NIRMA UNIVERSITY

Institute of Technology

M Tech Computer Science and Engineering/INS/DS

Semester – I

L	T	P	C
3	0	2	4

Course Code	6CS202
Course Name	High Performance Computing Architecture

Course Learning Outcomes (CLOs):

At the end of the course, students will be able to –

1. comprehend various High Performance Computing (HPC) system architectures
2. identify design issues related to the architectural characteristics and performance of HPC systems
3. design and implement compute intensive applications on HPC platform

Syllabus:

Teaching Hours

Unit I **08**

Parallel Computer Models: Computing states, Multiprocessors and Multicomputers, Multivector and SIMD Computers, Conditions of parallelism, Program Partitioning and scheduling, Program flow mechanisms, System interconnect architecture

Unit II **10**

Principles of Scalable Performance and Processor Hierarchy: Performance Metrics and Measures, Parallel processing applications, Speedup Performance Laws, Scalability Analysis and Approaches, Advanced Processor and Memory Hierarchy Technology, Distributed Shared Memory

Unit III **16**

Requirement and general issues of High Performance Computing: Dependable Clustered Computing,Metacomputing: Harnessing Informal Supercomputers, Specifying Resources and Services in Metacomputing Systems,High Speed Networks, Lightweight Messaging Systems, Xpress Transport Protocol, Software RAID and Parallel File systems, Load Balancing Over Networks, Job and Resource Management Systems

Unit IV **08**

Parallel Models and High Performance Languages: Scheduling Parallel Jobs on Clusters, Parallel Programming Models, Parallel and High Performance programming languages, Dependence Analysis of Data arrays

Unit V **03**

Advance Computing: Introduction to Petascale computing, Optical Computing, Quantum computing and its issues

Self Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 5 experiments to be incorporated.

Suggested Readings^:

1. Kai Hwang,Advance Computer Architecture: Parallelism, Scalability, Programmability, McGraw Hill International Editions
2. Buyya, Rajkumar, High Performance Cluster Computing : Programming and Applications, Pearson Education
3. Georg Hager and Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, CRC Press

L=Lecture, T=Tutorial, P=Practical, C=Credit

^this is not an exhaustive list