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Department of Computer Engineering	
Parallel Processing (66523)	
Total Credits	**3**
major elective	
Prerequisites	P1 : Computer Architecture II (66423)

Course Contents

Introduction to parallel computing (motivation and applications), parallel architectures (shared memory &distributed memory), multi-core architectures, principles of parallel algorithm design (decompositions, mapping, scheduling and synchronization), parallel programming models and methods for shared and distributed memory systems (PThreads, Cilk, OpenMP, MPI, UPC), Performance Analysis of Parallel Programs, Graphics Processor Units Programming, the MapReduce programming model andparallel algorithms and applications (parallel matrix multiplication and sorting).

	Intended Learning Outcomes (ILO's)	Student Outcomes (SO's)	Contribution
1	Learn the fundamentals of parallel computing and apply the principles of parallel algorithm design, which include: decomposing a parallel problem into tasks, mapping and scheduling the tasks and understanding the various factors and trade-offs involved in the process.	A	20 %
2	Learn the properties and characteristics of the various parallel computing architectures, programming models and parallel algorithm models and apply this understanding to map parallel problems into specific programming models and architectures	E	25 %
3	Develop and apply the skills to write parallel programsusing various programming models like:PThreads,Cilk, OpenMP, MPI, GPU and MapReduce.	K	35 %
4	Apply the theoretical and practical knowledge to model and analyze the performance of parallel programs and systems.	C	20 %

Textbook and/ or Refrences

Introduction to Parallel Computing, Second Edition, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003

Assessment Criteria	Percent (%)
Mid. Term Exam	35 %
Homeworks	15 %
Final Exam	50 %

Course Plan

Week	Topic
1	. Introduction 1.1 Motivating Parallelism 1.2The Multi-core Revolution 1.3Applications for Parallelism
2-5	2.Principles of Parallel Algorithm Design 2.1 Decomposition Techniques 2.2 Mapping and Scheduling 2.3 Parallel Algorithm Models
6-8	Programming Shared-address Space Platforms 3.1 PThreads 3.2 Cilk 3.3OpenMP
8	First Exam
9-11	4. Parallel ComputingArchitectures 4.1 Shared Memory Systems &Distributed Memory Systems 4.2Interconnection Networks and Routing 4.3 Basic Communication Operations

12-13	Programming Scalable Systems 5.1 Message Passing &MPI 5.2 Global Address Space Languages Unified Parallel C (UPC)
13	Second Exam
14-15	6. Analytical Modeling of Parallel Programs 6.1 Performance Metrics for Parallel Execution 6.2 Speedup, Scalability, Efficiency 6.3 Cost-optimality, Iso-efficiency
16	7. Introduction to Graphics Processor Unit (GPU) Programming 7.1 Introducing General Purpose Computing using GPUs 8. Parallel algorithms Example 8.1 Matrix Multiplication, Sorting &Map-Reduce
16	Final Exam