Computer Architecture (3-1-0)

Evaluation:

	Theory	Practical	Total
Sessional	50	-	50
Final	50	-	50
Total	100	-	100

Course Objectives

The general objectives of the course are as follows:
- To acquaint the students with the fundamentals of computer systems.
- To apprise the students with the architectural and associated components of computer systems.
- To aware the students about the architecture of the computer systems available in the market.

Course Contents

Unit I: Introduction 4 **hours**

Computer Organization and Computer Architecture , Review of Evolution of Computer System Basic Structure of Computer System, Examples of Computer Families, Future Trends in Computer, Review of Instruction Sets, Addressing Modes and Instruction Formats

Unit II: Register Transfer and Micro Operations 2 **hours**

Register Transfer and RTL, Micro operations, Data Transfer Micro operations, Arithmetic and Logical Micro operations, Shift Micro operations, Introduction to HDL and VHDL

Unit III: Central Processing Unit 3 **hours**

CPU Organization/Structure, Register Organization and Data Paths, Instruction Cycle, Arithmetic and Logical Unit and Design Principles for Modern Systems

Unit IV: Computer Arithmetic 6 **hours**

Integer Representation, Integer Arithmetic, Unsigned Binary Addition and Subtraction, Unsigned Binary Multiplication Algorithm, Booth's Algorithm, Unsigned Binary Division Algorithm, Floating Point Representation, BCD Arithmetic Unit, BCD Adder, Arithmetic Pipelining

Unit V: Control Unit 6 **hours**

Control of the Processor, Hardwired Control Unit: Control Unit Inputs and Control Unit Logic Micro programmed Control Unit: Micro Instructions and Its Types and Architecture of Micro programmed Control Unit, Micro Instruction Sequencing, Micro Instruction Execution, Applications of Hardwired and Micro programmed Control Units

Unit VI: Memory Organization 6 **hours**

Memory Hierarchy, Main Memory: RAM and ROM, Auxiliary Memory: Magnetic Disks and Tapes, Optical Disks, Flash Drives, Review of RAID. Associative Memory: Hardware Organization, Address Matching Logic, Read/Write Operations. Cache Memory: Cache Initialization, Mapping Cache Memory, Direct, Associative and Set Associative Memory Mapping Write Policy

Unit VII: Input Output Organization 4 **hours**

External Devices, I/O Module Structure, Review of Programmed I/O and Interrupt Driven I/O, Review of DMA, I/O Channels and I/O Processors, External Interfaces,

Unit VIII: Reduced Instruction Set Computers   **4 hours**

RISC VS. CISC, RISC Pipelining, Instruction Pipelining, Conflicts in Instruction Pipelining and their Solutions, Introduction to Register Windows and Register Renaming

Unit IX: Introduction to Parallel Processing   **6 hours**

Parallelism in Uniprocessor System, Multiprocessor Systems and their Characteristics
Flynn's Classification, Interconnection Structures in Multiprocessors, Cache Coherence
Introduction to Vector Processing and Array Processors, Introduction to Multithreaded Architecture

Unit X: Multicore Computers   **3 hours**

Hardware Performance Issues: Increase in Parallelism, Alternative Chip Organizations, Power Consumption, Software Performance Issues: Software on Multicore, Multicore Organization, Dual Core and Quad Core Processors, Power efficient Processors

Laboratory

The individual student should develop a project or perform a case study on Computer Architecture. The topic could be either initiated by the student or selected from a list provided by the instructor. An oral presentation with a demonstration in case of project should be part of the laboratory. Reports must be prepared.

Text Books
- Stallings, W., "*Computer Organization and Architecture*", Eighth Edition, 2011, Pearson.
- Mano, M.M., "*Computer Systems Architecture*", Third Edition, 2011, Pearson.

References
- Tanenbaum, A.S., "*Structured Computer Organization*", Fourth Edition, 2003, Pearson Education.
- Carpinelli, J.D., "*Computer Systems Organization and Architecture*", 2012, Pearson.
- Rajaraman, V. et all, "*Computer Organization and Architecture*", 2011, PHI.
- Sima, D. et all, "*Advanced Computer Architecture*", 2000, Addison Wesley.