

# **Stream: High Performance Computing**

## **Courses: Sem-I**

- 1. Parallel Computing**
- 2. Distributed Computing**

## **Courses: Sem-II**

- 3. Multi-Core Computing**
- 4. Grid and Cloud Computing**

## **Parallel Computing**

### **Credit: 3 + 3Hrs/Week Lab**

#### **1. Introduction to Parallel Computing:**

Why Parallel Computing & Scope of Parallel Computing, Sieve of Eratosthenes, Control and Data Approach, PRAM model of parallel computation, Design paradigms of Parallel Computing, examples, Bulk Synchronous Parallel (BSP) model, algorithms on PRAM and BSP model.

#### **2. Classification:**

Flynn's Taxonomy, MPP, SMP, CC-NUMA, Clustering of Computers, Beowulf Cluster, Use of MPI in Cluster Computing. Debugging, Evaluating and tuning of Cluster Programs, Partitioning and Divide and Conquer Strategies. Cluster: dedicated high performance (HP), high availability (HA), CoPs, PoPs, CoWs; distributed, on-demand, high-throughput, collaborative, data-intensive computing, Interconnection networks.

#### **3. Practical Parallel Programming Paradigms:**

Foster's design paradigm for Multi computing programming, Programmability Issues, Programming Models: Message passing, Message passing standards: PVM (Parallel Virtual Machine), MPI (Message Passing Interface) and its routines, Advanced Features of MPI, Load balancing techniques.

#### **4. Programming on Multiprocessors:**

Introduction to OpenMP (History, Overview, Programming Model, OpenMP Constructs, Performance Issues and examples, Explicit Parallelism: Advanced Features of OpenMP). The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using Map-Reduce.

### **Text books:**

1. Quinn, M. J., Parallel Computing: Theory and Practice (McGraw-Hill Inc.).
2. Bary Wilkinson and Michael Allen: Parallel Programming Techniques using Networked of workstations and Parallel Computers, Prentice Hall, 1999.
3. R. Buyya (ed.) High Performance Cluster Computing: Programming and Applications, Prentice Hall, 1999.
4. William Gropp, Rusty Lusk, Tuning MPI Applications for Peak Performance, Pittsburgh (1996).
5. W. Gropp, E. Lusk, N. Doss, A. Skjellum, A high performance portable implementation of the message passing interface (MPI) standard, Parallel Computing 22 (6), Sep 1996.
6. Gibbons, A., W. Rytter, Efficient Parallel Algorithms (Cambridge Uni. Press).