COURSE CODE	COURSE TITLE	L T P C
UCS1727	GPU COMPUTING	3 0 0 3

OBJECTIVES

 To understand the basics of GPU architectures

 To write programs for massively parallel processors

 To understand the issues in mapping algorithms for GPUs

 To introduce different GPU programming models

 To understand the concepts of OpenCL

UNIT I GPU ARCHITECTURE 12

Evolution of GPU architectures -- Understanding Parallelism with GPU -- Typical GPU Architecture -- CUDA Hardware Overview -- Threads, Blocks, Grids, Warps, Scheduling -- Memory Handling with CUDA: Shared memory, Global memory, Constant memory and Texture memory.

UNIT II CUDA PROGRAMMING 8

Using CUDA -- Multi GPU -- Multi GPU Solutions -- Optimizing CUDA Applications: Problem decomposition, Memory considerations, Transfers, Thread usage, RNesource contentions.

UNIT III PROGRAMMING ISSUES 8

Common Problems: CUDA error handling, Parallel programming issues, Synchronization, Algorithmic issues, Finding and avoiding errors.

UNIT IV OPENCL BASICS 8

OpenCL Standard -- Kernels -- Host Device Interaction -- Execution Environment – Memory Model -- Basic OpenCL Examples.

UNIT V ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix -- Matrix Multiplication -- Programming Heterogeneous Cluster.

TOTAL PERIODS: 45

OUTCOMES

On successful completion of this course, the student will be able to

- Understand GPU architecture (K2)
- Write programs using CUDA, identify issues and debug them (K3)
- Implement efficient algorithms in GPUs for common application kernels such as matrix multiplication (K3)
- Write simple programs using OpenCL (K3)
- Write an efficient parallel program for a given problem(K3).

TEXTBOOKS

1. Shane Cook, “CUDA Programming: A Developer ’s Guide to Parallel Computing withGPUs (Applications of GPU Computing)”, 1st Edition,Morgan Kaufmann, 2012.

2. DavidRKaeli, Perhaad Mistry, Dana Schaa, Dong Ping Zhang, “Heterogeneous Computing with OpenCL”, 3rd Edition, Morgan Kauffman, 2015.

REFERENCE BOOKS

1. DavidB Kirk, Wen-mei W Hwu, “Programming Massively parallel Processors – A

Hands-on Approach”, 3rd Edition,Morgan Kaufmann, 2016.

2. Nicholas Wilt, “CUDA Handbook: A Comprehensive Guideto GPU Programming”,

Addison - Wesley, 2013.

3. Jason Sanders, Edward Kandrot, “CUDA by Example: An Introduction to General

Purpose GPU Programming”, Addison - Wesley, 2010.

4. http://www.nvidia.com/object/cuda_home_new.html

5. http://www.openCL.o