SSNCOLLEGE OF ENGINEERING

KALAVAKKAM-603 110

Department of Computer Science and Engineering

Staff Name :D.VenkataVara Prasad **Designation : Professor**
Staff Name :K.Lekshmi **Designation : Assistant Professor**

Subject : Multicore Architectures & Prog **Sub Code : CS6801**

Department : CSE **Semester : VIII sem B.E(2016-17)**

SYLLABUS

L T P C
3 0 0 3

OBJECTIVES:

The student should be made to:

- Understand the challenges in parallel and multi-threaded programming.
- Learn about the various parallel programming paradigms, and solutions.

UNIT I MULTI-CORE PROCESSORS **9**

Single core to Multi-core architectures – SIMD and MIMD systems – Interconnection networks - Symmetric and Distributed Shared Memory Architectures – Cache coherence - Performance Issues –Parallel program design.

UNIT II PARALLEL PROGRAM CHALLENGES **9**

Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OpenMP **9**

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Libraryfunctions – Handling Data and Functional Parallelism – Handling Loops - Performance Considerations.

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI **9**

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT V PARALLEL PROGRAM DEVELOPMENT **9**

Case studies - n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL: **45 PERIODS**

OUTCOMES:

At the end of the course, the student should be able to:

- Program Parallel Processors.
- Develop programs using OpenMP and MPI.
- Compare & contrast programming for serial processors and prog for parallel processors.

TEXT BOOKS:

1. Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan-Kauffman/Elsevier, 2011.
2. Darryl Gove, “Multicore Application Programming for Windows, Linux, and Oracle Solaris”, Pearson, 2011 (unit 2)

REFERENCES:

1. Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill, 2003.
2. ShameemAkhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.

SSNCOLLEGE OF ENGINEERING

KALAVAKKAM-603 110

Department of Computer Science and Engineering

Staff Name :D.VenkataVara Prasad **Designation : Professor**

Staff Name :K.Lekshmi **Designation : Assistant Professor**

Subject : Multicore Architectures & Prog **Sub Code : CS6801**

Department : CSE **Semester : VIII sem B.E(2016-17)**

S.No	Unit No	Topic	CDM	Proposed No of Periods	No of Periods (actual)	Remarks
1	I	Single core to Multi-core architectures		2		
2	I	SIMD and MIMD systems		1		
3	I	Interconnection networks	T	4		
4	I	Symmetric and Distributed Shared Memory Architectures		3		
5	I	Cache coherence		1		
6	I	Performance Issues		1		
7	I	Parallel program design.		1		
8	I	Performance – Scalability – Synchronization and data sharing		1		
9	II	Data races		1		
10	II	Synchronization primitives		1		
11	II	mutexes, locks, semaphores, barriers, deadlocks and livelocks		3		
12	II	communication between threads		2		
13	II	condition variables, signals, message queues and pipes		2		
14	III	OpenMP Execution Model		2		
15	III	Memory Model		1		
16	III	OpenMP Directives ,Work-sharing Constructs, Libraryfunctions		3		
17	III	Handling Data and Functional Parallelism		1		
18	III	Handling Loops		1		

19	III	Performance Considerations		2		
20	IV	MPI program execution		2		
21	IV	MPI constructs – libraries, MPI Send and Receive		2		
22	IV	Point-to-point and Collective communication		2		
23	IV	MPI derived datatypes		2		
24	IV	Performance evaluation		1		
25	V	Case studies - n-Body solvers	S	2		
26	V	Tree Search –	S	2		
27	V	OpenMP and MPI implementations and comparison	S	2		

Total Number of Syllabus Hours : 45
Total Number of Planned Hours : 48

Content Delivery Methods (CDM): T-Tutorial, S-Seminar

PREPARED BY
D.Venkata Vara Prasad/
K.Lakshmi

APPROVED BY

HOD-CSE

SSNCOLLEGE OF ENGINEERING

KALAVAKKAM-603 110

Department of Computer Science and Engineering

Staff Name :D.VenkataVara Prasad **Designation : Professor**
Staff Name :K.Lekshmi **Designation : Assistant Professor**

Subject : Multicore Architectures & Prog **Sub Code : CS6801**

Department : CSE **Semester : VIII sem B.E(2016-17)**

COURSE OBJECTIVES:

