HPC LAB

Course Code	21CSL73	**Credits**	1
Hours/Week (L-T-P-S)	0-0-2	**CIE Marks**	50
Total Teaching Hours	26	**SEE Marks**	50
Exam Hours	03	**Course Type**	PCC
Course Component	Practical		

COURSE LEARNING OUTCOMES

Students will be able to:

1. Design and implement high performance versions of standard single threaded algorithms
2. Demonstrate the architectural features in the GPU and MIC hardware accelerators
3. Design programs to extract maximum performance in a multicore, shared memory execution environment processor
4. Develop programs using OPENMP, MPI and CUDA
5. Design and deploy Parallel programs on Processor clusters, configuring clusters and cloud storage.

Pre-Requisite Knowledge: (You can delete this row if it is not applicable)

The student should possess prior knowledge of

COURSE CONTENTS

PART A

1. Given a nxn matrix A and a vector x of length n, their product y=A·x, write a program to implement the multiplication using OpenMP PARALLEL directive.
2. Consider a Scenario where a person visits a supermarket for shopping. He purchases various items in different sections such as clothing, gaming, grocery, stationary. Write anopen MP program to process his bill parallelly in each section and display the final amount to be paid. (sum of elements parallelly)
3. X on the earth, to find his accurate position on the globe werequire the value of Pi. Write a program to compute the value of pi function by NumericalIntegration using OpenMP PARALLEL section.
4. Using OpenMP, Design and develop a multi-threaded program to generate and printFibonacci Series. One thread must generate the numbers up to the specified limit and another thread must print them. Ensure proper synchronization.
5. University awards gold medals to the student who has scored highest CGPA. Write aprogram to find the student with highest CGPA in a list of numbers using OpenMP.
6. Assume you have n robots which pick mangoes in a farm. Write a program to calculatethe total number of mangoes picked by n robots parallelly using MPI.
7. Design a program that implements application of MPI Collective Communications.
8. Implement Cartesian Virtual Topology in MPI.
9. Design a MPI program that uses blocking send/receive routines and nonblockingsend/receive routines.
10. Multiplytwo square matrices (1000,2000 or 3000dimensions). Compare theperformance of a sequential and parallel algorithm using open MP.

PART B

CUDA is a parallel computing platform and an API model that was developed by Nvidia.Using CUDA one can utilize the power of Nvidia GPUs to perform general computing tasks, such as multiplying matrices and performing other linear algebra operations, instead of just doing graphical calculations. Students write programs in CUDA and understand the efficiency and power of parallelism.

TEXT BOOKS					
SINO	**Unit**	**Textbook Title**	**Author(s)**	**Publisher(s)**	**Edition/Year of Publication**
1.	All	Introduction to parallel computing	Ananth Grama, Anshul Gupta, Vipin Kumar, George Karypis	Pearson education publishers	second edition, 2003
2	All	Programming Massively Parallel Processors on Approach	David B Kirk, Wen-mei W. Hwu	Elsevier and nvidia publishers	First edition,2010
3	All	http://science.oregonstate.edu/ rubin/.	Rubin H Landau,	Oregon State University	
4	All	Introduction to High Performance Computing for Scientists and Engineers	Georg Hager, Gerhard Wellein	Taylor and Francis Group, LLC, CRC Press	2011
REFERENCE BOOKS					
1	All	Parallel Programming for Multicore and cluster systems	Thomas Rauber and Gudula Runger	Springer International	2009.
2	All	Computer Architecture: A quantitative Approach	Hennessey and Patterson	Morgan Kaufman Publishers	2011
3	All	Parallel Programming in C with MPI and Open MP	Michael J. Quin	McGraw Hill	Fifth edition
4	All	http://science.oregonstate.edu/ rubin/.	Rubin H Landau	Oregon State University	

COURSE ASSESSMENT METHOD

Continuous Internal Evaluation (CIE):

Experiment Write up + Execution + Viva	- 20 Marks
Lab Record Writing	- 10 Marks
Lab Internals Test	- 15 Marks
Self-Study Component Evaluation	- 05 Marks
Total	= 50 Marks

Semester End Examination (SEE):

Final examination will be conducted for 100 marks on Part A questions only and evaluated for 50 Marks.

CO-PO-PSO MAPPING															
CO	PO												PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12			
1	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
2	3	3	1	-	3	-	-	-	-	-	-	-	3	-	-
3	3	3	2	-	3	-	-	-	-	-	-	-	3	-	-
4	3	3	2	3	3	-	-	-	-	-	-	-	3	-	-
5	3	3	3	-	3	-	-	-	-	-	-	-	3	-	-
CL	3	3	2	3	3	-	-	-	-	-	-	-	3	-	-