CS404: High Performance	L	T	P	Computer Architecture
	3	1	0	

Course Objective: To introduce the concept of advanced computer architectures with Parallel algorithms and Parallel programming with high end computer systems and methods for achieving high performance.

S. No.	Course Outcomes (CO)
CO1	Explain key characteristics of advanced computing architectures and their impact on performance.
CO2	Analyze computational complexity and performance using case studies from engineering applications.
CO3	Identify and compare memory hierarchies and processor models in HPC systems.
CO4	Implement and optimize parallel algorithms for both regular and irregular problems.
CO5	Apply parallel programming techniques and performance optimization methods to improve application efficiency.

S. No	Contents	Contact Hours
UNIT 1	Introduction to advanced computer architectures, parallel algorithms, parallel languages, and performance oriented computing, discussing about the key characteristics of highend computing architectures .	6
UNIT 2	Introduction to Computational Science and Engineering Applications, their characteristics and requirements, Review of Computational Complexity, Performance: metrics and measurements, Granularity and Partitioning, temporal/spatial/stream/kernel, Basic methods for parallel programming, Real-world case studies which are drawn from multiscale, multidiscipline applications .	8

UNIT 3	Memory Hierarchies, Multi core Processors, Homogeneous and Heterogeneous, Sharedmemory Symmetric Multiprocessors, Vector Computers, Distributed Memory Computers, Super computers and Petascale Systems, Application Accelerators / Reconfigurable Computing, Novel computers: Stream, multithreaded, and purposebuilt.	**8**
UNIT 4	Discussion about Parallel algorithms with Parallel models including ideal and real frameworks, Basic Techniques including Balanced Trees, Pointer Jumping, Divide and Conquer, Partitioning, Regular Algorithms: Matrix operations and Linear Algebra,Irregular Algorithms: Lists, Trees, Graphs, Randomization: Parallel PseudoRandom Number Generators, Sorting, Monte Carlo techniques.	**8**
UNIT 5	Parallel Programming involving Revealing concurrency in applications ,Task and Functional parallelism, Task Scheduling, Synchronization Methods, Parallel Primitives (collective operations), SPMD Programming (threads, OpenMP, MPI), I/O and File Systems, Parallel Matlabs (Parallel Matlab, StarP, Matlab MPI) Partitioning Global Address Space (PGAS) languages (UPC, Titanium, Global Arrays).	**10**
UNIT 6	Discussion about high performance methods with Achieving Measuring performance, Identifying performance bottlenecks, Restructuring applications for deep memory hierarchies, Partitioning applications for heterogeneous resources, Using existing libraries, tools, and frameworks	**8**
	Total	**48**