Course Specification

(Postgraduate)

Course Title:	Advanced Operating Systems
Course Code:	CS 6112
Program:	Master of Science in Computer Science
Department:	Computer Science
College:	Computer Science
Institution:	King Khalid University
Version:	V.1
Last Revision Date:	13 February 2026

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A. General information about the course:

1. Course Identification:

1. Credit hours: (3)

2. Course type

A. ☐ University ☐ College ☒ Department ☐ Track

B. ☒ Required ☐ Elective

3. Level/year at which this course is offered: (1)

4. Course general Description:

This course covers advanced concepts in operating systems, focusing on process and thread management, CPU scheduling, synchronization, memory management, virtual memory, and file system design. Students will study operating system principles using the textbook *Operating Systems: Three Easy Pieces (OSTEP)* and implement core OS components using the PintOS instructional operating system. Through hands-on projects, students will gain practical experience in implementing thread schedulers, system calls, virtual memory, and file systems. The course emphasizes both theoretical understanding and practical implementation of modern operating system mechanisms.

5. Pre-requirements for this course (if any):

Undergraduate course in Operating Systems or equivalent, and programming experience in C or C-like languages. Basic knowledge of Linux is recommended.

6. Co-requirements for this course (if any):

None

7. Course Main Objective(s):

At the completion of this course, students will be able to describe basic functionality of an Operating System, internal working of threads and processes, various scheduling techniques for CPU scheduling, deadlocks and deadlock avoidance, memory management in a multi-tasking environment, virtual memory, design of file systems, and some of these concepts extended to distributed systems.

2. Teaching Mode: **(mark all that apply)**

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1	Lectures	40
2	Laboratory/Studio	
3	Field	
4	Tutorial	
5	Others (specify).....	
	Total	**40**

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

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	Explain the structure and components of modern operating systems.	PLO-K1	Lectures, Tutorial, Discussions	Assignments, Exams
1.2	Describe process management, CPU scheduling, synchronization, and memory management techniques.	PLO-K2	Lectures, Tutorial, Discussions	Assignments, Exams
1.3	Explain virtual memory and file system design principles.	PLO-K3	Lectures, Tutorial, Discussions	Assignments, Exams
2.0	**Skills**			
2.1	Implement thread scheduling and synchronization mechanisms using PintOS.	PLO-S1	Lectures, Case Studies, Discussions	Assignments, Mini project, Exams
2.2	Implement system calls, virtual memory, and file systems.	PLO-S2	Lectures, Case Studies, Discussions	Assignments, Mini project, Exams
2.3	Analyze operating system performance and behavior.	PLO-S3	Lectures, Case Studies, Discussions	Assignments, Mini project, Exams

Code	Course Learning Outcomes	Code of PLOs aligned with program	Teaching Strategies	Assessment Methods
3.0	**Values, autonomy, and responsibility**			
3.1	Work independently and collaboratively on operating system projects.	PLO-V1	Lectures, Case Studies, Discussions	Assignments, Mini project, Exams
3.2	Apply operating system concepts to solve real-world system problems.	PLO-V2	Lectures, Case Studies, Discussions	Assignments, Mini project, Exams

C. Course Content:

No	List of Topics	Contact Hours
1	Introduction to Operating Systems	2
2	Introduction Setup PintOS	1
3	Processes and Process API	2
4	Threads and Thread API	2
5	Synchronization: Locks and Semaphores	2
5.1	Project 1: Threads	1
6	CPU Scheduling	2
6.1	Project 1	1
7	Advanced Scheduling Multi-level feedback queue	2
7.1	Project 1	1
8	Address Spaces and Virtual Memory Address Spaces	2
9	Paging and Memory Management	2
9.1	Project 2: User Programs	1
10	System Calls and Process Control	2
10.1	Project 2	1
11	Virtual Memory Implementation	2
11.1	Project 3: Virtual Memory	2
12	Virtual Memory (continued)	2
12.1	Project 3	2
13	File System Implementation	2
13.1	Project 4: File System	2
14	File System Design	2
15	Project 4	2
	Total	**40**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1	Programming Assignments in PintOS		60% (4 PAs of 15% each)
2	Midterm Exams		15%
3	Class and online participation		5%
4	Final		20%

*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	Operating Systems: Three Easy Pieces `https://pages.cs.wisc.edu/~remzi/OSTEP/` Operating System Concepts (9th Edition) A. Silberschatz, P.B. Galvin, and G. Gagne. Wiley Publishers, 2012 ISBN: 978-1-118-06333-0
Supportive References	The C Programming Language B. Kernighan and D. Ritchie. Prentice Hall, Inc., 1988 ISBN 0-13-110362-8 Advanced Programming in the UNIX(R) Environment W. Stevens, Addison Wesley Longman Publishing Co., Inc. 1992 ISBN 0-201-56317-7
Electronic Materials	Course website, LMS, GitHub repositories, PintOS documentation, and instructor-provided materials.
Other Learning Materials	Additional readings and programming references may be provided during the semester.

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Class room
Technology equipment (Projector, smart board, software)	Projector
Other equipment (Depending on the nature of the specialty)	–

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students, Program Committee	Student survey, peer review
Effectiveness of students assessment	Instructor, Program Committee	Assessment moderation, grade analysis
Quality of learning resources	Students, Instructor	Student feedback, resource review
The extent to which CLOs have been achieved	Instructor, Program Committee	CLO assessment analysis
Other		

Assessor (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))
Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL / COMMITTEE	
REFERENCE NO.	
DATE	