The University of Jordan

School of Engineering

Computer Engineering Department

Fall 2023/2024

Course	Parallel Processing – 0907536 (3 Cr. – Core Course)
Catalog Description	Flynn's taxonomy, SIMD processors, MIMD processors, Shared-memory and Distributed-memory parallel architectures. Interconnection Networks and Topologies. Parallel Programming. Problem Decomposition. Synchronization Methods (Barriers, Critical Sections, Locks, Atomic operations). OpenMPI Programming. MPI Programming. Parallelization techniques, Speedup and Efficiency. Parallel Algorithms.
Prerequisites by Course	Computer Organization and Architecture (2) (0907432)
Prerequisites by Topic	Students are assumed to have had sufficient knowledge pertaining to 1. single-core processor architecture: datapath design and control, pipelining, superscalar execution, caches 2. Basic data structures: stacks, queues, and graphs 3. Execution analysis of algorithms using asymptotic notations 4. C++ programming in Linux
Textbook	P. Pacheco, An Introduction to Parallel Programming, Morgan Kaufmann, 2011.
References	1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar., Introduction to Parallel Computing, 2nd edition, 2010. 2. D. Culler and J.P. Singh with A. Gupta. Parallel Computer Architecture: A Hardware/Software Approach, Morgan Kaufmann, 1998. 3. Michael J. Quinn, Parallel programming in C with MPI and OpenMP, 2003.
Website	**Microsoft Teams**
Schedule & Duration	15 Weeks, 45 lectures, 50 minutes each (including exams)
Student Material	Text book, class handouts, lecture notes, and any additional reading assigned by the instructor
College Facilities	Classroom with whiteboard and projection display facilities, library, and computer laboratory.
Course Objectives	The objectives of this course are: 1. Introduce students to the technological changes in designing and building parallel processors 2. Learn how to write shared-memory parallel programs in OpenMP and analyze their performance 3. Learn how to write distributed-memory parallel programs in *MPI* and analyze their performance 4. Study some commonly-used parallel algorithms

Course Outcomes and Relation to ABET Program Outcomes

Upon successful completion of this course, a student should be able to:

1. Write and execute a parallel program [1].
2. Analyze the performance of a parallel program [1].
3. Learn commonly-used parallel algorithms in modern high-performance computing applications [1].

Course Topics

1. Motivation: why parallel computing? (Chapter 1)
2. Parallel hardware and parallel software (Chapter 2)
3. Shared-memory programing with *OpenMP* (Chapter 5)
4. Distributed-memory programing with *MPI* (Chapter 3)
5. Parallel program development (Chapter 6)

Computer Usage

Practical aspects of the course will be covered by programming assignments

Policies

- Attendance is required. Class attendance will be taken every class and the university's polices will be enforced in this regard.
- All submitted work must be yours and cheating will not be tolerated
- Check department announcements at: http://www.facebook.com/pages/Computer-Engineering-Department/369639656466107 for general department announcements.

Grading policy

Programming assignments	20%
Midterm Exam	30%
Final Exam	50%

Instructors

Dr. Fahed Jubair, f.jubair@ju.edu.jo
Room: CPE 417
Office Hours: Sunday and Thursday: 12:00–1:00. Wednesday: 12:30-1:30

Class Time and Location

Section 1: Sunday, Tuesday, and Thursday: 10:00–11:00, Class Room: CPE 001

Program Outcomes (PO)

1	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3	an ability to communicate effectively with a range of audiences
4	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.