Devi Ahilya University, Indore, India Institute of Engineering & Technology				**II Year B.E. (Computer Engineering) (Full Time)**			
Subject Code & Name	**Instructions Hours per Week**			**Credits**			
CER3G1	**L**	**T**	**P**	**L**	**T**	**P**	**Total**
COMPUTER ORGANIZATION & ARCHITECTURE	**3**	**1**	**0**	**3**	**1**	**0**	**4**
Duration of Theory Paper: 3 Hours							

Learning Objectives:

- Provide a framework for understanding the fundamentals of computing.
- To familiarize students with relationship between hardware and software to focus on the concepts that are the basis for current computers.
- Develop skills to understand how to design a computer.
- Develop ability to understand how to enhance performance of a computer system.

Prerequisites: NIL

COURSE CONTENTS

Unit-I

Introduction: Difference Between Computer Organization and Computer Architecture, Computer Types, Flynn's Classification, Functional Units, Basic Operational Concepts: Bus Structures, Software; Performance: Processor Clock, Basic Performance Equation, Clock Rate, Compiler, Performance Measurement; Multiprocessors and Multicomputers, Historical Perspective: Generation of computer, Evolution of Performance; Arithmetic for Computers: Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Booth Algorithm, Floating Point Arithmetic: Addition and Multiplication.

Unit-II

Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories: ROM, PROM, EPROM, EEPROM, Flash Memory; Memory Speed, Size and Cost Considerations; Cache Memories: Mapping Functions, Replacement Algorithms, Performance Considerations, Hit Rate and Miss Penalty, Caches on the Processor Chip; Virtual Memories: Address Translation; Memory Management Requirements.

Unit-III

Processing Unit: Addressing Modes, Connections between the Processor and the Memory, Processor Activity, Instruction cycle, John Von Neumann Architecture, State Machine Concept, Processor as a State Machine, Data Path Architecture, Data Path Controller: Microprogrammed; Hardwired Design, Firmware Design, Microcontroller Design, Design of Flip-Flop to understand the Design of CPU.

Unit-IV

Input Output Organization: I/O Devices: Introduction**,** Typical Collection, Diversity; Dependability, Reliability, Availability, Disk Storage, Flash Storage, Connecting Processor Memory and I/O Devices, Connection Basics, Interfacing I/O Devices to the Processor Memory and Operating System: Giving Commands to I/O Devices, Communicating with the Processor, Interrupt Priority Levels, Transferring the Data between a Device and Memory, Direct Memory Access and

the Memory System; I/O Performance Measures, Impact of I/O on System Performance.

Unit-V

Pipelining & Multiprocessors: Principles of Pipelining, Principles of Linear Pipelining, Clock Period, Speedup, Efficiency, Throughput, Classification of Pipeline Processor, General Pipelines and Reservation Tables, Collision Vector, State Diagram for a Pipeline, Pipeline Hazards, Shared Memory Multiprocessors, Clusters and Other Message-Passing Multiprocessors, Introduction to Graphics Processing Units, Introduction to Multiprocessor Network Topologies.

Learning Outcomes:

Upon completing the course, students will be able to:

- Acquire advance knowledge and understanding of computing.
- Use skills in computer design.
- Apply acquired knowledge to improve performance of a computer.
- In addition to development in technology student will be able to innovate in the architecture of computers, such as the use of caches and pipelining.

Books Recommended:

1. Computer Organization, 5th Ed., C. Hamacher, Z. Vranesic, S. Zaky, McGraw Hill International Edition 2002.
2. Computer Organization and Design, 5th Ed. ,David A. Patterson, John L. Hennessy, The hardware/software interface, Morgan Kaufmann Publisher, 2014.
3. Patterson & Hennessy, Computer Organization and Design, Morgan Kaufmann Publisher, 2007.
4. Computer Architecture and Parallel Processing, Kai Hwang, Faye A. Briggs, McGraw Hill Education, 2012.

List of Assignments (Theory):

During the learning of course, students need to do assignments:

1. Performance measurement of a Computer.
2. Arithmatic for Computers.
3. Cache Hit Rate/Miss Penalty issues.
4. Virtual Memory : Address Translation.
5. Use of Addressing Modes.
6. Study on designs of CPU.
7. Secondary storage performance.
8. Impact of I/O on system performance.
9. Pipelining performance.
10. Multi-core, GPU Processor and Multiprocessor : A Comparison.