Course Syllabus

1	**Course title**	Operating Systems
2	**Course number**	1901761
3	**Credit hours**	3
	Contact hours	3
4	**Prerequisites/co-requisites**	Operating Systems in Bachelor level
5	**Program title**	Master 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 –Master
11	**Year of study and semester (s)**	Second Year, Second 2022/2023
12	**Final Qualification**	Master in CS
13	**Other department (s) involved in teaching the course**	No
14	**Language of Instruction**	English
15	**Teaching methodology**	☐Blended ☐Online √☐ Face to Face
16	**Electronic platform(s)**	√☐**Moodle** √☐**Microsoft Teams** ☐Skype ☐Zoom ☐Others……
17	**Date of production/revision**	Revision: Feb, 27, 2023

18 Course Coordinator:

Name: **Prof. Mohammad Qatawneh -** Office number: 108
Department Phone Number: 06-5355000 ext. 22586
Office Location:KASIT First Floor –108
Office Hours: Wednesday 1:00 -2:00, or by appointment
Sunday, 15:15 – 16:00, Thursday, 12:00-13:00

19 Other instructors:

20 Course Description:

A. **Introduction**: An operating system (OS) is the most widely used system software in any computer system. The OS controls all the computer's resources and provides the base upon which the application programs can be written. A major function of an OS is to hide complexity in the computer systems and give the user a more convenient set of instruction to work with. On top of an OS is the rest of the system software. The OS performs two basically unrelated functions: extended machine and resource manager. The first view is to present the user the equivalent of virtual machine that is easier to program than the underlying hardware. The second function is to provide an orderly and controlled allocation of processors, memories, and I/O devices among various programs competing for them.

A first-year graduate level course in operating systems intends to provide a clear description of concepts that are applicable to variety of distributed systems. It starts with topics such as operating systems structuring, multithreading and synchronization and then moves on to systems issues in parallel and distributed computing systems. In addition to the textbook, students will read and discuss a number of important research papers that have been published, and implement major techniques to solve problem face OS. Case studies will be explained.

B. **Description**: This course includes topics in Distributed Operating Systems (DOSs). Distributed systems, Design Issues, Communication in distributed systems: remote procedure calls, client-server model, and remote invocation method, Synchronization: clock synchronization, Logical clock, and Mutual Exclusion Algorithms, Deadlock; Processes Management and scheduling; Distributed shared memory; and file management. The student will implement communication functions such as remote procedure calls and remote invocation method, client-server model, or Lamport's algorithm for synchronization. There will be a presentation of at least one DOSs case, and a team project on the course content.

21 Course aims and outcomes:

The Goal: The aim of this course is to establish principles for understanding, designing and implementation of distributed operating systems.

Course Objectives: When you completes this course, you will be able to

A. Understand

A.1 Understand what distributed systems and operating systems are, what they do, and how they are designed and implemented.

A.2 Know how communication, synchronization, processors, and distributed shared memory are managed in distributed environment.

B. Cognitive

B.1 Recognize the software design issues for DSs.

B.2 Distinguish between client server, remote procedure call, and group communication.

B.3 Show how different choices in operating system design and implementation techniques.

B.4 Compare between methods for synchronization, election, system models, allocation, and Consistency.

C. Subject

C.1 Derive a mathematical models for RPC, Threads, or Distributed shared memory.

C.2 Implement some of the distributed OS functions based on Page, Shared Memory, Shared variable, or Object.

D. Transferable Skills

D.1 Write a mathematical models as a solution for a software issues in DSs.

D.2 Write a term research paper in DS with wire, wireless, blockchain, IoT, and cloud computing environment.

D.3 Present case studies and the mathematical models and the paper.

22. Topic Outline and Schedule:

Week	Topic	Teaching Methods*/Platform	Evaluation Methods**	References
1	**Review (Operating Systems):** Functions, services, features, Design, Components, and operating system Structures.	Lectures, Reading, Moodle	Class and Discussion	Text Book
2	**Distributed Systems and Software concepts:** DS (Goals, HW concepts, SW concepts, Design issues).	Lectures, Reading, Moodle	Class and Discussion	Text Book
3,4	**Communication in DSs:** Layered protocols, ATM, Client-Server Model, RPC, and Group Communication.	Lectures, Reading, Moodle	Class and Discussion	Text Book
5,6	**Synchronization:** Clock (Physical and logical), Mutual Exclusion Algorithms, election algorithms.	Lectures, Reading, Moodle	Class, Discussion, and Assignment	Text Book Handout
7	**Midterm Exam**			
8	**File system**	Lectures, Reading, Moodle	Class and Discussion	Text Book
9,10	**Processes and Processors:** Threads (overview, multithreading models, threading issues), System models (Workstation, pool, hybrid), Processor allocation, Fault Tolerance, Real Time DSs.	Lectures, Reading, Moodle	Class and Discussion	Text Book
11	Deadlocks	Lectures, Reading, Moodle	Class and Discussion	Text Book
12,13	Distributed Shared Memory	Lectures, Reading, Moodle	Class and Discussion	Text Book
14,15	**Presentation**	Lectures, Reading, Moodle		
16	**Final Exam**			

*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	30	Topics: 1 through 6	Sunday April 16, 20623, KASIT 16:00- 17:00	Essay
Final Exam	40	Topics: 1 through 14	Thursday June 8, 2023 KASIT 16:00-17:00	Essay
Research Projects: Report & Presentations	30	10% for presentation and discussion and 20 % on report	TBA	Class Meeting & Report

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.

25 Course Policies:

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

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
0-50 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, 3ed 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: Mohammad Qatawneh
Signature: -- Mohammad Qatawneh ---- Date: --27/2/2023

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

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

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

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