



# MANIPAL UNIVERSITY JAIPUR

School of Computing and Information Technology

Department of Computer Science and Engineering  
Course Hand-out

Parallel Processing | CS 1603 | 4 Credits

Session: 2015-2016 | Faculty: Jaya Krishnan

**Course Outcomes:** At the end of the course, students will be able to

**[CO 1603.1] Understand and employ the fundamental concepts and mechanisms which form the basis of the design of parallel computation models and algorithms.**

**[CO 1603.2] Recognize problems and limitations to parallel systems, as well as possible solutions.**

**[CO 1603.3] Familiar with some of the relevant papers in the area of parallel algorithms and systems, both current and classic to enhance entrepreneurship skills.**

## A. SYLLABUS

Introduction: Heterogeneous Parallel Computing, Architecture of a Modern GPU, Parallel Programming Languages and Models, History of GPU Computing, Introduction to Data Parallelism, Data parallelism and CUDA C: Data Parallelism, CUDA Program Structure, Device Global Memory and Data Transfer, Kernel Functions and Threading; Data-Parallel Execution Model: Cuda Thread Organization, Mapping Threads to Multidimensional Data, Matrix-Matrix Multiplication, Synchronization and Transparent Scalability, Assigning Resources to Blocks, Thread Scheduling and Latency Tolerance; CUDA Memories: Importance of Memory Access Efficiency, CUDA Device Memory Types Strategy for Reducing Global Memory Traffic, Tiled Matrix, Memory as a Limiting Factor to Parallelism, Performance Considerations; Performance Considerations: Warps and Thread Execution, Global Memory Bandwidth, Dynamic Partitioning of Execution Resources, Instruction Mix and Thread Granularity; Parallel Patterns: Convolution -1D/2D, Constant Memory and Caching, Prefix Sum, Sparse Matrix vector Multiplication; Programming Models: Open ACC, CUDA, C++AMP, Thrust, and important trends in heterogeneous parallel computing, CASE Studies.

## B. TEXT BOOKS

- i. D. Kirk and W. Hwu, Programming Massively Parallel Processors, 2nd Edition, Elsevier Inc. 2012.
- ii. Barbara Chapman, Gabriele Jost and Ruud Van Der Pas, Using OpenMP
- iii. Ananth Grama, George Karypis, Vipin Kumar, and Anshul Gupta, Introduction to Parallel Computing, 2nd Edition, Addison Wesley 2003.

