Subject Code	Subject Name	Credits
26CS004	COMPUTER ARCHITECTURE	4

Course Objectives:

1. To cover fundamental concepts of computer architecture and computer organization (particularly, structures and functions of significant components of computer systems)
2. To know their design/functioning perspectives.
3. To relate these concepts to contemporary design of computer systems

Learning Objectives:

On successful completion of the course, students will be able to:

1. Explain the working principles of various components of modern computer systems.
2. Comprehend and differentiate various computer architectures and hardware.
3. Design algorithms for memory management techniques
4. Analyse the performance of a system by applying various Cache memory optimization techniques

Unit I - Introduction to Computer Architecture and Organization (12 Hrs.)

Von Neumann architecture, Flynn's taxonomy. Register Transfer and Micro-operations: Register Transfer Language, Arithmetic Micro-operations, Logic Micro-operations, Shift Micro-operations, Bus and Memory Transfers. Computer Organization and Design: Instruction Cycle, Computer Registers, Common Bus System, Computer Instructions, Addressing Modes, Design of a Basic Computer.

Unit II - The Arithmetic and Logic Unit (12 Hrs.)

Fixed-Point Representation: Integer Representation, Sign Magnitude, 1's and 2's Complement and Range. Integer Arithmetic: Negation, Addition and Subtraction, Multiplication, Division. Floating-Point Representation and Floating-Point Arithmetic. Control Unit: Hardwired Control Unit, Microprogrammed Control Unit, Control Memory, Microprogram Sequencing.

Unit III - CPU Organization (12 Hrs.)

Basic CPU Organization, Multiple Bus Organization, Execution of Instructions, Instruction Cycle. Control Unit Design: Hardwired Control, Microprogrammed Control. Introduction to Instruction-level parallelism.

UNIT IV - Pipelining (12 Hrs.)

Introduction to Instruction pipeline, Pipeline Hazards – Data Hazards and Control Hazards. Data Path and Control Considerations. Performance Considerations. Exception Handling. Advanced Concepts in Pipelining. Dynamic Scheduling. Multiple Issue Processors.

UNIT V - Memory Organization (12 Hrs.)

Semiconductor Memory Technologies, Memory hierarchy, Interleaving. Main Memory – RAM and ROM Chips, Address Map. Associative memory – Hardware Organization. Cache Memory – Size vs Block Size. Mapping Functions – Associative, Direct, Set Associative Mapping. Replacement Algorithms. Write Policies. Auxiliary Memory – Magnetic Disks.

Reference Books:

1. Carl Hamacher,ZvonkoVranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.
2. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Third Edition, Elsevier, 2005.
3. William Stallings, "Computer Organization and Architecture: Designing for Performance", Sixth Edition, Pearson Education, 2003.
4. John P. Hayes, "Computer Architecture and Organization", Third Edition, Tata McGraw Hill, 1998.