Faculty: Information Technology	
Department: Computer Science	**Program: Bachelor**
Academic year:	**Semester:**

Course Plan

First: Course Information

Course No.: 1501439	***Course Title:*** Parallel and Distributed Systems	***Credit Hours:*** 3	***Theoretical:***3	***Practical: -***
Prerequisite No. and Title: 1501430 Operating Systems		***Section No.:***	***Lecture Time:***	
Level in JNQF	7			
Type Of Course:	☐ ***Obligatory University Requirement*** ☐ ***Elective University Requirement*** ☐ ***Obligatory Faculty Requirement*** ☐ ***Elective Faculty Requirement*** ☐ ***Obligatory Specialization Requirement*** ■ ***Elective Specialization Requirement*** ☐ ***Ancillary course***			
Type of Learning:	☐ ***Face-to-Face Learning*** ■ ***Blended Learning (2 Face-to-Face + 1 Asynchronous)*** ☐ ***Online Learning (2 Synchronous+ 1 Asynchronous)***			

Second: Instructor's Information

Course Coordinator:				
Name:		***Academic Rank:***		
Office Number:		***Extension Number:***	***Email:***	
Course Instructor:				
Name:		***Academic Rank:***		
Office Number:		***Extension Number:***	***Email:***	
Office Hours:	***Sunday***	***Monday***	***Tuesday***	***Wednesday*** ***Thursday***

Third: Course Description

This undergraduate course presents the basic concepts of parallel and distributed systems: hardware, software, design issues, and inter-process communications in distributed systems; External data representation and marshaling. It presents the architecture of these systems and its characteristics; client-server vs. P2P model, the layered protocols; synchronous vs. asynchronous communication mechanisms, Request-reply protocols, Remote Procedure Call (RPC), and Remote Method Invocation (RMI), Indirect and Group communication, The operating system support; Processes and Threads; naming and allocation; consistency and replication. Time and synchronization in distributed systems: physical vs. logical clocks; distributed mutual exclusion, election algorithms; distributed transactions; and case studies.

Fourth: Course Objectives

1. Introducing the student to fundamental concepts of parallel and distributed computing architectures and paradigms, its design issues, and the challenges.
2. Getting the student to understand the models that describe these systems; Physical, Architectural, and Fundamental systems models.
3. Being familiar with the underlying communication architecture of parallel and distributed computing systems, the inter-process communication mechanisms, including synchronous and asynchronous mechanisms.
4. Comparing the used systems technologies, and distinguish its advantages and disadvantages.
5. Understanding the operating systems layer support; protection, processes and threads, and the communication and invocation.
6. Knowing the concepts of time in parallel and distributed systems; events and process states, Synchronizing physical clocks, Logical time and logical clocks.
7. Knowing some of the different distributed algorithms; synchronization algorithms, distributed mutual exclusion, election algorithms; distributed transactions.

Fifth: Learning Outcomes

Level descriptor according to (JNQF)	*CILOs Code*	*CILOs* If any CLO will not be assessed in the course, mark NA.	*Associated PILOs Code* *Choose one PILO for each CILO**	*Assessment method* *Choose at least two methods*
Knowledge	**K1**	Explain basic concept and theory of Parallel computing and Distributed computing, classify and describe its design models	**PK1**	• Quizzes • Mid-term Exam • Final Exam
	K2	Analyze the middleware technologies that support distributed applications, remote invocation paradigms, and indirect communication techniques	**PK1**	• Quizzes • Mid-term Exam • Final Exam
	K3	Examine the operating systems layer support; Logical time, Logical clocks.	**PK1**	• Quizzes • Mid-term Exam • Final Exam
	K4	Evaluate the algorithms of synchronization, distributed mutual exclusion, election; distributed transactions.	**PK1**	• Final Exam
Skills	**S1**	Knowledge of distributed computing principles and architectures, distributed computing models, and cluster computing.	**PS2**	• Mid-term Exam • Final Exam
	S2	Design and architect distributed systems to meet specific requirements, taking care of factors like fault tolerance, scalability, and performance	**PS2**	• Quizzes • Mid-term Exam • Final Exam
	S3	Knowledge of and evaluate the techniques for managing concurrent access to shared resources	**PS3**	• Quizzes • Mid-term Exam • Final Exam
	S4	Identify and implement locking mechanisms, transaction management, and isolation levels	**PS3**	• Quizzes • Final Exam
Competencies	**C1**	Develop effective communication skills needed for group collaboration.	**PC1**	• Participation • Group presentation
	C2	Analyze the challenges and solutions related to the parallel and distributed computing.	**PC4**	• Participation • Group presentation
	C3	Analyze the performance of systems, and implement optimization techniques to enhance systems performance.	**PC3**	• Participation • Group presentation

*CILOs: Course Intended Learning Outcomes; PILOs: Program Intended Learning Outcomes; For each CILO, the PILO could be the same or different.

