CENG 303 – OPERATING SYSTEMS DESIGN AND CONSTRUCTION

Course Code	Course Name			Semester	
CENG 303	Operating Systems Design and Construction			Fall ☒ Spring ☐ Summer ☐	
Hours				Credit	ECTS
Theory	Practice	Lab		3	8
3	-	-			

Course Details	
Department	Computer Engineering
Course Language	English
Course Level	Undergraduate ☒ Graduate ☐
Mode of Delivery	Face to Face ☒ Online ☐ Hybrid ☐
Course Type	Compulsory ☒ Elective ☐
Course Objectives	The information in CENG 303 helps students comprehend the fundamentals of operating systems (OS), which serve as the foundational computing framework for a wide range of computer applications. The course bridges the gap that exists between user applications that require OS services and computer architecture. Students can design and manage computing infrastructures, create high performance and concurrent software applications, and create systems applications and libraries.
Course Content	Introduction, Operating-System Structures, Processes, Threads & Concurrency, CPU Scheduling, Synchronization Tools and Examples, Deadlocks
Course Method/ Techniques	Lecture ☒ Question & Answer ☒ Presentation ☐ Discussion ☒
Prerequisites/ Corequisites	
Work Placement(s)	

Textbook/References/Materials

- Operating System Concepts by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 10th Ed. Wiley

Course Category				
Mathematics and Basic Sciences	☐		Education	☐
Engineering	☒		Science	☐
Engineering Design	☐		Health	☐
Social Sciences	☐		Profession	☐

Weekly Schedule		
No	**Topics**	**Materials/Notes**
1	**Introduction:** What Operating Systems Do, Computer-System Organization, Computer-System Architecture, Operating-System Operations, Resource Management	
2	Security and Protection, Virtualization, Distributed Systems, Kernel Data Structures, Computing Environments, Free and Open-Source Operating Systems	
3	**Operating-System Structures:** Operating-System Services, User and Operating-System Interface, System Calls, System Services, Linkers and Loaders, Why Applications Are Operating-System Specific	
4	Operating-System Design and Implementation, Operating-System Structure, Building and Booting an Operating System, Operating-System Debugging	
5	**Processes:** Process Concept, Process Scheduling, Operations on Processes	
6	Interprocess Communication, IPC in Shared-Memory Systems, IPC in Message-Passing Systems, Examples of IPC Systems, Communication in Client– Server Systems	
7	**Threads & Concurrency:** Overview, Multicore Programming, Multithreading Models, Thread Libraries	
8	**Midterm Exam**	
9	Implicit Threading, Threading Issues, Operating-System Examples	
10	**CPU Scheduling:** Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling	
11	Multi-Processor Scheduling, Real-Time CPU Scheduling, Operating-System Examples, Algorithm Evaluation	
12	**Synchronization Tools:** Background, The Critical-Section Problem, Peterson's Solution	
13	Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors, Liveness, Evaluation	
14	**Synchronization Examples**: Classic Problems of Synchronization, Synchronization within the Kernel, POSIX Synchronization, Synchronization in Java, Alternative Approaches	
15	**Deadlocks:** System Model, Deadlock in Multithreaded Applications, Deadlock Characterization, Methods of Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock	
16	**Final Exam**	

Assessment Methods and Criteria		
In-term studies	**Quantity**	**Percentage**
Attendance	12	6
Lab		
Practice		
Fieldwork		
Course-specific internship		
Quiz/Studio/Criticize		
Homework	4	24
Presentation / Seminar		
Project		
Report		
Seminar		
Midterm Exam	1	30
Final Exam	1	40
	Total	**100%**
Contribution of Midterm Studies to Success Grade		
Contribution of End of Semester Studies to Success Grade		
	Total	**100%**

ECTS Allocated Based on Student Workload			
Activities	**Quantity**	**Duration (Hrs)**	**Total Workload**
Course Hours	14	3	42
Lab			
Practice			
Fieldwork			
Course-specific Work Placement			
Out-of-class study time	15	4	60
Quiz/Studio/Criticize			
Homework	4	15	60
Presentation / Seminar			
Project			
Report			
Midterm Exam and Preparation for Midterm	1	19	19
Final Exam and Preparation for Final Exam	1	19	19
Total Workload			200
Total Workload / 25			8
ECTS Credit			8

Course Learning Outcomes	
No	**Outcome**
L1	Recognize operating system design and implementation
L2	Recognize how complicated software systems organize their memory and data structures
L3	Recognize how a sophisticated software system shares resources
L4	Recognize how a complicated software system exchanges data concurrently
L5	Check the integrity of the data in concurrent systems
L6	Create and put into practice algorithms for issues involving synchronization and concurrency

Program Competencies	
No	**Outcome**
P1	An ability to apply knowledge of science, mathematics, and engineering
P2	An ability to design programs and algorithms
P3	An ability to work with multi-disciplinary teams
P4	An ability to identify, formulate, and solve engineering problems
P5	Take responsibility to solve unpredictable and complex problems encountered in applications as an individual and as a member of a team
P6	Plan and manage activities in teamwork
P7	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
P8	Can do research on interdisciplinary fields

Contribution of Course Learning Outcomes to Program Competencies/Outcomes

Contribution Level: 1: Very Slight, 2: Slight, 3: Moderate, 4: Significant, 5: Very Significant

	P1	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**Total**
L1	3			4												7
L2	2			3												5
L3	3			2												5
L4	2			2												4
L5					4											4
L6		5					4									9
															Total	34