# III Year I Semester

# Code: 20AI5655

# HIGH PERFORMANCE COMPUTING (Honors)

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# **Course Objectives:**

After completion of this course, students able to

- 1. Understand the high-performance computing techniques
- 2. Understand the pipelining techniques in performance of the computing.
- 3. Understand the memory management techniques.
- 4. Understand the parallelism techniques
- 5. Understand the multiprocessor architectures

#### **Course Outcomes:**

Upon completion of the course, graduates will be able to

- 1. Inferring the high-performance computing techniques
- 2. Interpreting the pipelining techniques in performance of the computing
- 3. Annotating the memory management techniques
- 4. Inferring the parallelism techniques
- 5. Distinguish the multiprocessor architectures

#### UNIT-I

Introduction: Review of basic computer architecture, quantitative techniques in computer design, measuring and reporting performance. CISC and RISC processors.

#### UNIT-II

Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards, and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques. Compiler techniques for improving performance.

## UNIT-III

Hierarchical memory technology: Introduction, Coherence and locality of reference properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies.

## UNIT-IV

Instruction-level parallelism: Basic concepts, techniques for increasing ILP, superscalar, superpipelined and VLIW processor architectures. Array and vector processors.

## UNIT-V

Multiprocessor architecture: Taxonomy of parallel architectures. Centralized shared-memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture.

#### **Text Book:**

1. John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.

## **Reference Books**:

- 1. John Paul Shen and Mikko H. Lipasti, Modern Processor Design: Fundamentals of Superscalar Processors, TataMcGraw-Hill
- 2. M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.
- 3. Kai Hwang, Advanced Computer Architecture: Parallelism, Scalability, Programmability, McGraw-Hill.