17CS3203 – HIGH PERFORMANCE COMPUTING

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| **Course Category:** | Professional Elective | **Credits:** | 4 |
| **Course Type:** | Theory | **Lecture – Tutorial – Practical:** | 3-2-0 |
| **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. | | |

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| **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, Selim G.Akl, Prentice Hall International Inc, 1989. 2. Computer Architecture and Parallel Processing, Hwang K. Briggs F.A.Mc Graw Hill – 1985. 3. The Technology of Parallel Processing, Parallel Processing Architecture and VLSI Hardware, Volume I, Angel L.Decegama, Prentice Hall Engle Wood Cliffs New Jersey 1989. 4. Parallel Computer Theory and Practice, Michael J.Quinn, McGraw Hill, Second Edition 1994. | |
| **E-Resources** | 1. <https://nptel.ac.in/courses> 2. <https://freevideolectures.com/university/iitm> | |