INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPT./CENTRE: **Electronics and Computer Engineering**

1. Subject Code: **EC – 556N** Course Title: **Advanced Computer Architecture**

2. Contact Hours: **L : 3** **T : 0** **P : 0**

3. Examination Duration (Hrs.): **Theory** 0 | 3 **Practical** 0 | 0

4. Relative Weight: **CWS** 15 **PRS** 00 **MTE** 35 **ETE** 50 **PRE** 00

5. Credits: 0 | 3 6. Semester: [ ] **Autumn** [√] **Spring** [ ] **Both**

7. Pre-requisite: **EC - 252**

8. Subject Area: **MSC**

9. Objective: To expose students to advanced techniques of computer design such as pipelining, vector processing and multiprocessing.

10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	Fundamentals of computer design, measuring and reporting performance.	2
2.	Principles of linear pipelining; Instruction level parallelism and instruction pipelines, speedup, data dependency hazards, remedial measures, branch handling; Arithmetic pipelines; Pipeline control methods; Job sequencing, collision prevention and pipeline chaining; Case study of pipelined systems.	8
3.	Loop unrolling, software pipelining and trace scheduling techniques for exposing instruction level parallelism.	4
4.	Dynamic scheduling algorithms, exploiting ILP using static scheduling and dynamic scheduling, hardware based speculation, multiple issues, and speculation.	8
5.	Vector processing characteristics and requirements, pipelined vector processing, vectorization methods, examples of vector processing.	4
6.	Array processing, SIMD array processors, communication between PEs, SIMD interconnection networks, algorithms for array processing.	4
7.	Data and control parallelism, concurrency, scalability, speedup and Amdahl's law, PRAM model of parallel computation, parallel algorithms.	4

8.	Multiprocessors and multi-computers; Processor organizations: mesh, binary tree, hypercube; Shared memory and message passing systems; Mapping and Scheduling: Embedding of task graphs in processor graphs, dilation and loading, load balancing, models for static and dynamic scheduling.	6
9.	Overview of parallel programming using MPI and Open MP.	2
	Total	**42**

11. Suggested Books:

Sl. No.	**Name of Books / Authors**	**Year of Publication**
1.	Hennessy, J. L. and Patterson, D. A., "Computer Architecture", 4th Ed., Morgan Kaufmann.	2007
2.	Sima, D., Fountain, T. and Kacsuk, P., "Advanced Computer Architecture: A Design Space Approach", Pearson Education.	2007
3.	Michael, J.Q., "Parallel Computing: Theory and Practice", Tata McGraw-Hill.	2002
4.	Hwang, K., "Advanced Computer Architecture", Tata McGraw-Hill.	2003