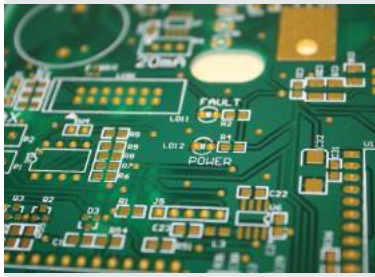
22EC207 COMPUTER ARCHITECTURE AND ORGANIZATION



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Hours Per Week :

L	T	P	C
2	2	0	3

PREREQUISITE KNOWLEDGE: Basics of Computers, Digital Electronics.

COURSE DESCRIPTION AND OBJECTIVES:

This course introduces the principles of computer organization and the basic architecture concepts. The course emphasizes design issues involved in the design and utilization of computing systems, including components, functions, instruction set architecture, performance evaluation, arithmetic, implementation, memory, input/output, pipeline, and multiprocessors.

MODULE–1

UNIT-1 **6L+6T+0P=12 Hours**

STRUCTURE OF COMPUTERS:

Introduction: History of computers; Von-Neumann, Harvard, Super Harvard architectures, Computer components, Computer Function.

Instruction Set Architecture (ISA): The Evolution of the Intel x86 Architecture, ARM Architecture, CISC Vs RISC; Designing for performance, Amdahl's law.

UNIT-2 **10L+10T+0P=20 Hours**

COMPUTER ARITHMETIC AND CPU:

Computer Arithmetic: Integer representation, Integer arithmetic, Floating-point representation, IEEE Standard 754, Floating-point arithmetic.

Instruction Sets: Address format, Instruction format, Types of operands, Intel x86 and ARM data types, Types of operations, and Addressing modes.

CPU Implementation: Processor organization, Register organization, Stack organization, Hardwired logic, Micro programmed logic.

PRACTICES:

- Examples of Von-Neumann, Harvard architectures.
- CISC and RISC instructions.
- 8086, 8051, ARM7 basics.
- Evaluating Performance.
- Arithmetic and Logic Micro-Operations.
- Integer arithmetic.
- Single precision representation in IEEE Standard 754.
- Floating point arithmetic.
- Problem Solving on Instruction Format.
- Examples for status flags.
- Instruction sets and addressing modes of 8086.
- Register Transfer Language.
- RTL interpretation of instructions.
- Arithmetic Logic Unit design.
- Difference between Hardwired and Micro-programmed Control Unit.

MODULE–2

UNIT-1 **8L+8T+0P=16 Hours**

MEMORY ORGANIZATION:

Memory: Internal memory - RAM, ROM; External memory - Magnetic disk, RAID, Cache memory,

SKILLS:

- ✓ *Understand the specifications and how well different components work together for a computer.*
- ✓ *Learn different data and number representations.*
- ✓ *Design ALU and Control unit.*
- ✓ *Identify the types of memories and their uses.*
- ✓ *Choose the appropriate data transfer mechanism for a given application.*

Mapping techniques, Virtual memory, Paging and Segmentation.

UNIT-2 **8L+8T+0P=16 Hours**

I/O ORGANIZATION AND MULTIPROCESSORS:

Input/Output: Memory-mapped I/O, Isolated I/O, Programmed I/O, Interrupt driven I/O, DMA. Pipeline: Arithmetic pipeline, Instruction pipeline, RISC pipeline.Multiprocessors: Characteristics of multiprocessors, Interconnection structures.

PRACTICES:

- Memory hierarchy.
- Memory capacity.
- Memory interface with 8086.
- Hit and Miss ratio.
- Mapping techniques.
- Write through and write back.
- Cache performance.
- I/O communication.
- IN/OUT instructions of 8086.
- Interfacing of 8086 with 8255.
- Pipeline dependencies.
- Flynn's taxonomy.
- Introduction to Visio/edraw/Verilog.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Build the computer system with functional units and levels of programming languages.	Apply	1	1, 2, 12
2	Make use of number system for data representation and binary arithmetic in digital computers.	Apply	1	1, 2, 5, 12
3	Apply arithmetic algorithms and interpret the processed data to build the CPU.	Apply	1	1, 2, 3, 5, 12
4	Categorize various memory mechanisms and different data transfer techniques.	Analyze	2	1, 2, 12
5	Classify various pipelining and multiprocessors.	Analyze	2	1, 2

TEXT BOOKS:

1. William Stallings, "Computer Organization & Architecture: Designing for Performance", 11th Edition, Pearson, 2019.
2. John D. Carpinelli, "Computer Systems Organization and Architecture", Pearson, 1st Edition, 2010.

REFERENCE BOOKS:

1. M. Morris Mano, "Computer System Architecture", Pearson, 3rd Edition update, 2017.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design-ARM Edition: The Hardware/Software Interface", Morgan Kaufmann Publication, Elsevier, 2017.
3. Linda Null and Julia Lobur, "Essentials of Computer Organization and Architecture", Jones & Bartlett Publishers, 5th Edition, 2018.
4. Sajjan G. Shiva, "Computer Organization, Design, and Architecture", CRC Press, Taylor & Francis, 5th Edition, 2014.
5. Jim Ledin, "Modern Computer Architecture and Organization", Packt Publishing, 2020. Applications and Design", 3rd edition, Wiley, 2022.