Sixth: Learning Resources

Main Reference:	Distributed Systems Concepts and Design.		
Author: Coulouris George, Jean Dollimore, Tim Kindberg, and Gordon Blair	***Issue No.***: 5th edition.	***Print:*** Addison-Wesley	***Publication Year:*** 2011
Additional Sources and Websites:	• Distributed and Cloud Computing From Parallel Processing to the Internet of Things, Hwang, K. Geoffrey C. Fox, and Jack J. Dongarra. 2013		
Teaching Type:	■ ***Classroom*** □ ***Laboratory*** □ ***Workshop*** ■ ***MS Teams*** ■ ***Moodle***		

Seventh: Course Structure

Week	Course Intended Teaching Outcomes (CILOs)	Topics	Teaching Procedures*	Teaching Methods**	References***
1	K1, S1	Syllabus Overview Introduction to distributed systems	Face-to-Face	-	Chapter 1
			Asynchronous	Videos, Self-reading	Moodle
2	K1, K2, S1, S2	System Models: Physical models, Architectural models, Fundamental models	Face-to-Face	Lecture, In-class Questions	Chapter 2
			Asynchronous	Videos, Self-reading, External web resource	Moodle
3	K2, S2, S3	Inter-process communication: API for the Internet protocols, External data representation and marshalling	Face-to-Face	Lecture, In-class Questions	Chapter 4
			Asynchronous	Videos, Self-reading, Assignment	Moodle
4	K3, S2, S3	Inter-process communication: Multicast communication, Network virtualization	Face-to-Face	Lecture, In-class Questions	Chapter 4
			Asynchronous	Videos, Self-reading, Assignment	Moodle
5	K2, K3, S2, S3	Remote Invocation: Request-reply protocols, Remote procedure call	Face-to-Face	Lecture, In-class Questions	Chapter 5
			Asynchronous	Videos, Self-reading, Quiz	Moodle
6	K2, K3, S2, S3	Remote Invocation: Remote method invocation	Face-to-Face	Lecture, In-class Questions	Chapter 5
			Asynchronous	Videos, Self-reading, Assignment	Moodle

Week	Course Intended Teaching Outcomes (CILOs)	Topics	Teaching Procedures*	Teaching Methods**	References***
7	K2, K3, S2, S3	Indirect communication: Group communication, Publish-subscribe systems	Face-to-Face	Lecture, In-class Questions	Chapter 6
			Asynchronous	Videos, Self-reading, Assignment	Moodle
8	K2, K3, S2, S3	Indirect communication: Message queues, Shared memory approaches	Face-to-Face	Lecture, In-class Questions	Chapter 6
			Asynchronous	Videos, Self-reading, External Web resources	Moodle
Midterm Exams					
9	K3, K4, S3, S4	Operating system support: Operating system layer, Protection, Processes and threads	Face-to-Face	Lecture, In-class Questions	Chapter 7
			Asynchronous	Videos, Self-reading, Assignment	Moodle
10	K3, K4, S3, S4	Operating system support: Communication and invocation, Operating system architecture	Face-to-Face	Lecture, In-class Questions	Chapter 7
			Asynchronous	Videos, Self-reading, Quiz	Moodle
11	K3, K4, S2, S3, S4	Distributed Objects and Components: Distributed objects, From objects to components	Face-to-Face	Lecture, In-class Questions	Chapter 8
			Asynchronous	Videos, Self-reading, Assignment	Moodle
12	K3, K4, S2, S3, S4	Time and Global States: Clocks, events and process states, Logical time and logical clocks, Global states	Face-to-Face	Lecture, In-class Questions	Chapter 14
	C1, C2, C3	Recent Parallel and Distributed systems research topics.	Asynchronous	Group presentation	MS teams
13	K3, K6, S2, S3, S4	Coordination and Agreement: Distributed mutual exclusion, Elections	Face-to-Face	Lecture, In-class Questions	Chapter 15
	C1, C2, C3	Recent Parallel and Distributed systems research topics.	Asynchronous	Group presentation	MS teams
14	K3, K6, S2, S3, S4	Coordination and Agreement: Coordination and agreement in group communication	Face-to-Face	Lecture, In-class Questions	Chapter 15
	C1, C2, C3	Recent Parallel and Distributed systems research topics.	Asynchronous	Group presentation	MS teams
Final Exams					

*Teaching procedures: (Face-to-Face, synchronous, asynchronous). ** Teaching methods: (Lecture, video….).
*** Reference: (Pages of the book, recorded lecture, video….)

Eighth: Assessment Methods

Methods	Online Learning	Blended Learning	Face-To-Face Learning	Specific Course Output to be assessed **If any CILO will not be assessed in the course, mark NA.										
				K1	K2	K3	K4	S1	S2	S3	S4	C1	C2	C3
First Exam														
Second Exam														
Mid-term Exam			30	✓	✓	✓		✓	✓	✓				
Participation			5									✓	✓	✓
Asynchronous Activities														
Quizzes			5	✓	✓	✓			✓	✓	✓			
Assignments			5										✓	✓
Group presentation			5									✓	✓	✓
Final Exam			50	✓	✓	✓	✓	✓	✓	✓	✓			
Total out of 100			100											

Ninth: Course Policies

- All course policies are applied to all teaching patterns (online, blended, and face-to-face Learning) as follows:
  a. Punctuality.
  b. Participation and interaction.
  c. Attendance and exams.
- Academic integrity: (cheating and plagiarism are prohibited).

Approval	Name	Date	Signature
Head of Department			
Faculty Dean			