CS3103: OPERATING SYSTEMS

Effective Term
Semester A 2022/23

Part I Course Overview

Course Title
Operating Systems

Subject Code
CS - Computer Science
Course Number
3103

Academic Unit
Computer Science (CS)

College/School
College of Engineering (EG)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
(CS2115 Computer Organization or EE2004 Microcomputer System) And (CS2310 Computer Programming or CS2311 Computer Programming or CS2360 Java Programming)

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to introduce the concepts, roles and functionality of operating systems, which are an essential part of any computer system. By going through the major areas in the development of operating systems including process management, memory management, scheduling, I/O and disk management, students are expected to gain a broad understanding of key approaches to operating system design and implementation. By discussing the design issues of different approaches, students should be able to analyse the trade-offs and contrast their performance in satisfying different system and application requirements.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Identify and describe the objectives, roles and functionality of typical operating systems.				
2	Explain concepts which are fundamental to operating system requirements and designs.				
3	Discuss design issues of different approaches to operating system design and implementation in order to understand their characteristics and analyse the trade-offs.		x		
4	Describe and contrast design and performance of different algorithms proposed for major operating system functionalities such as scheduling, concurrency, memory and disk management.		x		
5	Demonstrate ability/skill in applying operating system concepts to develop and implement effective solutions to programming problems.			x	

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Teaching and Learning Activities (TLAs)

	TLAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lecture	Explain basic concepts and introduce existing approaches to operating system design and implementation. Requires students to ask questions actively and apply knowledge to discuss and solve problems	1, 2, 3, 4	3 hours/week
2	Tutorial	Requires students to apply operating system concepts to analysis problems in operating system design and develop and implement solutions to programming problems.	1, 2, 3, 4, 5	8 hours/semester
3	Group project	Students will work as a group to apply operating system concepts and algorithms to solve programming problems and analyse its functional and non-functional aspects.	1, 2, 3, 4, 5	After class
4	Assignment	Students will apply operating system concepts to solve different programming, analysis and calculation problems that are common in modern operating system design.	1, 2, 3, 4, 5	After class

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks (e.g. Parameter for GenAI use)
1	Programming assignments	2, 5	17	
2	Case study	1, 2	8	
3	Mid-term quiz	1, 2, 3, 4	15	

Continuous Assessment (%)

40

Examination (%)

60

Examination Duration (Hours)

2

Additional Information for ATs

For a student to pass the course, at least 30% of the maximum mark for the examination must be obtained.

Assessment Rubrics (AR)

Assessment Task

Programming assignments

Criterion

1.1 Understanding and application of operating system concepts1.2 Ability to develop and implement effective solutions to programming problems.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching the marginal levels

Assessment Task

Case study

Criterion

2.1 Ability to identify and describe information and operations for supporting management functions provided by system utilities in a commercial operating system.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching the marginal levels

Assessment Task

Mid-term quiz

Criterion

3.1 Ability to describe basic concepts3.2 Ability to explain different approaches to operating system design and implementation.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching the marginal levels

Assessment Task

Examination

Criterion

3.1 Ability to describe basic concepts3.2 Ability to explain different approaches to operating system design and implementation3.3 Ability to contrast design and performance of different algorithms proposed for major operating system functionalities.

Excellent (A+, A, A-)

High

Good (B+, B, B-)

Significant

Fair (C+, C, C-)

Moderate

Marginal (D)

Basic

Failure (F)

Not even reaching the marginal levels

Part III Other Information

Keyword Syllabus

Operating system objectives and functions, processes and threads, mutual exclusion, synchronization, deadlock, processor scheduling, memory management, virtual memory, I/O buffering, disk scheduling and management.

Syllabus:

- Overview and basics of operating system
  Objectives and roles of operating system. Interrupt processing. Process and process control blocks. Process states and state diagrams. Modes of execution. Context switching. Multithreading. User-level and kernel-level threads.

- Concurrency
  Race condition. Mutual exclusion. Synchronization. Semaphores. Deadlock. Classic problems.
- Scheduling
  Long-term, medium-term and long-term scheduling. Preemptive and non-preemptive scheduling. Scheduling algorithms.
- Memory management
  Memory hierarchy. Caching. Paging. Segmentation. Virtual memory. Thrashing. Memory allocation. Working sets.
- Device management
  I/O devices. Direct memory access. Buffering. Disk scheduling. Failure recovery.
- File management
  File organization. Directories. Secondary storage management.

Reading List

Compulsory Readings

	Title
1	William Stallings (2015). Operating Systems: Internals and Design Principles. Pearson

Additional Readings

	Title
1	Abraham Silberschatz, Peter B. Galvin, Grey Gagne (2014). Operating System Concepts. Wiley.