MULTI CORE PROGRAMMING
(Professional Elective-VI)/ (Common to CSE & IT)

Course Code : 15CT1138	L	T	P	C
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Pre-requisites:

Computer Organization

Course Outcomes:

At the end of the Course, the Student will be able to:

CO 1 Describe Multi-Core processor Architecture

CO 2 Discuss multi core processors

CO 3 Discuss Parallel Programming Concepts

CO 4 Differentiate Threading API's

CO 5 Use OpenMP programming and MPI programming

UNIT-I   (10 Lectures)

INTRODUCTION TO MULTI-CORE ARCHITECTURE:

Motivation for Concurrency in Software, Parallel Computing Platforms (SIMD & MIMD systems, an overview of Single-Core,Multi-Processor, Multi-Core Architectures), Parallel Computing in Microprocessors, 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   (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   (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   (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   (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-core Programming - Increasing Performance through Software Multi-Threading", 1st Edition, Intel Press, 2006.
2. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", 2nd Edition, Tata McGraw Hill, 2007.

REFERENCES:

1. John L.Hennessey and David A.Patterson, "Computer architecture – A quantitative approach", 4th Edition, Morgan Kaufmann Elsevier Publishers, 2007.
2. David E. Culler, Jaswinder Pal Singh, "Parallel computer architecture: A hardware software approach", 1st Edition, Morgan Kaufmann Elsevier Publishers, 1999.