

Course Syllabus

1	Course title	Operating Systems & Distributed Systems
2	Course number	1901904
3	Credit hours	3
	Contact hours	3
4	Prerequisites/co-requisites	Operating Systems in Master or Bachelor level
5	Program title	PhD in Computer Science
6	Program code	19
7	Awarding institution	The University of Jordan
8	School	King Abdullah II School for Information Technology
9	Department	Computer Science
10	Level of course	Graduate –PhD
11	Year of study and semester (s)	Second Year, Second 2022/2023
12	Final Qualification	PhD in CS
13	Other department (s) involved in teaching the course	
14	Language of Instruction	English
15	Teaching methodology	<input type="checkbox"/> Blended <input type="checkbox"/> Online <input checked="" type="checkbox"/> Face to Face
16	Electronic platform(s)	<input checked="" type="checkbox"/> Moodle <input checked="" type="checkbox"/> Microsoft Teams <input type="checkbox"/> Skype <input type="checkbox"/> Zoom <input type="checkbox"/> Others.....
17	Date of production/revision	Revision: Feb, 21, 2023

18 Course Coordinator:

Name: **Prof. Ahmad Sharieh, PhD** Office number:
Department Office Phone Number: 06-5355000 ext. 22591
Office Location: KASIT First Floor –105
Office Hours: Wednesday 12:00 -1:00, or by appointment
Sunday, 15:15 – 16:00, Thursday, 12:00-13:00

E-mail: sharieh@ju.edu.jo

19 Other instructors:

20 Course Description:

As stated in the curriculum of the program:

“Students will study advanced operating system topics and be exposed to recent developments in operating systems research. In addition to being conversant in classic and recent research papers, this course aims to teach students to read research papers critically, formulate new research questions, and evaluate these questions experimentally. A study of specific topics of modern distributed and real-time systems, the theory behind them, and their implementation. Topics may include advanced concepts in distributed systems, wireless sensor networks, resource management in multi core and in distributed systems, and memory management, protection and security.”

Course Description:

The course exposes students to advanced topics in Distributed Operating Systems (DOS) and in Distributed Systems (DS) topics. **Topics in DOS** include modern Distributed Operating Systems (DOS); Message-Passing Programming for Point-to-Point and collective communication; Load Balancing; and Protection and Security management (Attacks, Policy, Access Control Models, and Fault-Tolerance). **Topics in DS** include Real time systems; Wireless Networks; Internet of Things; Cloud Computing; Theoretical aspects in DS: synchronization and Vector Clocks, Consensus problem (RAFT & Paxos) and Blockchains. The students will write a research project on contemporary topics in DSs and/or DOSs and present case studies.

21 Course aims and outcomes:

A- The Goal: To expose students to advanced topics in operating systems and in distributed systems and write a research project in these topics.

B- Course Objectives: Enable students to

- provide a thorough treatment of the concepts, design principles, implementation, and performance issues of contemporary operating systems and distributed systems.
- illustrate the structure of operating systems and distributed systems.
- understand in depth, the process concept and concurrency as the heart of modern operating systems.
- understand in depth, the thread concepts and multithreading techniques.
- understand in depth, the distributed deadlocks and load balancing in operating systems.
- illustrate security in operating systems.
- compare and contrast different interconnection network topologies.
- To illustrate the design and implementation algorithms for various problems in DOS.

22. Topic Outline and Schedule:

Week	Topic	Teaching Methods*/ platform	Evaluation Methods**	References
1	Distributed Systems (DS), Design Issues in DS Models of Parallel & Distributed Computers; Dynamic and Static Interconnection Networks. Project Proposal and Case Studies	Lectures, Reading, Moodle	Class Discussion	Text Book
2	Basic Communication Operations; Store-and-Forward and Cut-Through Routing Schemes Message Transfer between Two Processors: One-to-All & All-to-All Broadcast and Personalized. Case Studies	Lecture Presentation, Reading, Moodle	Class Discussion	Handout
3	Message-Passing Programming (MPI) Overview; MPI: Point-to-Point, Collective Communication	Practical presentation	Writing code using MPI, Assignment 10%	Down load Free MPI
4	Load Balancing, Granularity and Data Mapping, Scalability, Performance and Performance Metrics for DS (run time, speedup, efficiency and cost)	Lecture Presentation, Reading, Moodle	Writing code using MPI and show metrics Assignment 5%	Handout
5	Theoretical aspects in DS: synchronization and vector clocks	Lecture Presentation, Reading, Moodle	Discussion	Handout
6	Leader Election	Lecture, Presentation	Discussion	Handout
7	Distributed consensus problem (RAFT & Paxos)	Lecture Presentation, Reading, Moodle	Discussion	Handout
8	Midterm Exam Project Follow up		20 %	
9	Distributed Operating Systems (DOS), Network Operating Systems in Case Study of DOS	Lecture Presentation, Reading, Moodle Presentation	Discussion	Handout Students' presentation

