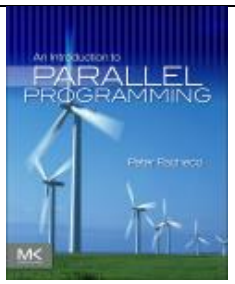
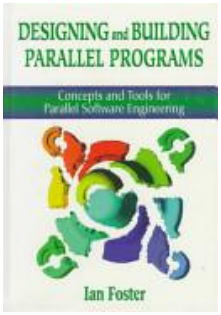
Identification	**Subject**	**CMS 605 Parallel Programming,** 4 KU /8 ECTS credits	
	Department	Computer Science	
	Program	Graduate	
	Term	Fall 2023	
	Instructor	**PhD, Associate Professor Leyla Muradkhanli**	
	E-mail:	leyla@khazar.org	
	Phone:	(+994 12) 421 1093	
	Classroom/ hours	41 Mehseti str. (Neftchilar campus), Thursday, 18:30-21:00	
Prerequisites	Programming Languages, Advanced Data Structure		
Language	English		
Compulsory/Elective	Major		
Textbooks and course materials	**Textbooks** An Introduction to Parallel Programming," Peter Pacheco, Morgan-Kaufmann Publishers, 2011  Designing and Building Parallel Programs, by Ian Foster http://www.mcs.anl.gov/~itf/dbpp/text/book.html  		
Course outline	Parallel Hardware and Parallel Software. Parallel Computer Memory Architectures. Parallel Algorithm Design. Parallel Programming Models. Shared Memory. Distributed Memory. Hybrid Distributed-Shared Memory. Designing Parallel Programs.		
Course objectives	This course is an introduction to parallel programming, how to parallelize programs, and how to use basic tools. It covers concepts and programming principles involved in developing scalable parallel applications.		
Learning outcomes	By the end of the course, students will be able to know : • the architecture and use of parallel computers, • parallel algorithms and parallel programming models • how to develop computer programs for different types of parallel computers.		
Teaching methods	**Lecture**		**x**
	Group discussion		**x**
	Assignments		**x**
	Course paper		**x**
Evaluation Criteria	**Methods**	**Date/deadlines**	**Percentage (%)**
	Midterm Exam		**30**
	Project		**15**
	Assignments		**15**
	Final Exam		**40**
	Total		**100%**

Policy	▪ **Assignments** Three assignments will be during the semester. Assignments will cover parallel software performance, parallel programs design topics. ▪ **Project** Students will develop parallel programs for solving different problems using OpenMP or MPI. Students should submit research paper, program codes and will give 15 minute presentation to the class, in the last week of the semester. ▪ **Preparation for class** The structure of this course emphasizes the importance of independent study and preparation outside of class. The lecture material will concentrate on the key points raised in the text. Reading the assigned chapters and becoming acquainted with them prior to class will aid your understanding of the lecture. Following the lecture, you should review your notes and work on relevant problems and cases from the chapter's end, as well as sample exam questions. We will also have many review sessions throughout the semester. These review sessions will take place during the regular class times. ▪ **Withdrawal (pass/fail)** This course strictly adheres to the grading policy of the School of Science and Engineering. As a result, a student is normally expected to pass with a grade of at least 65%. In the event of failure, he or she will be required to repeat the course the following term or year. ▪ **Cheating/plagiarism** Cheating or other plagiarism during the Quizzes, Midterm and Final Examinations will lead to paper cancellation. In this case, the student will receive a zero (0) without further consideration. ▪ **Professional behavior guidelines** During class, students must act in a way that fosters a positive academic and professional environment. Unauthorized conversations and unethical behavior are forbidden. ▪ **Ethics** Students should not arrive in late to class. All cell phones must be turned off and stowed away before entering class. Use of any electronic devices is not allowed in the classroom and violators will be punished accordingly.

Tentative Schedule

Week	Date	Topics	Textbook/Assignments
1	21.09.23	**Course Overview and Introduction.**	Presentation Chapter 1
2	28.09.23	**Why Parallel Computing?**	Chapter 1
3	05.10.23	**Parallel Hardware** SIMD systems	Chapter 2

		MIMD systems Interconnection networks Cache coherence Shared-memory versus distributed-memory	
4	12.10.23	**Parallel Software** Caveats Coordinating the processes/threads Shared-memory Distributed-memory Programming hybrid systems Input and Output Performance Parallel Program Design	Chapter 2
5	19.10.23	**Parallel Computer Memory Architectures** Shared Memory Distributed Memory Hybrid Distributed-Shared Memory	Chapter 3
6	26.10.23	**Parallel Algorithm Design**	Chapter 3
7	02.11.23	**Parallel Programming Models** Shared Memory Model Threads Model	Chapter 4
8	09.11.23	**Midterm exam**	
9	16.11.23	Distributed Memory / Message Passing Model Data Parallel Model	Chapter 3
10	23.11.23	Hybrid Model SPMD and MPMP	Chapter 5
11	30.11.23	**Designing Parallel Programs** Automatic vs. Manual Parallelization Understand the Problem and the Program	Chapter 6
12	07.12.23	**Designing Parallel Programs** Partitioning Communications Synchronization	Chapter 6
13	14.12.23	**Designing Parallel Programs** Data Dependencies Load Balancing Granularity I/O	Chapter 6

		Debugging Performance Analysis and Tuning	
14	21.12.23	**Parallel Examples** Array Processing PI Calculation	Lecture notes
15	28.12.23	**Parallel Examples** Simple Heat Equation 1-D Wave Equation	Lecture notes
		Final exam	