RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Computer Science & Information Technology, VI-Semester

Departmental Elective CSIT- 603 (C) Advanced Computer Architecture (ACA)

Objectives

This subject aims to provide students with a fundamental knowledge of computer hardware and computer systems, with an emphasis on system design and performance. The module concentrates on the principles underlying systems organization, issues in computer system design, and contrasting implementations of modern system

Course Outcomes:

1. Discuss the classes of computers, and new trends and developments in computer architecture.
2. Study advanced performance enhancement techniques such as pipelines, dynamic scheduling branch predictions, caches.
3. Compare and contrast the modern computer architectures such as RISC, Scalar, and multi CPU systems.
4. Critically evaluate the performance of different CPU architecture.
5. Improve the performance of applications running on different CPU architectures.
6. Develop applications for high performance computing systems.

Course Contents:

UNIT I:

Flynn's Classification, System Attributes to Performance, Parallel computer models - Multiprocessors and multicomputers, Multivector and SIMD Computers. Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Control flow, data flow and Demand driven mechanisms. Static interconnection networks, Dynamic interconnection Networks: Bus Systems, Crossbar Switch, Multiport Memory, Multistage and Combining Networks.

UNIT II:

Instruction set architecture, CISC Scalar Processors, RISC Scalar Processors, VLIW architecture, Memory Hierarchy, Inclusion, Coherence and Locality, Memory capacity planning. Interleaved memory organization-memory interleaving, pipelined memory access, Bandwidth and Fault Tolerance. Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt.

UNIT III:

Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, pipeline hazards, Dynamic instruction scheduling - score boarding and Tomosulo's algorithm, Branch handling techniques, Arithmetic Pipeline Design, Static arithmetic pipeline, Multifunctional arithmetic pipelines. Superscalar pipeline design, Super pipeline processor design.

UNIT IV:

Cache coherence, Snoopy protocols, Directory based protocols. Message routing schemes in multicomputer network, deadlock and virtual channel. Vector Processing Principles, Vector instruction types, Vector-access memory schemes. Vector supercomputer architecture, SIMD organization: distributed memory model and shared memory model. Principles of Multithreading: Multithreading Issues and Solutions, Multiple-Context Processors.

UNIT V:

Parallel Programming Models, Shared-Variable Model, Message-Passing Model, Data-Parallel Model, Object-Oriented Model, Functional and Logic Models, Parallel Languages and Compilers, Language Features for Parallelism, Parallel Programming Environment, Software Tools and Environments.

Recommended Books:

1. Kai Hwang, "Advanced computer architecture", TMH.
2. J.P.Hayes, "computer Architecture and organization"; MGH.
3. V.Rajaranam & C.S.R.Murthy, "Parallel computer"; PHI Learning.
4. Kain,"Advance Computer Architecture: -A System Design Approach", PHI Learning.
5. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing.
6. Hwang and Briggs, "Computer Architecture and Parallel Processing"; MGH.
7. David E. Callav & Jaswinder Pal Singh Marge Kaufmann",Advance Computer Architecture", EIS India.
8. Sajjan G. Shiva, Taylar & Francis, "Advance Computer Architecture.