CMPE 242 Operating Systems

Department: Computer Engineering

Program Name: Computer Engineering | **Program Code:** 25

Course Number: CMPE242 | **Credits:** 4 Cr | **Year/Semester:** 2022-2023 SPRING

☒ Required Course ☐ Elective Course (click on and check the appropriate box)

Prerequisite(s): CMPE112

Catalog Description:
Operating system definition, simple batch systems, multiprogramming, time-sharing, personal computer systems, parallel systems. introduction to process, process scheduling, operations on processes, cooperating processes, interprocess communications, interrupts, threads, process synchronization, critical-section problem, atomic instructions, semaphores, synchronization problems, CPU scheduling, scheduling criteria and algorithms, multiple processes and real-time scheduling, algorithm evaluation, deadlocks, characterization and handling of deadlocks, deadlock prevention avoidance and detection, deadlock recovery, memory management and virtual memory, address spaces, swapping, memory allocation, paging, segmentation.

Course Web Page: https://staff.emu.edu.tr/gurcuoz/en/cmpe242

Textbook(s):
Abraham Silberschatz, Peter Baer Galvin and Greg Gagne: Operating System Concepts, 9th edition, John Wiley & Sons, Inc., 2014. ISBN: 978-1-118-09375-7.

Indicative Basic Reading List :

1. Andrew S. Tanenbaum, Modern Operating Systems, Second Edition, Prentice Hall, 2001.
2. H. M. Deitel, P. J. Deitel, and D. R. Choffnes: Operating Systems, 3rd Edition, Pearson Education, 2004. ISBN: 0-13-124696-8.

Topics Covered and Class Schedule:
(4 hours of lectures per week)

Week 2	Operating system definition, simple batch systems, multiprogramming, time-sharing, personal computer systems, parallel systems. (SIL: ch1)
Week 3-4	Computer system structures, interrupts. Operating system structures, system calls. (SIL:ch1, ch2)
Week 5	Introduction to process, process scheduling, operations on processes, cooperating processes, interprocess communication (SIL: ch3), threads (SIL: ch4)
Weeks 6-7	Process synchronization; Critical-section problem, synchronizing hardware, semaphores, synchronization problems, critical regions, process monitors, conditional variables. (SIL:ch5)
Week 8	CPU scheduling; Basic concepts. Criteria and algorithms, multiple process and real-time scheduling, algorithm evaluation. (SIL:ch6)
Weeks 9-10	**Midterm Examination**
Week 11	CPU scheduling (Continue)
Weeks 12-13	Deadlocks; Characterization and handling of deadlocks, deadlock prevention avoidance and detection, deadlock recovery. (SIL:ch7)
Weeks 14-15	Memory management and virtual memory; Address spaces, swapping, contiguous allocation, paging, segmentation. (SIL:ch8, ch9)
Weeks 16-17	**Final Examination**

Laboratory Schedule:
(2 hours of laboratory per week)

Week 4 (20Mar-25Mar)	Lab 0: Introduction to programming in Linux Operating System
Week 5	Lab 1: Using fork() system call in a C program
Week 6	Lab 2: Multi-threaded programming
Week 7	Lab 3: Synchronization of multiple threads
Week 8	Lab 4: Process scheduling exercises
Week 11-12	Lab 5: Process scheduling exercises
Week 13	Lab 6: Deadlocks exercises
Week 14-15	Lab 7: Memory management exercises

Course Learning Outcomes:
At the end of the course, student must be able to

1. Understand the role and purpose of operating systems.
2. Understand the concept of how programming languages, operating systems, and hardware architectures interact.
3. Understand the concept of a process and concurrency problems: synchronization, mutual exclusion, deadlocks.
4. Describe concurrent execution using states and state diagrams, ready lists, process control blocks, dispatching and context switching, interrupt handling in a concurrent environment.
5. Identify scheduling policies (e.g. the issues involved with preemptive vs. nonpreemptive scheduling).
6. Know methods of deadlock avoidance, detection, prevention and recovery. Identify solution strategies, including semaphores, monitors and condition variables.
7. Describe physical memory and memory management, including overlays, swapping, partitions, paging and segmentation, page placement and replacement policies, working sets and caching.

	Method	**No**	**Percentage**
Assessment	Midterm Exam(s)	1	40%
	Lab Works (TASKS)	7	15%
	Final Examination	1	45%

Contribution of Course to Criterion 5
Credit Hours for:
Mathematics & Basic Science : 0
Engineering Sciences and Design : 4
General Education : 0

Relationship of Course to Program Outcomes

The course has been designed to contribute to the following program outcomes:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

Exams:

- You have re-sit exam chance at the end of semester if you fail. Note that; if your letter grade is "D" or above and you have no warning, you will not be able to enter re-sit exam. Yet, be aware that if you attend the re-sit exam, grade you get will be replace your midterm and final exam grades even if your grade is decreased.
- If you miss the midterm or the final exam, you **MUST submit a written report to the course instructor, stating your excuse, within 3 days of that examination. The report will be evaluated by the committee of instructors. If the committee approves, you will be able to take a make-up exam.**
- If you miss both midterm and final exams and do not submit any written report, you will get an "NG" grade. In the same case, if you submit report for both missed exams, you will be able to enter make-up for one of them only.

Labs:

- There will be no makeup for the missed lab experiments.
- **If you miss three or more lab works, your lab grade will be zero.**

Plagiarism:

- Plagiarism (which also includes any kind of cheating in exams, assignments, and lab works) is a disciplinary offence and will be dealt with accordingly. Furthermore, the penalty of plagiarism is to get grade zero for the corresponding exam, assignment, or lab work.

Important Remarks:

- You should have regular attendance to the lectures for being successful in the course. Course related materials, exercises, laboratory experiments, old exam questions and announcements will be published on the course web site and you will be responsible from all. Note that the course web site can update during the semester. Therefore, please check it regularly.

Prepared by: Gürcü Öz	**Date Prepared:** 1 March 2023