# 19CS32E3 - HIGH PERFORMANCE COMPUTING

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Category:** | Professional Elective | **Credits:** | 3 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-0-0 |
| **Prerequisite:** | Need to have a basic knowledge in parallel and computing techniques. | **Sessional Evaluation:**  **Univ. Exam Evaluation:**  **Total Marks:** | 40  60  100 |
| **Objectives** | * Understanding basic concepts, architecture and theoretical models of parallel computers. * Importance of compiler transformations, key issues and performance evaluation in parallel operating systems. | | |

|  |  |  |
| --- | --- | --- |
| **Course Outcomes** | Upon the successful completion of the course, the students will be able to: | |
| CO1 | Explore the need for parallel computers and supporting types of instructions |
| CO2 | Create awareness of structure of parallel computers |
| CO3 | Study different types of parallel algorithms and their applicability |
| CO4 | Acquire knowledge on compiler transformations for parallel computers. |
| CO5 | Understand various operating systems for parallel computers |
| CO6 | Study the performance evaluation of parallel computers |
| **Course Content** | **UNIT – I**  **Introduction –** Introduction to Parallel Computers, Utilizing Temporal Parallelism, Utilizing Data Parallelism, Comparison, Data Parallel Processing with Specialized Processors.  **Instruction Level Parallel Processing** - Pipelining, Delays, Difficulties, Superscalar Processors, Multithreaded Processors, Future Processor Architecture.  **UNIT – II**  **Structure of Parallel Computer -** Classifications, Vector Supercomputer, Array Processors, Systolic Array Processors, Shared Memory Parallel Computers, Interconnection Networks, Distributed Shared Memory Parallel Computers, Message Passing Parallel Computers, Cluster of Workstations.  **UNIT – III**  **Parallel Algorithms-** Models of Computation, Analysis of Parallel Algorithms, Prefix Computation, Sorting, Searching, Matrix Operations, Practical Models of Parallel Computations.  **UNIT – IV**  **Compiler Transformations for Parallel Computers -** Issues in Compiler Transformations, Target Architecture, Dependence Analysis, Transformations, Transformations for Parallel Computers, Fine Grained Parallelism, Transformation Framework, Parallelizing compilers.  **UNIT – V**  **Operating Systems for Parallel Computers -** Resource Management, Process Management, Process Synchronization, Interprocess Communication, Memory Management, Input / Output Disk Arrays.  **UNIT – VI**  **Performance Evaluation of Parallel Computers -** Basics of Performance Evaluation, Sources of Parallel Overhead, Speedup Performance Laws, Scalability Metric, and Performance Analysis. | |
| **Text Books and References** | **TEXT BOOK:**   1. Parallel Computers: Architecture and Programming, V.Rajaraman and C.Sivaram Murthy, Prentice-Hall of India private Ltd., 2000.   **REFERENCES:**   1. The Design and Analysis of Parallel Algorithms, SelimG.Akl, Prentice Hall International Inc, 1989. 2. Computer Architecture and Parallel Processing, Hwang K. Briggs F.A.McGraw Hill – 1985. | |
| **E-Resources** | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |