GAU, Faculty of Engineering

Course Unit Title	Parallel Computing
Course Unit Code	CEN455
Type of Course Unit	Technical Elective, Computer Engineering Students
Level of Course Unit	4th Year BSc
National Credits	3
Number of ECTS Credits Allocated	6 ECTS
Theoretical (hour/week)	3
Practice (hour/week)	-
Laboratory (hour/week)	-
Year of Study	4
Semester when the course unit is delivered	7/8
Mode of Delivery	Face to Face
Language of Instruction	English
Prerequisities and co-requisities	-
Recommended Optional Programme Components	Basic bacground Computing and Boolean Algebra

Objectives of the Course:

This course will introduce students to a topic of fundamental importance to a wide variety of application areas such as:

- Motivations for parallel processing
- Parallel computer architectures
- Multicore programming with OpenMP
- Programming on massively parallel architectures (GPUs)
- Message passing programming with MPI
- Fundamental algorithms: backtracking, branch-and-bound, divide and conquer, sorting, searching

Learning Outcomes

When this course has been completed the student should be able to		Assesment.
1	design and analyze algorithms that execute efficiently on parallel computers	1,2
2	implement distributed programs using the Message Passing Interface (MPI)	1,2
3	implement multicore programs using OpenMP	1,2
4	implement programs in CUDA on GPUs.	1,2

Assesment Methods: 1. Written Exam, 2. Assignment 3. Project/Report, 4.Presentation, 5 Lab. Work

Course's Contribution to Program

		CL
1	Ability to understand and apply knowledge of mathematics, science, and engineering	2
2	Ability to design and conduct experiments as well as to analyze and interpret data	1
3	Ability to work in multidisciplinary teams while exhibiting professional responsibility and ethical conduct	1
4	Ability to apply systems thinking in problem solving and system design	4
5	Knowledge of contemporary issues while continuing to engage in lifelong learning	1
6	Ability to use the techniques, skills and modern engineering tools necessary for engineering practice	4
7	Ability to express their ideas and findings, in written and oral form	1
8	Ability to design and integrate systems, components or processes to meet desired needs within realistic constraints	5
9	Ability to approach engineering problems and effects of their possible solutions within a well structured, ethically responsible and professional manner	3
10	To apply fundamental concepts of software design, database design, data processing and artificial intelligence in the modeling, designing, implementing, testing and deploying software solutions.	3
11	Ability to analyse and design hardware systems by applying the principles of embedded systems, microprocessors, computer networks, distributed systems and data communication.	4

CL: Contribution Level (1: Very Low, 2: Low, 3: Moderate 4: High, 5:Very High)

Course Contents

Week			Exams
1	Chapter 1	Parallel Algorithm Design	
2	Chapter 2	Shared-Memory Programming with OpenMP	
3		Shared-Memory Programming with OpenMP	
4		The Task Parallel Library (TPL) and Microsoft's Parallel Computing Platform (PCP)	
5	Chapter 3	Message-Passing Programming	
6		Message-Passing Programming	
7			Midterm
8	Chapter 4	The Sieve of Eratosthenes	
9		Floyd's Algorithm	
10	Chapter 5	Performance Analysis	
11		Matrix-Vector Multiplication	
12		Matrix-Vector Multiplication	Quiz
13		Combinatorial Search	
14		Sorting	
15			Final

Recommended Sources

Textbook:
Grama, A., A. Gupta, G. Karypis, and V. Kumar, "Introduction to Parallel Computing", Addison-Wesley, 2nd Edition, 2003.

Supplementary Material (s):
1. Chapman, B., G. Jost, and R. V. D. Pas, "Using OpenMP Portable Shared Memory Parallel Programming", MIT Press, 2008.
2. Gropp, W., E. Lusk, and A. Skjellum, "Using MPI: Portable Parallel Programming with the Message-Passing Interface", MIT Press, 1999.

Assessment

Attendance	10%	Less than 25% class attendance results in NG grade.
Laboratory	-	
Midterm Exam	30%	Written Exam
Quiz	20%	Written Exam
Final Exam	40%	Written Exam
Total	100%	

ECTS Allocated Based on the Student Workload

Activities	Number	Duration (hour)	Total Workload(hour)
Course duration in class (including the Exam week)	15	3	45
Labs and Tutorials	-	-	-
Assignments	-	-	-
Project/Presentation/Report Writing	1	25	25
E-learning Activities	-	-	-
Quizzes	1	15	15
Midterm Examination	1	15	15
Final Examination	1	15	15
Self Study	15	4	60
Total Workload			175
Total Workload/30 (h)			5.83
ECTS Credit of the Course			6