JAIN DEEMED-TO-BE UNIVERSITY | FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COMPUTER ARCHITECTURE AND ORGANIZATION

Course Code: 22CSE104 **Credits:** 03
L: T: P: 3-0-0 **Contact Hours:** 45
Prerequisite(s): Operating System **CA: UE:** 50:50

Course Objectives

The objective of the course is to

1. Discuss on the various basic concepts and structure of computers
2. Understand the concepts related to register transfer logic and different arithmetic operations.
3. Explain in detail on addressing modes and memory organization
4. Explore and learn various types of serial communication techniques

Course Outcomes

At the end of the course, students will be able to

Course Outcomes	Description	Bloom's Taxonomy Level
CO1	Discuss the theory, functionality and basic architecture of CPU.	Understanding (2)
CO2	Explain the design issues on the basis of speed, technology, cost and performance.	Understanding (2)
CO3	Demonstrate the working of a simple CPU by making use of theoretical concepts.	Applying (3)
CO4	Explain the different concepts of parallel processing, pipelining and inter-processor communication.	Understanding (2)
CO5	Discuss the I/O and memory organization in a better way.	Understanding (2)
CO6	Summarize the different number systems, binary addition and subtraction, 2's complement representation and operations along with-its representation.	Understanding (2)

Course Contents

MODULE 1: Fundamentals and Basics **[10 hours]**

CPU, Memory, Input-Output Subsystems, Control Unit, Functional units, Basic operational concepts, Bus structures, Software, Performance, Multiprocessors and Multi-Computers.

Encoders, Demultiplexers, Programmable Logic Arrays (PLAs), Digital Logic Circuits: Basic Logic Functions, Synthesis of Logic Functions Using AND, OR, and NOT Gates, Minimization of Logic

Expression, Synthesis with NAND and NOR Gates, Flip-Flops, Encoders, Demultiplexers.

MODULE 2: Data Representation and Operations [08 hours]

Data types, Complements, Other binary codes, Error Detection codes, Register and Micro operations: Register Transfer language, Register Transfer Bus and memory transfers, Arithmetic Micro operations, logic micro operations, Shift micro operations, Arithmetic logic shift unit, Circuits for all micro operations.

MODULE 3: Computer Arithmetic and Processing Unit [08 hours]

Addition, subtraction, multiplication and division operations, Floating point Arithmetic operations. Processing Unit: Instruction Codes, Computer Registers, Computer Instructions, Instruction Cycle, Memory Reference Instructions, Addressing modes, Data Transfer and manipulations, RISC, CISC

MODULE 4: Input/output Organization [09 hours]

Peripheral Devices, Input Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor, Serial communication

Parallel and Vector Processing: Parallel processing, Pipelining, Arithmetic pipeline, Instruction pipeline, RISC Pipeline, Vector Processing, Array Processors.

MODULE 5: Memory Organization [10 hours]

Types of memory, memory hierarchy, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies, Memory management hardware.

TEXTBOOKS:

1. M. Moris Mano, "Computer Systems Architecture", 4th Edition, Pearson/PHI, ISBN:10:0131755633
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 6th Edition, McGraw Hill.
3. David A. Patterson and John L.Hennessy, "Computer Organization and Design: The Hardware/Software Interface",5th Edition, Elsevier.

REFERENCES:

1. John L. Hennessy and David A. Patterson, "Computer Architecture a quantitative approach", 4th Edition Elsevier, ISBN:10:0123704901.
2. William Stallings, "Computer Organization and Architecture", 6th Edition, Pearson/PHI, ISBN:10:0-13-609704-9
3. Donald e Givone, "Digital Principles and Design", TMH. A.Anandkumar, "Fundamentals of digital circuits", 4th Edition, PHI.

Skill Based Activities (SBE):

Note:- These Projects/activities are only indicative; the Faculty member can innovate

Assignments:

1. Describe how computer architecture is different than computer organization? https://www.geeksforgeeks.org/differences-between-computer-architecture-and-computer-organization/
2. Compare Number Systems (Decimal, Binary, Octal, Hexadecimal) https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_number_system.htm

Case Studies:

1. Outline 15 methods to free up RAM in windows and mac https://us.norton.com/internetsecurity-how-to-how-to-free-up-ram.html
2. Describe different pipeline (Arithmetic, Instruction, Linear or Non-linear) https://www.geeksforgeeks.org/difference-between-linear-pipeline-and-non-linear-pipeline/?ref=rp
   https://www.geeksforgeeks.org/arithmetic-pipeline-and-instruction-pipeline/