MULTI CORE PROGRAMMING

(Professional Elective-VI)/ (Common for CSE,IT)

COURSE CODE: 15CT1138 **L T P C**
3 0 0 3

Pre-requisites: Linux

COURSE OUTCOMES:
At the end of the course the student shall be able to

CO1: Describe Multi-Core processor Architecture
CO2: Discuss multi core processors
CO3: Discuss Parallel Programming Concepts
CO4: Differentiate Threading API's
CO5: Use OpenMP programming and MPI programming

UNIT-I **(8-10 Lectures)**

INTRODUCTION TO MULTI-CORE ARCHITECTURE: Motivation for Concurrency in Software, Parallel ComputingPlatforms(SIMD & MIMD systems, an overview of Single-Core,Multi-Processor, Multi-Core Architectures) , Parallel Computing inMicroprocessors, Differentiating Multi-Core Architectures fromHyper-Threading Technology, Multi-threading on Single-Coreversus Multi-Core Platforms, Understanding Performance, Amdahl's Law, Gustafson's Law

UNIT-II **(8-10 Lectures)**

MULTI-CORE PROCESSORS: An Overview of Software Threading Defining Threads, System View of Threads: Threading above the Operating System, Threads inside the OS, Threads inside the Hardware , Application Programming Models and Threading ,Virtual Environment: Virtual Machines and Platforms, Runtime Virtualization, System Virtualization.

UNIT-III **(8-10 Lectures)**

PARALLEL PROGRAMMING FUNDAMENTAL CONCEPTS: Designing for threads, parallel programming patterns, Threading andparallel programming constructs: Synchronization, Critical sections,Deadlock, Synchronization Primitives, and Messages

UNIT-IV **(8-10 Lectures)**

THREADING API'S: Threading APIs for Microsoft Windows, Threading APIs for Microsoft .NET Framework: Creating Threads, Managing Threads, Thread Pools, Thread Synchronization, POSIX Threads: Creating Threads, Managing Threads, Thread Synchronization, Signaling, Compilation and Linking

UNIT-V **(8-10 Lectures)**

OPENMP PROGRAMMING: OpenMP Challenges in threading a loop, Minimizing Threading overhead, Performance oriented Programming, Library Functions. Solutions to parallel programming problems: Data races, deadlocks and Livelocks Non-blocking algorithms, Memory and cache related issues.

MPI PROGRAMMING: Message-Passing Model, Message-Passing Interface, MPI functions, Compiling and running MPI Programs, collective communication, data decomposition, Point-to-point communication – MPI Library.

TEXT BOOKS:

1. Shameem Akhter and Jason Roberts, *"Multi-coreProgramming- Increasing Performance through SoftwareMulti-Threading"*, 1st Edition, Intel Press, 2006.
2. Michael J Quinn, *"Parallel programming in C with MPIand OpenMP"*, 2nd Edition, Tata McGraw Hill, 2007.

REFERENCES:

1. John L.Hennessey and David A.Patterson, *"Computerarchitecture – A quantitative approach"*, 4thEdition, MorganKaufmann Elsevier Publishers, 2007.
2. David E. Culler, Jaswinder Pal Singh, *"Parallel computingarchitecture: A hardware software approach"*, 1st Edition,Morgan Kaufmann Elsevier Publishers, 1999.

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