Course Title: Introduction to GPU Programming

Credit Structure (L-T-P-Cr): (3-0-2-4)

Course Code: IT477

Prerequisites: Good Programming Background in C/C++ and understanding of Algorithms.

Course objective: The course aims to give an overview of an important trend in high performance computing – GPU programming. GPUs (graphics processing units) are special purpose hardware originally designed for graphics and games; however GPUs are very efficient in solving some general-purpose computing problems particularly computationally intensive mathematical, engineering and scientific problems. The course will help the students in understanding the basic concepts of GPU programming, CUDA (Compute Unified Device Architecture) parallel computing platform and hands-on experience on implementing some standard CUDA programs. Students will also learn about design and analysis of parallel algorithms.

Course content:

- Parallel Programming concepts. GPUs as parallel computers. CPUs and GPUs.
- Introduction to Data Parallelism and Cuda C. GPU nVIDIA architecture. Setting up CUDA. Compile and execute simple CUDA programs. Example kernel functions and threading, Device global memory.

Case studies and parallel patterns: Vector/matrix addition. Matrix multiplication. Convolution. Reduction, Scan, Histogram etc.

Labs: Every week 2 hours. Implementation of case studies in lab and preparation of lab reports.

Project: Three weeks compulsory project. Team size -2.

Course Outcome: Ability to design parallel algorithms on many-core architectures such as GPUs and implement GPU based codes using CUDA.

Evaluation:
Second insem (30%) and end-sem exam (35%). Exam-Total = 65%;
Lab-attendance =5%;
Assignments = 15%;
Course Project =15%.
Suggested textbook/references:

1. CUDA by Example: An Introduction to General-Purpose GPU Programming. Author: Jason Sanders, Edward Kandrot, Publisher: Addison-Wesley.

2. Programming Massively Parallel Processors: A Hands-on Approach. Author: Wen-Mei Hwu, David Kirk; Publisher: Morgan Kaufmann

3. CUDA Programming by Shane Cook. Publisher: Morgan Kaufmann