: Evolution of Computing Systems and Processors

Objectives:

- Explore the historical development of computing systems and processors.
- Understand the trends in microprocessor evolution.

Content:

1. **History of Computing**
    - Early Mechanical and Electrical Computers (ENIAC, UNIVAC)
    - First, Second, and Third Generation Computers
2. **Evolution of Processors**
    - From Single-Core to Multi-Core Processors
    - Moore's Law and Its Impact
    - Notable Processor Families: Intel x86, ARM Architecture

Activities:

- Timeline creation of major processor releases and their capabilities.
- Case study: Comparison between early Intel processors and modern ARM chips.

References:

1. Smotherman, M. (2023). *History of Computing and Processors*. Computing History Journal.
2. Flynn, M., & Hung, E. (2022). *Computer System Design: System-on-Chip Design and Evolution*. Springer.
3. Hennessy, J. L., & Patterson, D. A. (2019). *Computer Architecture: A Quantitative Approach*. Elsevier.

Module 4: Introduction to Embedded Systems

Objectives:

- Define embedded systems and their applications.
- Identify the differences between general-purpose and embedded systems.

Content:

1. **What is an Embedded System?**
    - Definition and Characteristics
    - Embedded vs. General-Purpose Computing
    - Real-Time Systems
2. **Common Applications**
    - Embedded Systems in Automobiles, Consumer Electronics, and Industrial Devices
    - Internet of Things (IoT) and Smart Devices

Activities:

- Group discussion on the role of embedded systems in everyday life.
- Project: Building a simple embedded system using Arduino or Raspberry Pi.

References:

1. Wolf, W. (2022). *Computers as Components: Principles of Embedded Computing System Design*. Morgan Kaufmann.
2. Kamal, R. (2021). *Embedded Systems: Architecture, Programming and Design*. McGraw-Hill Education.
3. Vahid, F., & Givargis, T. (2019). *Embedded Systems Design: A Unified Hardware/Software Introduction*. Wiley.

Module 5: Overview of Integrated Circuits and Microcontrollers

Objectives:

- Learn the fundamentals of integrated circuits (ICs) and microcontrollers (MCUs).
- Understand the role of microcontrollers in embedded systems.

Content:

1. **Introduction to Integrated Circuits**
    - Overview of IC Manufacturing
    - Types of ICs: Analog, Digital, and Mixed-Signal
    - Moore's Law and VLSI (Very-Large-Scale Integration)
2. **Introduction to Microcontrollers**
    - Microcontroller Architecture
    - Applications of Microcontrollers in Embedded Systems
    - Popular Microcontroller Families: AVR, ARM Cortex, PIC

Activities:

- Hands-on lab: Introduction to programming a microcontroller (e.g., Arduino).
- Group research project: Investigating the evolution of ICs and microcontrollers.

References:

1. Barrett, S. F., & Pack, D. J. (2023). *Embedded Systems Design with the Atmel AVR Microcontroller*. Springer.
2. Peatman, J. B. (2020). *Design with PIC Microcontrollers*. Pearson.
3. Jivan, S. (2019). *Introduction to Integrated Circuits and Microcontrollers*. Wiley.

These modules are designed to give students a comprehensive understanding of computer systems, processors, embedded systems, and related hardware. They include both theoretical concepts and hands-on activities to reinforce learning.