MODULE DESCRIPTION FORM
نموذج وصف المادة الدراسية

Operating Systems (CET1101) الأساسيات الرقمية
5th Semester الفصل الأول

Module Information معلومات المادة الدراسية					
Module Title	**Operating Systems**			**Module Delivery**	
Module Type	**Core**			☒ **Theory** ☐ **Lecture** ☒ **Lab** ☐ **Tutorial** ☐ **Practical** ☐ **Seminar**	
Module Code	**CET3101**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	5	
Administering Department	CET		**College**	IUC	
Module Leader	Hamza Abbass Al-Sewadi		**e-mail**	hamza.ali@iuc.edu.iq	
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph.D.	
Module Tutor			**e-mail**		
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	10/70/2023		**Version Number**	1.0	

Relation with other Modules العالقة مع المواد الدراسية ألخرى			
Prerequisite module	None	**Semester**	
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents أهداف المادة الدراسية ونتائج التعلم والمحتويات إلرشادية	
Module Aims أهداف المادة الدراسية	1. This course includes the basic concepts of operating system components. 2. To develop problem-solving skills and understand process management, deadlocks, and synchronization. 3. To understand consists of memory management techniques. 4. This course deals with File system implementation. 5. It also includes a case study on the Linux operating system. 6. To understand the I/O device management principles. 7. To perform the disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK), and Disk Formatting.
Module Learning Outcomes مخرجات التعلم للمادة الدراسية	1. Should understand: hardware components that must be managed by an operating system. 2. Describe need and role of operating system. 3. The concept of a process, the process life cycle, process states and state transitions, process control blocks (PCBs)/process descriptors. 4. How processors transition between processes via context switching. How interrupts enable hardware to communicate with software. How processes converse with one another via interprocess communication (IPC). 5. The motivation for creating threads. The similarities and differences between processes and threads. The various levels of support for threads. The life cycle of a thread. Thread signaling and cancellation. 6. The challenges of synchronizing concurrent processes and threads. Critical sections and the need for mutual exclusion. how to implement mutual exclusion primitives in software 7. How monitors synchronize access to data. How condition variables are used with monitors. Solutions for classic problems in concurrent programming such as readers and writers and circular buffer. 8. The problem of deadlock. The four necessary conditions for deadlock to exist. The problem of indefinite postponement. The notions of deadlock prevention, avoidance, detection and recovery. 9. Understand OS components such a scheduler, memory manager, file 10. System handlers and I/O device managers. 11. Analyze and criticize techniques used in OS components 12. Demonstrate and simulate algorithms used in OS components 13. Identify algorithms and techniques used in different components of Linux

Indicative Contents المحتويات الإرشادية	**1.** Operating System Overview teaching hours: 10 hrs **2.** Process Management teaching hours: 10 hrs **3.** Process Deadlocks teaching hours: 10 hrs **4.** Memory Management teaching hours: 14 hrs **5.** File Management teaching hours: 10 hrs **6.** Device Management teaching hours: 10 hrs **7.** Linux Case Study teaching hours: 10 **hrs**

Learning and Teaching Strategies استراتيجيات التعلم والتعليم	
Strategies	The main strategy that will be adopted in delivering this module is to encourage students' participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to An operating system that acts as an intermediary between the user of a computer and the computer hardware. The purpose of an operating system is to provide an environment in which a user can execute programs in a convenient and efficient manner.

Student Workload (SWL) الحمل الدراسي للطالب موزع على)15(اسبوع			
Structured SWL (h/sem) الحمل الدرا يالمنتظم للطالب خالل الفصل	14	**Structured SWL (h/w)** الحمل الدرا يالمنتظم للطالب أسبوعيا	4.26
Unstructured SWL (h/sem) الحمل الدرا يغ ريالمنتظم للطالب خالل الفصل	11	**Unstructured SWL (h/w)** الحمل الدرا يغ ريالمنتظم للطالب أسبوعيا	4.06
Total SWL (h/sem) الحمل الدرا يالك إليالطالب خالل الفصل	125		

Module Evaluation

تقييم المادة الدراسية

		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	2	10% (10)	5, 10	LO #1-4, LO #5-9
	Assignments	2	20% (10)	2, 12	LO #1,2, LO #3-10
	Report	1	10% (10)	continuous	
Summative assessment	Midterm Exam	2 hr	10% (10)	7	LO # 1-8
	Final Exam	4hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

