Course Name: Parallel Processing
Course Code: CS471

I. Basic Course Information

Major or minor element of program: Both Major and Minor
Department offering the course: Computer Science Department

Academic level: 400 Level
Semester in which course is offered: Second (Spring) Semester
Course pre-requisite(s): Computer Architecture and Organization CS322

Credit Hours: 3
Contact Hours Through:

Lecture	Tutorial*	Practical*	Total
2.5	0.0	1.5	4.0

* 1.5 hours for **either** Tutorial or Practical

Approval date of course specification: January 2015

II. Overall Aims of Course

This course is designed to teach concepts and practice of parallel processing. Topics covered include Parallel Computing Architectures, Parallel system models, Parallel programming languages and paradigms, and techniques for performance assessment and optimization. Real life applications are used to practice the modeling and programming of parallel systems.

III. Program ILOs covered by course

Program Intended Learning Outcomes (By Code)			
Knowledge & Understanding	Intellectual Skills	Professional Skills	General Skills
K5,K10,K18,K19	I6,I17,I19	P6,P8,P17	G2,G9

IV. Intended Learning Outcomes of Course (ILOs)

a. Knowledge and Understanding

On completing the course, students should be able to:

K.1 Identify the different parallel computing architectures.
K.2 Recognize different parallel programming languages.
K.3 Distinguish between parallelizable and non-parallelizable problems.
K.4 Explain the feasibility and unfeasibility of parallel computing.

b. Intellectual/Cognitive Skills

On completing the course, students should be able to:

I.1 Analyze and assess the performance of a parallel computing system.
I.2 Use parallel programming to modify performance for both better and worse.
I.3 Analyze the processing and communication effects of parallel programs on performance.

c. Practical/Professional Skills

On completing the course, students should be able to:

P.1 Write, compile, and run parallel programs in MPI for cluster systems.
P.2 Write, compile, and run parallel programs in OpenMP for multi-core systems.
P.3 Design parallel solutions to abstract and practical problems.

d. General and Transferable Skills

On completing the course, students should be able to:

G.1 Gain Work and Time Organization Skills
G.2 Think in parallel for problem solving

V. Course Matrix Contents

	Main Topics / Chapters	Duration (Weeks)	Course ILOs Covered by Topic (By ILO Code)			
			K & U	I.S.	P.S.	G.S.
1-	Course introduction and motivation	1	K3,K4			
2-	Overview of Parallel Computing	2	All			G2
3-	Introductory parallel programming	1	All	I1,I3	P1	All
4-	Parallel applications, Numerical Integration	1	All	All	P1,P3	All
5-	Collective Communications	3	All	All	P1,P3	All
6-	Performance	1	All	All	P1,P3	All
7-	OpenMP programming	1	All	All	All	All
8-	Parallel Algorithms	1	All	All	All	All
9-	Project	2	All	All	All	All
	Net Teaching Weeks	**13**				

VI. Course Weekly Detailed Topics / hours / ILOs

Week No.	Sub-Topics	Total Hours	Contact Hours	
			Theoretical Hours	Practical Hours*
1	Course introduction and motivation	2.5	2.5	
2	Overview of Parallel Computing	4	2.5	4
3	Overview of Parallel Computing	4	2.5	4
4	Introductory parallel programming	4	2.5	4
5	Parallel applications, Numerical Integration	4	2.5	4
6	Collective Communications (Broadcast and Reduce)	4	2.5	4
7	**Midterm Exam**			
8	Collective Communications (Scatter and Gather)	4	2.5	1.5
9	Collective Communications (Data grouping and communicators)	4	2.5	1.5
10	Performance	4	2.5	1.5
11	OpenMP programming	4	2.5	1.5
12	Pipelined computations	4	2.5	1.5
13	Parallel Algorithms	4	2.5	1.5
14	Project	4	2.5	1.5
15	**Final Exam**			
Total Teaching Hours		**51**	**33**	**18**

* **No Practical/Tutorial during the first week of the semester**

VII. Teaching and Learning Methods

Teaching/Learning Method	Selected Method	Course ILOs Covered by Method (By ILO Code)			
		K & U	Intellectual Skills	Professional Skills	General Skills
Lectures & Seminars	*	All	All	All	All
Tutorials					
Computer lab Sessions	*	All	All	All	All
Practical lab Work					
Reading Materials					
Web-site Searches					
Research & Reporting					
Problem Solving / Problem-based Learning					
Projects					
Independent Work	*		All	All	All
Group Work	*		All	All	All
Case Studies					
Presentations					
Simulation Analysis					
Others (Specify):		Electronic course notes and lab sheets			

VIII. Assessment Methods, Schedule and Grade Distribution

Assessment Method	Selected Method	Course ILOs Covered by Method (By ILO Code)				Assessment Weight / Percentage	Week No.
		K & U	I.S.	P.S.	G.S.		
Midterm Exam	*	All	All	PI,P2		10%	7
Final Exam	*	All	All	All		60%	15
Quizzes	*	All	All	All	All	10%	
Course Work	*		All	P1		10%	
Report Writing							
Case Study Analysis							
Oral Presentations							
Practical							
Group Project	*				All	10%	13
Individual Project							
Others (Specify):							

IX. List of References

Essential Text Books	• Peter Pacheco: Parallel Programming with MPI, Morgan Kaufmann Publishers Inc.
Course notes	• Additional material and internet searches are assigned for specific applications and additional tutorials
Recommended books	• Michael Quinn: Parallel Programming in C with MPI and OpenMP, McGraw-Hill
Periodicals, Web sites, etc…	• A website for submission and grading is created plus recommendation of several parallel computing websites

X. Facilities required for teaching and learning

- Computer Laboratories
- Software (C compilers with MPI and OpenMP libraries)
- Projector

Course coordinator: Dr. Ahmed Shawky

Head of Department: Prof. Abeer El Korany

Date: January 2015