

AP5001 COMPUTER ARCHITECTURE AND PARALLEL PROCESSING

DETAILED SYLLABUS

OBJECTIVES

- Understand the difference between pipeline and parallel processing concepts
- Study various types of processor architectures and the importance of scalable architectures
- Study Memory Architectures, Memory Technology and Optimization.

UNIT I COMPUTER DESIGN AND PERFORMANCE MEASURES

Fundamentals of Computer Design – Parallel and Scalable Architectures – Multiprocessors – Multivector and SIMD architectures – Multithreaded architectures – Stanford Dash multiprocessor – KSR1 - Data-flow architectures - Performance Measures

UNIT II PARALLEL PROCESSING, PIPELINING AND ILP

Instruction Level Parallelism and Its Exploitation - Concepts and Challenges - Pipelining processors - Overcoming Data Hazards with Dynamic Scheduling – Dynamic Branch Prediction - Speculation - Multiple Issue Processors - Performance and Efficiency in Advanced Multiple Issue Processors

UNIT III MEMORY HIERARCHY DESIGN

Memory Hierarchy - Memory Technology and Optimizations – Cache memory – Optimizations of Cache Performance – Memory Protection and Virtual Memory - Design of Memory Hierarchies.

UNIT IV MULTIPROCESSORS

Symmetric and distributed shared memory architectures – Cache coherence issues – Performance Issues – Synchronization issues – Models of Memory Consistency - Interconnection networks – Buses, crossbar and multi-stage switches.

UNIT V MULTI-CORE ARCHITECTURES

Software and hardware multithreading – SMT and CMP architectures – Design issues – Case-studies – Intel Multi-core architecture – SUN CMP architecture – IBM cell architecture – hp architecture.

REFERENCES

1. David E. Culler, Jaswinder Pal Singh, "Parallel Computing Architecture: A hardware/software approach", Morgan Kaufmann / Elsevier, 1997
2. Dimitrios Soudris, Axel Jantsch, "Scalable Multi-core Architectures: Design Methodologies and Tools", Springer, 2012
3. Hwang Briggs, "Computer Architecture and parallel processing", McGraw Hill, 1984.
4. John L. Hennessey and David A. Patterson, "Computer Architecture – A quantitative approach", Morgan Kaufmann / Elsevier, 4th. edition, 2007
5. John P. Hayes, "Computer Architecture and Organization", McGraw Hill
6. John P. Shen, "Modern processor design. Fundamentals of super scalar processors", Tata McGraw Hill 2003
7. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 2001
8. William Stallings, "Computer Organization and Architecture – Designing for Performance", Pearson Education, Seventh Edition, 2006