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Course Code: CS E212

Semester: III

COMPUTER ORGANIZATION & ARCHITECTURE

Course Objective:

This course will help the learner to understand the basic digital logic circuits, computer architecture, the memory system and Input / Output organization of a computer system.

UNIT - I

15 Periods

Basics in Boolean logic and Combinational/Sequential Circuits: Digital Computers - Logic Gates - Boolean Algebra - Map Simplification - Combinational Circuits - Flip-Flop - Sequential Circuits. **Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. **Data representation:** Signed number representation, fixed and floating point representations, character representation. **Computer arithmetic:** Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Unsigned Numbers - Multiplication of Signed Numbers - Fast Multiplication - Integer Division - Floating-Point Numbers and Operations, IEEE 754 format.

UNIT - II

15 Periods

Instruction set architecture of a CPU: Memory Locations and Addresses - Memory Operations - Instructions and Instruction Sequencing - Addressing Modes - Assembly Language - Stacks - Subroutines - Additional Instructions - CISC Instruction Sets. **Introduction to x86 architecture:** The Intel IA-32 Architecture: Memory Organization - Register Structure - Addressing Modes – Instruction Set – Interrupts and Exceptions.

UNIT - III

15 Periods

CPU control unit design: Instruction Codes - Computer Registers - Computer Instructions - Timing and Control - Instruction Cycle - Memory-Reference Instructions - Input-Output and Interrupt - Design of Basic Computer - Design of Accumulator Logic. **Microprogrammed Control:** Control Memory - Address Sequencing- Microprogram Example - Design of Control Unit. **Pipelining:** Basic Concept - Pipeline Organization - Pipelining Issues - Data Dependencies - Memory Delays- Branch Delays - Superscalar Operation - Pipelining in CISC Processors. **Parallel Processors:** Hardware Multithreading - Vector (SIMD) Processing - Cache Coherence

UNIT - IV

15 Periods

Memory system: Basic Concepts - Semiconductor RAM Memories - Read-only Memories - Direct Memory Access - Memory Hierarchy - Cache Memories - Performance Considerations - Virtual Memory - Memory Management Requirements - Secondary Storage. **Basic Input/Output:** Accessing I/O Devices - Interrupts. **Input / Output Organization:** Bus Structure - Bus Operation – Arbitration - Interface Circuits - Interconnection Standards

TEXTBOOKS

1. M. M. Mano, Computer System Architecture, Prentice Hall of India, 3rd Edition, 2007.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Morgan Kaufmann publishers, 5th Edition, 2014.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, Computer Organization and Embedded Systems, McGraw Hill, 5th Edition, 2012.

REFERENCES

1. John P. Hayes, Computer Architecture and Organization, McGraw-Hill, 2nd Edition, 1998.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson India, 11th Edition, 2019.

UNITWISE LEARNING OUTCOMES

Upon successful completion of each unit, the learner will be able to

Unit I	<ul style="list-style-type: none">• Describe the background for understanding the digital circuits• Illustrates various data types represented in binary form and presents arithmetic algorithms
Unit II	<ul style="list-style-type: none">• Discuss the concepts of machine instructions, addressing techniques, and instruction sequencing and explores the X86 architecture
Unit III	<ul style="list-style-type: none">• Presents the organization and design of a basic digital computer and discuss the microprogramming concepts
Unit IV	<ul style="list-style-type: none">• Describe the memory hierarchy and explain the operation of cache memory• Explain the techniques that computers use to communicate with input and output devices

COURSE LEARNING OUTCOMES

Upon successful completion of this course, the learner will be able to

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- Illustrates various data types represented in binary form and presents arithmetic algorithms
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- Describe the memory hierarchy and explain the operation of cache memory
- Explain the techniques that computers use to communicate with input and output devices