10	Processes and Communication in Case Study of DOS	Presentation, Moodle		Handout Students' Presentations
11	Real Time Systems, Real Time OS Fault Tolerance	Lecture Presentation, Reading, Moodle		Handout Handout
12	Wireless Networks	Lecture Presentation, Reading, Moodle		Handout
	Internet of Things (IoT)			
13	Cloud Computing	Lecture Presentation, Reading, Moodle	Assignment 5%	Handout
	Fog and Edge computing			
14	Security management: Attacks	Lecture Presentation, Reading, Moodle	Discussion	Handout
	Protection and Policy			
	Block chains			
15+16	Project Presentation and Report Final Exam		20% 40%	

*Teaching/ Learning methods include: Synchronous lecturing/meeting; Asynchronous self- study

**Evaluation methods include: Homework, Exams, Practical assignments, Participation, ...etc

23 Evaluation Methods:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

Evaluation Activity	Mark %	Topic(s)	Period (Week)	Platform
Midterm Exam	20	Topics: 1 through 7	Sunday April 16, 2023, KASIT 16:00- 17:00	Essay
Final Exam	40	35% on Topics: 9 through 14	Thursday June 8, 2023 KASIT 16:00- 17:00	Essay
Research Projects: Report & Presentations	20	10% for presentation and discussion and 10% on report	TBA	Class Meeting & Report
Assignments & Case Studies	20	See the Topics Outline Schedule	TBA	Submit on Moodle

24 Course Requirements (e.g: students should have a computer, internet connection, account on a specific software/platform...etc):

Students should have a computer, internet connection, account on a specific Microsoft Teams software/ Moodle platform, and MPI Software

25 Course Policies:

Please follow The University of Jordan regulations regarding the following policies, more information is at www.ju.edu.jo

A- Attendance policies:

. **See the UJ attendance policies.**

B- Absences from exams and submitting assignments on time

Late assignment will not be accepted

C- Health and safety procedures:

Follow the JU regulations and policies.

D- Honesty policy regarding cheating, plagiarism, misbehavior:

If there is cheating or plagiarism in a home works and in a MATLAB assignment, both sources will be given 0.

E- Grading policy: Intended marks-grades

0-54	F	50-54	C-	55-59	C	60-64	C+	65-70	B-	71-79	B	80-84	B+
85-89	A-	90-100	A										

The grade may be given based on the average of all marks out of 100%.

F- Available university services that support achievement in the course:

Lab with and 20 desktops, Microsoft Teams plat form for lecturing, one laptop with multimedia, the webpage (<https://elearning.ju.edu.jo>) is a primary communication vehicle.

26 References:

A- Required book(s), assigned reading and audio-visuals:

List of handouts as specified on the E-learning.

B- Recommended books, materials and media:

- **Operating System Concepts**, by Avi Silberschatz, Peter Galvin, and Greg Gagne, Current Edition, John Wiley & Sons.
- **Distributed Systems: Concepts and Design**, by George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, Current Edition, Addison-Wesley.
- **Distributed Systems: Principles and Paradigms**, by Andrew S. Tanenbaum and Maarten van Steen, Prentice Hall, Current edition.
- **Modern Operating Systems**, by A. S. Tanenbaum, 3^{ed} Edition, Prentice Hall, 2008.
- **Introduction to Parallel Computing**, by Ananth Grama, Anshul Gupta, George Karypis, and Vipin Kumar, Addison-Wesley an imprint of Pearson Education, Second Edition, 2003.
(<http://www-users.cs.umn.edu/~karypis/parbook/>)

- **Parallel Programming in C with MPI and OpenMP**, by Michael J. Quinn, Mc Graw Hill, Current version.
- **Introduction to Algorithms**, by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, The MIT Press, Third Edition, 2009.

27 Additional information:

Name of Course Coordinator: Ahmad Sharieh Signature: -- Ahmad Shareih --- Date: --3/10/2021--

Head of Curriculum Committee/Department: ----- Signature: -----

Head of Department: ----- Signature: -----

Head of Curriculum Committee/Faculty: ----- Signature: -----

Dean: -----Signature: -----