

Computer Organization and Architecture

- 1.1 Course Number: CS211
- 1.2 Contact Hours: 3-0-0 Credits: 9
- 1.3 Semester-offered: 2nd Year-Even
- 1.4 Prerequisite: Computer Programming
- 1.5 Syllabus Committee Member: Dr. Sushum Biswas, Dr. Daya Sagar Gupta & Dr. Gargi Srivastava

2. Objective:

- Basic understanding of Digital logic and computer design, understanding the concepts and design aspects of combinational and sequential circuit design.
- Computer organization: roles of processors, main memory, and input/output devices. Understanding the concept of programs as sequences of machine instructions. Understanding simple data paths and control designs for processors. Understanding memory organization, including cache structures and virtual memory schemes.

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Fundamentals of digital logic and Computer Design:	Switching devices, logic gates, digital integrated circuits technologies. Combinational Logic Analysis Procedure, Design Procedure, Study of Different Combinational Circuits, HDL for Combinational Circuits. Synchronous Sequential Logic Sequential Circuits, Flip Flops, State Reduction and Assignment. Registers and Counters, Ripple Counters, Synchronous Counters.	8
2	Memory and Programming Logic	Introduction, Random Access Memory, Memory Decoding, Error Detection and Correction. Read Only Memory, Programmable Logic Array, Programmable Array Logic. Asynchronous Sequential Logic: Introduction, Analysis Procedure, Circuits with Latches, Design Procedure, Race Free State Assignment, Hazards.	8
3	Computer Arithmetic	Introduction to computers, Register Transfer and Micro-operations, Addition and subtraction with signed magnitude, BCD addition and subtraction, Multiplication: Multiplication algorithm, Booth's multiplication, Array multiplier, Division algorithm: restoring and non-restoring	8

		division, array divider, Floating point arithmetic. Programming the basic computer.	
4	Organization of a simple stored-program computer	Central Processing Unit (CPU), Stack Organization, Register Stack, Memory Stack, Reverse Polish Notation. Instruction Formats, Three- Address, Two-Address, One-Address, and Zero-Address Instructions, Instruction cycle, Addressing Modes, Reduced Instruction Set Computer (RISC), CISC Characteristics RISC Characteristics.	8
5	Memory Organization	Primary and auxiliary memory, Hierarchical memory organization, Cache memory concepts and cache mapping techniques, Associative Memory. Control Unit: Hardwired and micro-programmed control unit. Input-Output organization: Modes of transfer, Priority Interrupt, Direct memory access (DMA), Input- Output Processor (IOP), CPU-IOP Communication.	8
		Total	40

4. Readings

4.1 Textbook:

1. Digital logic and computer design: M. Morris Mano, PHI
2. Computer System Architecture M. Morris Mano.
3. Computer Architecture and Organization, J.P. Hayes.

4.2 Reference books:

1. Computer Organization, 5-th edition, Carl Hamacher, Zvonko Vranesic, Safwat Zaki,
2. Advanced Computer Architecture, Kai Hwang

5 Outcome of the Course: Students will be able to:

- Describe the fundamental organisation of a computer system
- Explain the functional units of a processor
- Explain addressing modes, instruction formats and program control statements
- Distinguish the organization of various parts of a system memory hierarchy
- Describe basic concept of parallel computing
- Describe fundamentals concepts of pipeline and vector processing