Course-Plan

Spring Semester, 2025

School	**ENGINEERING**
Department	**Computer Science and Engineering**
Course Code	**CO214**
L-T-P-C	**3-1-0-4**
Course Name	**Computer Architecture and Organization**
Instructor	**Shobhanjana Kalita**

Pre-requisites: Digital Logic Design, Introductory Computing

1. Abstract

This course presents an overview of the structure and functioning of computers. It covers aspects of the representation of data for computation and storage in computer, the modular structure and operation of the machine, the design and functioning of the individual modular units- processor, memory, input-output. The course also discusses the design options in terms of the variety of devices available, their interconnectivity and their operation. In addition, some concepts on contemporary architectures and high performance computers are also discussed.

2. Course Objectives

i. To equip the student with a sound understanding of the machine level organization and functioning of a computer,
ii. To introduce the organizational options available in the design of a machine,
iii. To introduce machine level and assembly language level programming,
iv. To introduce some of the contemporary computer architectures

3. Course Outcomes

Students who complete the course will have the ability to:

COs	Statements	Blooms Level
CO1	Demonstrate **understandin**g of the various architectural and organizational aspects of computer systems at the machine level;	L2
CO2	**Analyze** performance and **Choose** among the various design options based on the trade-offs and quantitative performance analysis for the various functional modules in a machine;	L4
CO3	**Write** machine and assembly language programs for a given instruction set architecture and **analyse** their performance;	L4

CO4	Demonstrate **understanding** of the mechanisms built into the machines to support the design of advanced digital systems, operating systems etc.	L2

4. Mapping of Programme and Course Outcome:

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	1	1	-	1
CO2	3	2	-	-	-	-	1	-	-	-	-	-
CO3	3	1	2	-	-	-	1	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-

5. Course Plan

Topics	**CO mapping**	**No of Classes**
Basic organization of computers; Block level organization of the functional units; Programmability concepts and program execution model; Instruction execution cycles.	**CO1**	**4**
Instruction set architecture: Instruction set, instruction types and formats, addressing modes; Assembly language programming	**CO3**	**8**
Information representation, Computer arithmetic and their implementation	**CO1, CO2**	**4**
Processor organization: Components of a processor, functional components, control and data path, design of data paths, Control unit design	**CO1**	**6**
Memory and I/O access: Memory and I/O addressing and data transfer, synchronization and handshaking	**CO1, CO2**	**8**
Input-output organization: I/O mapping, Programmed I/O, Polled and Interrupt driven I/O, DMA data transfer; I/O subsystems: Peripheral devices such as Disk, CD-ROM, Printer etc.; Interfacing with I/O devices, keyboard and display interfaces;	**CO2, CO4**	**8**
Memory organization: Types of memory, static and dynamic memory organization; Memory Hierarchy – Cache memory and their organization, Virtual memory mechanisms;	**CO1, CO2**	**10**

Advanced Architectures: RISC versus CISC architectures; Parallel architectures- Instruction level parallel (ILP) processors- Pipelined, VLIW, Superscalar, Hazards ILPs; Multiprocessors & Multicomputer architectures, Vector processing; Multicore Processors	**CO4**	**4**

6. Suggested Reading:

Textbook

1. Computer Organization and Architecture: Designing for Performance 9E, William Stallings, Pearson Education.
2. Computer Organization, Hamacher, Zaky, Vranesic, McGrawHill.

Supplementary Texts

1. Computer Organization and Design: The Hardware/ Software Interface, Patterson and Hennessy, Elsevier.
2. Computer System Architecture, M. Mano, Pearson.
3. Introduction to Assembly Language Programming, S Dandamudi, Springer.

6. Student Evaluation

Sl.no	Component	Marks
1	Test I (Type A) + Test II (Type B)	10+10 = 20
2	Midterm	30
3	End-Term	50

Total : 100

7. Pedagogy

Teaching-Learning Methods to be used

- Lectures and Discussion
- Tutorials
- Assignments