الهاشمية الجامعة

The Hashemite University

Deanship of Academic Development and International Outreach

عمادة التطوير الأكاديمي والتواصل الدولي

Syllabus: Parallel and Distributed Computing (1910011423)

COURSE INFORMATION

Course Name: Digital Logic Design **Semester:** Second Semester 2021/2022 **Department:** Department of Computer Science and Application **Faculty:** Prince Al-Hussein bin Abdullah II Faculty for Information Technology	**Course Code:** 1910011423 **Section:** 1 **Core Curriculum**: Mandatory
Day(s) and Time(s): Sunday Tuesday Thursday 2-3 **Classroom:** مبنى الحسين الباني ح.ب 105	**Credit Hours:** 3 **Prerequisites**: 1910011320

COURSE DESCRIPTION

This course gives an overview of parallel and distributed computer architectures, and parallel programming models while focusing on shared memory programming. The covered topics include: overview of shared and distributed memory computers, principles of parallelism, using OpenMP as an API for writing multithreaded applications, performance analysis and optimization, and some basics of distributed computing via message-passing interface (MPI).

DELIVERY METHODS

The course will be delivered through an active classroom based discussion and online Videos (Blended learning).
The whole material is uploaded on Moodle including slides, assignments, video lectures and extra supportive material.

FACULTY INFORMATION

Name	**Dr. Ahmad Qawasmeh**	
Academic Title:	**Associate Professor**	
Office Location:	**IT 123**	

	Telephone Number:	-	
	Email Address:	ahmadr@hu.edu.jo	
	Office Hours:	**Sunday/Tuesday 12-1** *Please send an e-mail (ahmadr@hu.edu.jo) to meet at any other time at the office or online via teams.*	

REFERENCES AND LEARNING RESOURCES

a) Textbook:
1. Using OpenMP: Portable Shared Memory Parallel Programming by Barbara Chapman, Gabriele Jost and Ruud van der Pas. MIT Press, 2008. ISBN-13: 978-0-262-53302-7
b) Additional References:
1. Using MPI - 2nd Edition: Portable Parallel Programming with the Message Passing Interface by William Gropp, Ewing Lusk, and Anthony Skjellum, 2014. ISBN-13: 978-0262571326 ISBN-10: 0262571323
2. Website for OpenMP: http://openmp.org
3. Website for MPI: https://www.mcs.anl.gov/research/projects/mpi/usingmpi/ https://mpitutorial.com/tutorials/

STUDENT LEARNING OUTCOMES MATRIX*

Core Curriculum Learning Outcomes	Program Learning Outcomes	Course Objectives	Course Student Learning Outcomes	Assessment Method
	SLO1- Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.	Recognize the numbering systems and digital logic circuits.	SLO1 and SLO2	· Exam, Project
		Analyze the principles of parallelism in	SLO1 and SLO2	Exam, Project

		applications.		
	SLO2- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline. SLO3- Communicate effectively in a variety of professional contexts. SLO4- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles. SLO5- Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.	Design parallel solutions to sequential applications using high-level API	SLO1 and SLO2	Exam, Project
		Evaluate and improve parallel solutions via performance and optimization techniques.	SLO1 and SLO2	Exam, Project

ACADEMIC SUPPORT

It is The Hashemite University policy to provide educational opportunities that ensure fair, appropriate and reasonable accommodation to students who have disabilities that may affect their ability to participate in course activities or meet course requirements. Students with disabilities are encouraged to contact their Instructor to ensure that their individual needs are met. The University through its Special Need section will exert all efforts to accommodate for individual's needs.

Special Needs Section:

Tel: 053903333 EXT 5023/4583

Location: (https://hu.edu.jo/facnew/index.aspx?typ=68&unitid=70000000)

Email: (huniv@hu.edu.jo)

COURSE REGULATIONS

Participation

Class participation and attendance are important elements of every student's learning experience at The Hashemite University, and the student is expected to attend all classes. A student should not miss more than 15% of the classes during a semester. *Those exceeding this limit of 15% will receive a failing grade regardless of their performance*. It is a student's responsibility to monitor the frequency of their own absences. **Attendance record begins on the first day of class irrespective of the period allotted to drop/add and late registration. It is a student's responsibility to sign-in; failure to do so will result in a non-attendance being recorded.**

In exceptional cases, the student, with the instructor's prior permission, could be exempted from attending a class provided that the number of such occasions does not exceed the limit allowed by the University. The instructor will determine the acceptability of an absence for being absent. A student who misses more than 25% of classes and has a valid excuse for being absent will be allowed to withdraw from the course.

Plagiarism

Plagiarism is considered a serious academic offence and can result in your work losing marks or being failed. HU expects its students to adopt and abide by the highest standards of conduct in their interaction with their professors, peers, and the wider University community. As such, a student is expected not to engage in behaviours that compromise his/her own integrity as well as that of the Hashemite University.

Plagiarism includes the following examples and it applies to all student assignments or submitted work:

- **Use of the work, ideas, images or words of someone else without his/her permission or reference to them.**
- **Use of someone else's wording, name, phrase, sentence, paragraph or essay without using quotation marks.**
- **Misrepresentation of the sources that were used.**

The instructor has the right to fail the coursework or deduct marks where plagiarism is detected

Late or Missed Assignments

In all cases of assessment, students who fails to attend an exam, class project or deliver a presentation on the scheduled date without prior permission, and/or are unable to provide a

medical note, will automatically receive a fail grade for this part of the assessment.