المنهاج االسبوعي النظري

	Material Covered
Week 1	Introduction to Operating Systems Operating System Architectures, Definition, Two views of operating system, Evolution of operating system, Types of OS
Week 2	System Call, Handling System Calls, System Programs, Operating System Structures, The Shell, Open Source Operating Systems
Week 3	Process vs Program, Multiprogramming, Process Model, Process States, Process Control Block. Threads, Thread vs Process, User and Kernel Space Threads. Inter Process Communication, Race Condition, Critical Section
Week 4	Implementing Mutual Exclusion: Mutual Exclusion with Busy Waiting (Disabling Interrupts, Lock Variables, Strict Alteration, Peterson's Solution, Test and Set Lock), Sleep and Wakeup, Semaphore, Monitors, Message Passing, Classical IPC problems: Producer Consumer, Sleeping Barber, Dining Philosopher Problem.
Week 5	Process Scheduling: Goals, Batch System Scheduling (First-Come First-Served, Shortest Job First, Shortest Remaining Time Next), Interactive System Scheduling (Round-Robin Scheduling, Priority Scheduling, Multiple Queues), Overview of Real Time System Scheduling.
Week 6	Introduction, Deadlock Characterization, Preemptable and Non-preemptable Resources, Resource – Allocation Graph, Conditions for Deadlock.
Week 7	**Midterm Exam**
Week 8	Handling Deadlocks: Ostrich Algorithm, Deadlock prevention, Deadlock Avoidance, Deadlock Detection (For Single and Multiple Resource Instances), Recovery From Deadlock (Through Preemption and Rollback. Introduction, Monoprogramming vs. Multi-

	programming, Modelling Multiprogramming, Multiprogramming with fixed and variable partitions, Relocation and Protection. Memory management (Bitmaps & Linked-list), Memory Allocation Strategies.
Week 9	Virtual memory: Paging, Page Table, Page Table Structure, Handling Page Faults, TLB's Page Replacement Algorithms: FIFO, Second Chance, LRU, Optimal, LFU, Clock, WS- Clock,
Week 10	Concept of Segmentation: Need of Segmentation, its Drawbacks, Segmentation with Paging(MULTICS).
Week 11	File Overview: File Naming, File Structure, File Types, File Access, File Attributes, File Operations, Single Level, two Level and Hierarchical Directory Systems, File System Layout.
Week 12	Implementing Files: Contiguous allocation, Linked List Allocation, Linked List Allocation using Table in Memory, Inodes. Directory Operations, Path Names, Directory Implementation, Shared Files
Week 13	Free Space Management: Bitmaps, Linked List
Week 14	Classification of IO devices, Controllers, Memory Mapped IO, DMA Operation, Interrupts, Goals of IO Software, Handling IO(Programmed IO, Interrupt Driven IO, IO using DMA), IO Software Layers (Interrupt Handlers, Device Drivers) . Disk Structure, Disk Scheduling (FCFS, SSTF, SCAN, CSCAN, LOOK, CLOOK), Disk Formatting (Cylinder Skew, Interleaving, Error handling), RAID.
Week 15	History, Kernel Modules, Process Management, Scheduling, Inter-process Communication, Memory Management, File System Management Approaches, Device Management Approaches.

Delivery Plan (Weekly Lab. Syllabus) المنهاج االسبوعي للمختبر	
	Material Covered
Week 1	Lab 1: Introduction to Demonstration of basic Linux Commands
Week 2	Lab 2: Process creation and termination, thread creation and termination
Week 3	Lab 3: Simulation of IPC techniques
Week 4	Lab 4: Simulation process Scheduling algorithms
Week 5	Lab 5: Simulation of page replacement algorithms
Week 6	Lab 6: Simulation of File allocation techniques
Week 7	Lab 7: Simulate free space management techniques
Week 8	Lab 8: Simulation of disk scheduling algorithms

Learning and Teaching Resources مصادر التعلم والتدريس		
	Text	**Available in the Library?**
Required Texts	Operating Systems (3rd Edition) 3rd Edition by Harvey M. Deitel (Author), Paul J. Deitel (Author), David R. Choffnes (Author)	Yes
Recommended Texts	Operating System Concepts Essentials Tenth Edition Avi Silberschatz Peter Baer Galvin Greg Gagne	yes
Websites		

Grading Scheme مخطط الدرجات				
Group	**Grade**	التقدير	**Marks (%)**	**Definition**
Success Group (50 - 100)	**A** - Excellent	امتياز	90 - 100	Outstanding Performance
	B - Very Good	جيد جدا	80 - 89	Above average with some errors
	C - Good	جيد	70 - 79	Sound work with notable errors
	D - Satisfactory	متوسط	60 - 69	Fair but with major shortcomings
	E - Sufficient	مقبول	50 - 59	Work meets minimum criteria
Fail Group (0 – 49)	**FX** – Fail	راسب (قيد المعالجة)	(45-49)	More work required but credit awarded
	F – Fail	راسب	(0-44)	Considerable amount of work required

Note: Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above.