- Understand the need for Multicore Architectures and different interconnection networks.
- Understand the challenges in parallel and multi-threaded programming .
- Learn about the parallel programming paradigm, and solutions - SHARED MEMORY PROGRAMMING WITH OpenMP
- Learn about the parallel programming paradigm, and solutions - DISTRIBUTED MEMORY PROGRAMMING WITH MPI
- OpenMP and MPI implementations of case studies : n-BodySolvers, Tree Search

Blooms Taxonomy

Remember	Understand	Apply	Analyze	Evaluate	Create
K1	K2	K3	K4	K5	K6

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

1. Understand the limitations of Single core processors and the need for multicore architectures, Discuss the issues related to multiprocessing and suggest solutions. **(K3)**
2. Understand the challenges in parallel and multi-threaded programming.(**K2**)
3. Develop programs using OpenMP. (**K3**)
4. Develop programs using MPI. (**K3**)
5. Understand OpenMP and MPI implementations of case studies : n-BodySolvers, Tree Search. **(K2)**

Program Outcomes (PO)

1. **Engineering knowledge:** Our graduates will have the knowledge of mathematics, logic, probability and statistics, computer science and engineering, and the skill to apply them in the fields of computer software and hardware.
2. **Problem analysis:** Our graduates will have the knowledge and skill to identify, formulate, and solve hardware and software problems using sound computer science

principles.

3. **Experimentation:** Our graduates will have the skill to design and conduct experiments, organize, analyze, and interpret data.
4. **Design and development:** Our graduates will have the skill to design and construct hardware and software systems, components, or processes as per needs and specifications.
5. **Team work:** Our graduates will have the interpersonal and communication skills to function as team players on multidisciplinary teams.
6. **Modern tools usage:** Our graduates will be able to use the techniques, skills, and modern hardware and software tools necessary for computer engineering practice.
7. **Social and environmental responsibility:** Our graduates will demonstrate knowledge related to social, ethical, legal, economical, health and safety, sustainability and environmental dimensions.
8. **Communication skills:** Our graduates will be able to effectively communicate technical information in speech, presentation, and in writing.
9. **Contemporariness:** Our graduates will have knowledge of contemporary issues in the practice of their profession.
10. **Self-learning:** Our graduates will develop confidence for self learning and ability for life-long learning.
11. **Competitive exam preparedness:** Our graduates will participate and succeed in competitive examinations such as GATE, IES, GRE.
12. **Leadership:** Our graduates are trained to enhance their managerial skills, leadership quality and entrepreneurial spirit.

MAPPING COURSE OUTCOMES TO PROGRAMME OUTCOMES

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
		K3	K3	K3	K3	-	K3	-	-	-	-	-	-
CO1	K3	3	3	3	3	0	0	1	0	1	1	2	0
CO2	K2	2	2	2	2	0	0	1	0	1	1	2	0
CO3	K3	3	3	3	3	0	0	1	0	2	1	1	0
CO4	K3	3	3	3	3	0	0	1	0	2	1	1	0
CO5	K2	2	2	2	2	0	0	0	0	0	1	1	0

DESCRIPTION OF ASSESSMENT TOOLS

Exams: 3 Continuous Assessment Tests during the term, plus final exam

COURSE ASSESSMENT MATRIX

	Course Outcome				
	1	**2**	**3**	**4**	**5**
Assessment *Test -1*	X	X			
Assessment *Test 2-*		X	X		
Assessment *Test-3*				X	X

Justification of CO- PO mapping

CO	Description	Knowledge level	Remarks
CO1	Understand the limitations of Single core processors and the need for multicore architectures, Discuss the issues related to multiprocessing and suggest solutions.	K3	Understand the limitations of Single core processors and the need for multicore architectures. Suggest solutions for issues in Multiprocessing
CO2	Understand the challenges in parallel and multi-threaded programming	K2	Understand the features and architectures of Vector Processors, GPU Processors
CO3	Develop programs using OpenMP	K3	Apply the concepts of OpenMP and develop programs
CO4	Develop programs using MPI	K3	Apply the concepts of MPI and develop programs
CO5	Understand OpenMP and MPI implementations of case studies : n-BodySolvers, Tree Search	K2	Apply the concepts of OpenMP and MPI and implement n-BodySolvers, Tree Search algorithms

PREPARED BY
D.Venkata Vara Prasad/
K.Lakshmi

VERIFIED BY

APPROVED BY
HOD-CSE