· Submitting a term paper on time is a key part of the assessment process. Students who fail to submit their work by the deadline specified will automatically receive a 10% penalty. Assignments handed in more than 24 hours late will receive a further 10% penalty. Each subsequent 24 hours will result in a further 10% penalty.
· In cases where a student misses an assessment on account of a medical reason or with prior permission; in line with University regulations an incomplete grade for the specific assessment will be awarded and an alternative assessment or extension can be arranged.

Student Complaints Policy

Students at Hashemite University have the right to pursue complaints related to faculty, staff, and other students. The nature of the complaints may be either academic or non academic. For more information about the policy and processes related to this policy, you may refer to the students' handbook.

COURSE ASSESSMENT

Course Calendar and Assessment

Students will be graded through the following means of assessment and their final grade will be calculated from the forms of assessment as listed below with their grade weighting taken into account.

Assessment	Grade Weighting	Deadline Assessment
Midterm Exam	40%	TBD
Project	20%	TBD
Final Exam	40%	TBD
Total	100%	

ASAS

Description of Exams:

Test questions will predominately come from the material presented in the lectures. Semester exams will be conducted during the regularly scheduled lecture period. Exam will consist of a combination of multiple-choice, short answer, match, true and false and/or descriptive questions.

Homework:

Will be given for each chapter, while the chapter in progress you are supposed to work on them continuously and submit in next lecture when I finish the chapter.

You are also expected to work on in-chapter examples, self-tests and representative number of end of chapter problems. The answers of self-tests and end of chapter exercises are given at the end of the book.

Quizzes: Unannounced quizzes will be given during or/and at the end of each chapter based upon the previous lectures. It will enforce that you come prepared to the class.

No make-up exams, homework, or quizzes will be given. Only documented absences will be considered as per HU guidelines.

Grades are not negotiable and are awarded according to the following criteria*:

Letter Grade	Description	Grade Points
A+	Excellent	4.00
A		3.75
A-		3.50
B+	Very Good	3.25
B		3.00
B-		2.75
C+	Good	2.50
C		2.25
C-		2.00
D+	Pass	1.75
D	Pass	1.50
F	Fail	0.00
I	Incomplete	-

WEEKLY LECTURE SCHEDULE AND CONTENT DISTRIBUTION

Topics Covered					
Topic	**Chapter in Text**	**Week #**	**Lecture**	**Content**	**Delivery Method**
Intro to Parallelism	Ch1	Week1	Lect. 1	Syllabus and Introduction	Face to face
			Lect. 2	parallel and distributed computing in general.	Face to face
			Lect. 3	Shared and distributed memory models	Online\ asynchronous video Moodle and Youtube Lec 3
Digital and Numbering Systems	Ch1	Week2	Lect. 1	Shared and distributed memory Architectures	Face to face
			Lect. 2	Shared and distributed memory computers	Face to face
			Lect. 3	Recap	Online\ asynchronous video Moodle Lec 3

Concepts of Parallelism	Ch2	Week3	Lect. 1	Concepts of parallelism	Face to face
			Lect. 2	Synchronization	Face to face
			Lect. 3	Granularity and its types	Online\ asynchronous video Moodle Lec 4
		Week4	Lect. 1	Finding parallelism	Face to face
			Lect. 2	Types of dependencies	Face to face
			Lect. 3	Correctness considerations with examples.	Online\ asynchronous video Moodle Lec 6
		Week5	Lect. 1	Overview of OpenMP	Face to face
			Lect. 2	OpenMP concepts and ideas	Face to face
			Lect. 3	Parallel region in OpenMP	Online\ asynchronous video Moodle Lec 8
Using OpenMP	Ch3	Week6	Lect. 1	Using OpenMP for writing parallel code	Face to face
			Lect. 2	OpenMP Application Examples: Laplace Equation	Face to face
			Lect. 3	Midterm Exam	Paper-based
OpenMP API and Specifications	Ch4	Week7	Lect. 1	OpenMP features	Face to face
			Lect. 2	Work sharing constructs and clauses	Face to face
			Lect. 3	OpenMP Synchronization constructs and clauses	Online\ asynchronous video Moodle Lec 11
		Week8	Lect. 1	Data environment	Face to face
			Lect. 2	Runtime functions and env variables	Face to face
			Lect. 3	Quiz	Online
		Week9	Lect. 1	Intro to OpenMP Tasks	Face to face
			Lect. 2	Tasks features, types, and clauses	Face to face
			Lect. 3	Using OpenMP in programming	Online\ asynchronous video Moodle Lec 13
Performance and Optimization	Ch5	Week10	Lect. 1	Concepts of performance analysis	Face to face
			Lect. 2	Speedup and efficiency	Face to face
			Lect. 3	Scalabilty and overheads types	Online\ asynchronous video Moodle Lec 15
		Week11	Lect. 1	Loop transformation techniques	Face to face
			Lect. 2	Cache utilization techniques	Face to face
			Lect. 3	Load balancing	Online\ asynchronous video Moodle Lec 15
		Week12	Lect. 1	OpenMP scheduling	Face to face
			Lect. 2	Code bottlenecks	Face to face
			Lect. 3	Performance issues with OpenMP	Online\ asynchronous video Moodle Lec 17
MPI	https://mpitutorial.com/tutorials/	Week13	Lect. 1	Intro to MPI	Face to face
			Lect. 2	MPI blocking	Face to face
			Lect. 3	MPI non-blocking communication and functions	Online\ asynchronous video Moodle Lec 19
		Week14	Lect. 1	MPI data types	Face to face
			Lect. 2	Collective communication in MPI	Face to face
			Lect. 3	Project discussion	Online

		Week15	Lect. 1	Performance issues in MPI	Face to face
			Lect. 2	MPI code examples	Face to face
			Lect. 3	Project discussion	Online