Syllabus for EECS251: Advanced Operating Systems

Spring 2022

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Office Hours:	Please find the detailed information in my lecture slides.
Course Description:	This course is 4 units, including two lectures and one lab session every week. This course will offer students great opportunities to dig deeper into Operating Systems. We will use the first 4 lectures to review the basic concepts of Operating Systems, and the next 6 lectures to introduce some advanced concepts of Operating Systems, including computer networks and system security. We will use the next 6 lectures to introduce some cutting-edge applications of modern Operating Systems, including big data processing, distributed systems, Internet of Things, real-time control and robotics. At the beginning of the semester, I will recommend more than 12 recent top-conference papers in the research domain of Operating Systems. Each student needs to choose 7 papers from my recommended list. The student can also find 7 papers from top conferences (like SIGCOMM, SOSP, NSDI, and OSDI) and ask my approval, instead of being constrained by my recommended list. The student will orally present one or two of these papers in the class and write summaries for the rest 5 or 6 papers individually. Students will also accomplish a project in a group. In the last 10 classes, each student will present the chosen paper and her project in the class. The students need to find their project by the middle of the semester. They will use the lab sessions to test some ideas in the first part of the semester and to implement their ides in the last part of the semester. Regarding with paper reading, students are expected to understand the papers completely and further criticize the papers and discuss on possible research opportunities.
Course Objective:	This course aims at the following objectives. • Reviewing the basic concepts of operating systems. • Learning more advanced concepts of operating systems, including computer networks and system security. • Understanding the unique design requirements of different applications on operating systems, and corresponding solutions. • Leading an engineering project with research components by working with undergraduate students. • Knowing the state-of-the-art research on operating systems. • Critical thinking while reading research papers.
Course Learning Outcomes:	At the end of this course, students will receive a set of training, including: 1. Hands-on experience with the development of a specific system on an operating system. By analyzing a research problem with scientific methods, the students will

focus on system development, including system design, implementation, performance analysis and evaluation.
2. Designing the evaluation plan to test the developed system in a comprehensive way.
3. Learning the recent development of Operating Systems and understanding the new techniques that advance the start-of-the-art of Operating Systems.
4. Identifying the major research challenges in current research of Operating Systems; Accomplishing a project and write the project results with high standard.
5. Working in a team and presenting the results by oral presentation.

Program Learning Outcomes:

Based on the training described in the above items, including course description, course objectives and course learning outcomes, students will obtain the abilities to

1. Apply their knowledge of computing, mathematics, science, and engineering to the analysis of technological problems, as well as to the design and implementation of viable solutions to those problems.
2. Design and conduct experiments and computational simulations for the purpose of evaluating and comparing proposed solutions on the basis of empirical evidence.
3. Possess the characteristics of lifelong learners; they are able to acquire and use new techniques, skills, and engineering and scientific tools for research and development in electrical engineering and computer science, as well as to develop new methods and make new discoveries.
4. Practice a high standard of professional ethics, including integrity in the conducting and writing of research.
5. Communicate effectively through oral, visual, and written means, effectively addressing a broad range of technical audiences

Higher expectation compared with CSE 151 or 150:

The graduate students must learn the state-of-the-art research on operating systems and show their understanding in their summary of the papers. In addition, they must read the papers independently and train their critical thinking by criticizing the papers in their summary. However, undergraduate students will read the papers and present a paper in a group. The summary of paper reading from a graduate student must be 1 page with a separate section on criticizing the paper.

A graduate student must accomplish the final project independently. The selection of the project topic should consider research-oriented projects.

Prerequisite by Topic:

Course Policies:

<u>CLASS/LAB SCHEDULE</u>

CSE150 is a 4-credit course, which includes 3hours of lecture, 3 hours of lab each week. You should plan on spending at least 6 hours outside of lecture and lab on reading, studying, and project assignments.

<u>STUDENT RESPONSIBILITIES:</u>

Please be sensitive to the learning environment. It is assumed that every student is attending class to learn; therefore, anything which distracts any student from learning is not appropriate classroom behavior (for example, cell phones, conversing during lecture, checking E-mail or Facebook, Internet use not related to current class topic).

In attempting to keep with a business-like, professional atmosphere, any behavior which would be considered inappropriate in a business setting will be addressed in class (talking during lecture, sitting on the floor, feet on chairs, etc.)

<u>DEVICE AND FACILITY POLICIES:</u>

Computers are NOT needed for exams or for any in-lecture activities. Please do not bring laptops or mobile gaming devices to lecture. It is not necessary for you to have your own computer for this course, as all computing resources necessary will be provided in the lab. Projects can be completed within the designated weekly lab sessions and with use of any Open Access lab. Even though our labs will use the Linux operating system, the Eclipse programming environment we will use is identical for Linux, Windows and macOS.

COLLABORATION POLICIES:
The project assignments will be done in groups of 3 to 4 students. You may help each other understand the assignment, and are encouraged to approach other students to ask about concepts, algorithms, or general approaches to solve problems. However, each group must write their OWN CODE, and submitted work MUST be of the students turning them in. Allowing students from other groups to see your code, asking to see another group's code, or copying code/solutions from any other sources IS STRICTLY PROHIBITED.

You may, of course, seek assistance from the course TAs and the course instructor for all the assignments.

USE OF STUDENT WORK:
Work submitted by students may be used as examples for future students for educational or academic purposes. Names will be removed as possible. You may specifically request to not participate.

DEADLINE AND LATE POLICIES:
The posted deadline on CatCourses will be the official deadline for each assignment. The instructor has the discretion to change the deadline on a per-assignment basis. The penalty will be 10% for each day you are late with the submission unless stated otherwise.

CLASS/LAB ATTENDANCE POLICIES:
You are expected to attend the lab sessions for which you are enrolled, unless you make explicit arrangements with the instructor. Lab sessions are where you will get most of the information and learn so it is important to be there physically every week.

If you will be missing class lectures or labs due to participation in sports or academic activities (e.g., seminar), you should provide the professor with documentation at the start of the semester, and then provide confirmation before missing each such date. This is particularly important in the case of exams and program deadlines; as mentioned earlier, make-up exams and extension of deadlines will NOT be provided unless arrangements are made beforehand.

Academic Dishonesty Statement:

a. Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.
b. You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of the University of California,

Merced's Academic Honesty Policy can also be extended to include failure of the course and University disciplinary action.

c. During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam and may lead to failure of the course and University disciplinary action.

Disability Statement:

Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register with Disability Services Center to verify their eligibility for appropriate accommodations.

opics:

Broadly the topics are:

- Processes and Threads
- Scheduling and Synchronization
- Protection Schemes
- Address translation and Caching
- Paging (on-demand)
- File Systems
- Networking and Distributed Systems
- Security
- Big data processing
- The Internet of Things
- Real-time control and robotics

Assessment/ Grading Policy:

Grading will be based on written tests, projects and in-class presentation. All tests will be closed-book. Your final grade will be calculated based on the following (Note that the final grade components may change):

2 homework: 40%

1 or 2 in-class presentation: 20%

4 paper summaries: 20%

1 project: 20% (10% project report and 10% project presentation.)