



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

ADVANCED COMPUTER ARCHITECTURE								
II Semester: CSE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2525804	Foundation	3	0	0	3	40	60	100
		Practical Classes: Nil			Total Classes: 45			
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 45			
Prerequisites: Computer Organization.								

Course Overview:

This is a specialized course that explores the design, organization, and performance optimization of modern computer systems. It builds on basic computer architecture concepts and dives into advanced techniques for improving throughput, efficiency, scalability, and parallelism in high-performance processors and computing systems.

Course Objectives:

1. To understand the concepts and principles of parallel and advanced computer architectures.
2. To study performance optimization techniques, scalability, and parallel processing models.
3. To analyze pipelining, superscalar, vector, and SIMD architectures in modern processors.
4. To understand shared-memory, multiprocessor, and multicomputer system architectures and synchronization mechanisms.
5. To design efficient high-performance computing systems using advanced parallel architecture techniques.

Course Outcomes: After Completion of the Course, Students should be able to

1. Apply models of parallelism, program partitioning, and scheduling techniques to optimize execution in distributed and high-performance systems.
2. Analyze performance metrics, speedup laws, and scalability approaches to evaluate the efficiency of parallel systems.
3. Implement shared-memory architectures, pipelining, and superscalar designs to improve throughput in modern processors.
4. Evaluate interconnection networks, cache coherence, and synchronization mechanisms for reliable multiprocessor and multicomputer systems.
5. Design vector and SIMD architectures to support advanced applications in machine learning, graphics, and scientific simulations.

UNIT - I: Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT - II: Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors.

UNIT - III: Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT - IV: Parallel and Scalable Architectures, Multiprocessors and Multicomputer, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputer, Message-passing Mechanisms, Multivector and SIMD computers.

UNIT - V: Vector Processing Principles, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

TEXT BOOKS:

1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers.

REFERENCE BOOKS:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor & Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press

ELECTRONIC RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc25_cs01/preview
2. <https://www.coursera.org/learn/comparch>
3. <https://www.udemy.com/course/advance-computer-architecture-and-organization/>
4. <https://online.vtu.ac.in/course-details/Advanced-Computer-Architecture>

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper – II
9. Lecture notes
10. E-Learning Readiness Videos (ELRV)