هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

T-104
2022

Course Specification

Course Title:	**Advanced Operating Systems**
Course Code:	**332 COMP-3**
Program:	**Bachelor in Computer Science**
Department:	**Computer Science**
College:	**College of Computer Science and Information Technology**
Institution:	**Jazan University**
Version:	**V2**
Last Revision Date:	**12 September 2021**

Table of Contents:

A. General information about the course:

Course Identification					
1. Credit hours:	3				
2. Course type					
a.	University ☐	College ☐	Department☒	Track☐	Others☐
b.	Required ☒	Elective☐			
3. Level/year at which this course is offered:	Level 11/Year 4				
4. Course general Description					
This course provides the detailed description of distributed system concepts and its applications. It includes synchronization, concurrency, distributed scheduling algorithms and various aspects and mechanisms for operating system security.					
5. Pre-requirements for this course (if any): None					
6. Co- requirements for this course (if any): None					
7. Course Main Objective(s)					

- Describe the fundamentals of distributed system, multiprocessor system, real-time systems and trends in Operating system design.
- Demonstrate the application and implementation of various multiprocessor and Real-time scheduling algorithms in solving scheduling problems.
- Show the applications and implementation of various mutual exclusion algorithms for distributed systems.
- Explain the various aspects of operating system security and mechanisms to reinforce it.

1. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1.	Traditional classroom	44	80%
2.	E-learning		
3.	Hybrid • Traditional classroom • E-learning		
4.	Distance learning (Self Learning)	11	20%

2. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	Lectures	22
2.	Laboratory/Studio	22

3.	Field	
4.	Tutorial	
5.	Others (specify)	8
	Total	52

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	Knowledge and understanding			
1.1	**Describe** the fundamentals of distributed system, multiprocessor system, real-time systems, synchronization and concurrency.	K1	• Lectures/Presentations • Media Lectures • Lab Demonstration	• Exam 1 • Exam-2 • Assignment • Final Theory Exam
1.2	**Outline** the recent trends in Operating system design.	K2	• Lectures/Presentations • Media Lectures	• Exam-2 • Assignment • Final Theory Exam
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2.0	Skills			
2.1	**Implement** various mutual exclusion algorithms for distributed systems.	S4	• Lectures /Presentations • Media Lectures • Tutorials • Lab Demonstration	• Exam-1 • Exam 2 • Assignment • Final Theory Exam • Final Lab Exam
2.2	Apply various multiprocessor and Real-time scheduling algorithms to solve a given problem.	S1	• Lectures /Presentations • Media • Lectures Tutorials	• Assignment • Final Theory Exam
2.3	Analyze the various aspects	S4	• Lectures	• Assignmen

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	of operating system security and mechanisms to reinforce it.		/Presentations • Media Lectures • Tutorials	t • Final Theory Exam
2.4	Communicate the findings of the task to solve a given problem.		• Media Lectures	• Assignment
3.0	Values, autonomy, and responsibility			
3.1	Show the ability to work as a member in solving a given problem in the field of distributed, multiprocessor and real-time systems.	V1	• Class discussion to train students to think independently	• Assignments
3.2				
...				

C. Course Content

No	List of Topics	Contact Hours
1.	**DISTRIBUTED SYSTEMS** Definition; Goals: Resource Accessibility, Distribution Transparency, Openness, Scalability, Pitfalls, Type of Distributed Systems, Distributed Computing Systems, Distributed Information Systems, Distributed Pervasive Systems	3T + 3P
2.	**SYNCHRONIZATION** Clock Synchronization: Physical Clocks, Clock Synchronization Algorithms; NTP, Berkley algorithm, Logical Clocks: Lamport's Logical Clocks, Vector Clocks, Mutual Exclusion: Overview, Centralized Algorithm, Decentralized Algorithm	4T + 4P
3.	**CONCURRENCY** Monitors: Monitors with Signal, Message Passing: Synchronization, Addressing, Message Format, Readers/Writers Problem: Readers have priority, Writers have priority **RECENT TRENDS IN OPERATING SYSTEM** Virtualization and the Cloud, Many core Chips, Large-Address-	3T + 3P

	Space Operating Systems, Seamless Data Access, Battery-Powered Computers, and Embedded Systems	
4.	**DISTRIBUTED SCHEDULING ALGORITHMS** Distributed Algorithm, Token Ring Algorithm, Comparison of Algorithms , Election Algorithms, Traditional Election Algorithms; Bully algorithm, Ring algorithm, Elections in Wireless Environments, Election in Large-Scale Systems	4T + 4P
5.	**Multi-Processor and Real time operating system** Introduction, Multi-processor Systems, Structure of Multi-processor OS, Separate kernel, Master-slave, Symmetric configurations, Process Scheduling algorithms; Job blind, job aware scheduling algorithms, Introduction, Real-time Systems, Characteristics of Real time OS, Structure of a Real-time System, Real-time OS, Real-time scheduling algorithms; Rate monotonic, earliest deadline first scheduling algorithm.	6T + 6P
6.	**OPERATING SYSTEM SECURITY** Intruders and malicious software, Buffer Overflow, Access Control, Unix Access Control, Operating Systems Hardening, Security Maintenance, Windows	2T + 2P
Total		22T+22P

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm Exam	6th-7th week	20%
2.	Assignment I	3rd week	10%
3.	Assignment II	6th-7th week	10%
4.	Lab Exam + Lab Assignment	As per schedule	20%
5.	Final Theory Exam	As per schedule	40%
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*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.)

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	• Distributed Systems Principles and Paradigms, Andrew Tanenbaum and Maarten van Steen, 2016, Pearson, 2nd edition, ISBN-13: 978-1530281756 • Principles of Operating Systems, Naresh Chauhan, 2016, Oxford University Press, 1st edition, ISBN-13:

	978-0198082873
Supportive References	**i).** Operating Systems: Internals and Design Principles, William Stallings, 2018, Pearson, 9th edition, ISBN-13: 978-9352866717. **ii).** Modern Operating Systems, Andrew S. Tanenbaum, 2016, Pearson, 4th edition, ISBN-13: 978-9332575776.
Electronic Materials	• https://learn.saylor.org/course/cs401 • https://www.class-central.com/mooc/1016/udacity-advanced-operating-systems • https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-828-operating-system-engineering-fall-2012/lecture-notes-and-readings/ • http://www.scs.stanford.edu/17wi-cs140/
Other Learning Materials	• Online tutorial

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	• Classroom equipped with projector, whiteboard, and sufficient seating arrangements. • Lab with software installed and individual computer terminal for each student.
Technology equipment (projector, smart board, software)	• Whiteboards and projectors for classroom and labs • Following software for lab work: Linux OS installed (UBUNTU 16.1 or higher or Red Hat Linux) An active internet connection.
Other equipment (depending on the nature of the specialty)	None

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect (Course evaluation survey form)
Effectiveness of students assessment	CRC / QAU / HoD	Direct (Course reports / result analysis)
Quality of learning resources	Track leaders / CRC	Indirect (Review, meetings and star rating

Assessment Areas/Issues	Assessor	Assessment Methods
		with suggestions for further modification and improvements)
The extent to which CLOs have been achieved	CRC / QAU	Direct (CLO assessment template further verified at course coordinator, Track leader and QAU level)
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval Data

COUNCIL /COMMITTEE	DEPARTMENT COUNCIL
REFERENCE NO.	
DATE	15/10/2022