Operating Systems	Code & No:	CS 240
	Credits:	3 (3,0,1)
	Pre-requisite:	CS 210
	Co-requisite:	None
	Level:	6

Course Description:

The purpose of this course is to provide an overview of computer operating systems. The course presents the theory, design, implementation, and analysis of computer operating systems.
Topics include; Brief history of OS's and their design and development, OS Component, OS structure, System calls and interfaces, Process management, Resource scheduling and management (of the CPU, memory, etc.), Synchronization of concurrent processes, Deadlocks, Memory management, Virtual memory, File System Structure & implementation, Mass-storage structure and I/O Systems. Most of the programming assignments will be done on Linux machines using C/C++ Language.

Course Aims:

1) To study the operations performed by Operating System as a resource manager.
2) To learn the evolution of Operating systems.
3) To study process & threads issues and CPU Scheduling, synchronization, and deadlock Algorithms.
4) To understand how OS support for virtual memory, disk scheduling, I/O, and file systems
5) To study computer security issues and Operating System tools.

Student Outcomes (SOs):

☒(a) An ability to apply knowledge of computing and mathematics appropriate to the program's student outcomes and to the discipline

☒(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

☒(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

☒(d) An ability to function effectively on teams to accomplish a common goal

☐(e) An understanding of professional, ethical, legal, security and social issues and responsibilities

☒(f) An ability to communicate effectively with a range of audiences

☐(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society

☐(h) Recognition of the need for and an ability to engage in continuing professional development

☒(i) An ability to use current techniques, skills, and tools necessary for computing practice.

☐(j) An ability to apply mathematical foundations, algorithmic principles, and computer science theory in the modeling and design of computer-based systems in a way that demonstrates comprehension of the tradeoffs involved in design choices. [CS]

☐(k) An ability to apply design and development principles in the construction of software systems of varying complexity. [CS]

☐(j) An ability to use and apply current technical concepts and practices in the core information technologies of human computer interaction, information management, programming, networking, and web systems and technologies. [IT]

☐(k) An ability to identify and analyze user needs and take them into account in the selection, creation, evaluation, and administration of computer-based systems. [IT]

☐(l) An ability to effectively integrate IT-based solutions into the user environment. [IT]

☐(m) An understanding of best practices and standards and their application. [IT]

☐(n) An ability to assist in the creation of an effective project plan. [IT]

Course Learning Outcomes (CLOs):

1. Understand issues and problems involved in the design and implementation of operating systems & Identify the abstract services common to all operating systems
2. Understand and analyze theory and implementation of processes & threads.
3. Understand and apply scheduling techniques.
4. Understand and analyze theory and implementation of synchronization
5. Understand and analyze theory and implementation of Deadlock
6. Understand and analyze Memory Management concept.
7. Understand the File System Structure & implementation, Mass-Storage Structure, I/O Systems

SOs and CLOs Mapping:

CLO/SO	a	b	c	d	e	f	g	h	i	j	k	l	m	n
CLO1									√					
CLO2	√	√	√	√		√								
CLO3		√	√	√		√								

CLO4		√	√	√		√								
CLO5			√	√		√								
CLO6		√		√		√			√					
CLO7			√						√					

No.	Topics	Weeks	Teaching hours
1	Introduction to OS	02	2
	OS-Structures		2
	Computer-System Structures		2
2	Process Management Process Concept, Cooperating Processes Inter-process Communication, Communication in Client-Server	02	2
	Threads, Multithreading models, Threading Issues		2
	CPU Scheduling, Scheduling Criteria, Scheduling Algorithms		2
3	Process Synchronization	02	2
	Critical-Section Problem		2
	Classical Problems		2
4	Deadlocks, Deadlock Characterization	02	2
	Methods for Handling Deadlocks (Prevention, Avoidance, Detection)		2
	Recovery from Deadlock		2
5	Memory Management	02	1
	Address Binding Concept & Swapping		1
	Contiguous Memory Allocation		1
	Paging & Segmentation		1
	Virtual Memory, Page Replacement		2
7	File Concept, File-System Structure File-System Interface	01	1
	Access Methods, File-System Mounting		1
	File Sharing, Protection, File-System Implementation		1
8	Directory Structure	01	1
	Allocation Methods, Free-Space management		2
9	I/O Systems, Kernel I/O Subsystem	02	1
	Transforming I/O to Hardware Operations, Streams		1
	Mass-Storage Structure, Disk Structure,		1

		Disk Scheduling, Disk Management		1
		Swap-Space Management		1
		RAID Structure		1
		Total	**14**	**42**

Textbook:

- Operating System Concepts, Silberschatz, Galvin, and Gagne, 9th edition, Wiley,2012

Essential references:

- Charles Crowley, "Operating Systems: A Design Oriented Approach", Tata McGraw Hill 1999.
- Modern Operating Systems, Tanenbaum, 3rd edition, Prentice Hall, 2007.

  Operating Systems: Design and Implementation, Tanenbaum and Woodhull, Prentice