

Objective:

To understand principles that are shaping computing and organizational paradigms that determine the capabilities, performance and success of computer systems.

Theory:**Unit I Computer Abstraction and Technology**

Hardware and Software layers, five classic components of computer organization, computer performance

Unit II Instructions

Operations of Computer Hardware, Operands, Signed and Unsigned Numbers, Memory Addressing Modes, Parallelism and Instructions, x86 Instructions Arithmetic for computers, Addition and subtraction, Multiplication, Division, Floating Point, Parallelism and computer arithmetic, Floating point in x86

Unit III Pipelining and Instruction-Level Parallelism

Basic Pipeline Operations; Data and Control Pipeline Hazards; Instruction-Level Parallelism; Dynamic Instruction Scheduling and Branch Prediction

Unit IV Memory-Hierarchy Design

Cache Design Issues; Performance Evaluation; Virtual Memory Addressing; Memory Protection Mechanisms; Memory coherency techniques

Unit V Storage Systems

Types of Storage Devices; Buses-Connecting I/O Devices to CPU/Memory; I/O Performance Measures; Reliability, Availability, and RAID; Interfacing to an Operating System

Unit VI Multicores, Multiprocessors, and Clusters

Difficulty of Creating Parallel Processing Programs, Shared Memory Multiprocessors, Clusters and other Message Passing Multiprocessors, Hardware Multithreading, Introduction to Graphics Processing Units

Practical:

1. Survey of different hardware manufacturing companies
2. Exercise to understand throughput, response time and performance
3. Exercise on Amdahl's law
4. Exercise on Arithmetic 1 & Arithmetic 2
5. Exercise on Floating Point
6. Exercise on Pipelining
7. Exercise on cache hit and miss
8. Exercise on Storage and Exercise on I/O

Reference books:

1. Advanced Computer Architecture - Parallelism, Scalability, programmability, By Hwang, Tata McGraw hill Edition
2. D. Sima, T. Fountain, P. Kacsuk, Advanced Computer Architecture, Addison-Wesley.
3. H.S. Stone, High-performance Computer Architecture, 3rd edition, Addison-Wesley.
4. J. L. Hennessy and D. A. Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann.
5. Patterson, D. A. and Hennessy, J. L., Computer Organization and Design: The Hardware / Software Interface, Morgan Kaufmann.