University at Buffalo

CSE 421/521 - Introduction to Operating Systems
Fall 2021 Syllabus

All students are expected to read and understand this syllabus. It is the students' responsibility to ask questions if anything in the syllabus is unclear.

Course Logistics:

This course is expected to be in-person, but it may have **online real-time** components, Students are expected to be online and present, keep their cameras on and actively engage in the discussions.

Credit Hours: 3

Lecture Time:
TBD

Instructor:
Farshad Ghanei <farshadg@buffalo.edu>

Teaching Assistants:
TBD

Course Website: UBLearns and Piazza

Check UBLearns and Piazza for links to office hours and updated time changes.

Exam Schedule:
Midterm Exam: TBD
Final Exam: TBD

Note: If you need to email course staff, use your official UB email account, and please include [**CSE 421**] or [**CSE 521**] at the beginning of the subject line so your email is not missed. Emails without this subject or from non-UB accounts may be ignored.

Course Description:

CSE 421/521 is an introductory course on the design and implementation of operating systems. It covers the principles and techniques in the design of operating systems. Describes concepts of operating systems in terms of functions, structure, and implementation, particularly emphasizing multiprogramming. Topics include process coordination, deadlocks, memory management, device management, file systems, scheduling policies for CPU, and network and distributed operating systems. Illustrates concepts with examples from existing operating systems.

Course Prerequisites:

CSE 250 Data Structures, or an equivalent course, understanding C programming language. Students should make sure they are comfortable with reading and writing C code. Availability of Zoom, and the use of audio and video is expected for any potential online component. Please install the software and make sure your webcam and microphone work properly. Exceptions are only allowed if discussed with the instructor at the start of the semester.

Learning Outcomes:

At the end of this course, a successful student should be able to:

- Define different OS design techniques.
- Explain process management, processor scheduling, concurrent programming, deadlocks and synchronization, memory management, file management and I/O systems, disk scheduling.
- Distinguish main memory and virtual memory.
- Recognize user level and kernel level programming differences.
- Implement synchronization in multi-threaded programs.

Textbook:

Operating System Concepts (9th Edition)
A. Silberschatz, P.B. Galvin, and G. Gagne. Wiley Publishers, 2012
ISBN: 978-1-118-06333-0

Recommended Supplementary Text:

The C Programming Language
B. Kernighan and D. Ritchie. Prentice Hall, Inc., 1988
ISBN 0-13-110362-8

Advanced Programming in the UNIX(R) Environment
W. Stevens, Addison Wesley Longman Publishing Co., Inc. 1992
ISBN 0-201-56317-7

Piazza Discussion Forum:

We will use Piazza for class discussion. The system is highly efficient and faster, in order to ask your questions from classmates or teaching staff. Students are required to check Piazza frequently, and read all instructor announcements. (Link on the first page)

Accessibility Resources:

If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the Office of Accessibility Resources in 60 Capen Hall, 716-645-2608 and also the instructor of this course during the first week of class. The office will provide you with information and review appropriate arrangements for reasonable accommodations, which can be found on the web at: http://www.buffalo.edu/studentlife/who-we-are/departments/accessibility.html

Course Requirements:

The following items are required of every student, and failure to complete them may affect student grades:

Lectures and Quizzes:

We utilize offline lectures and online discussions over material and projects. The lecture contents are available through YouTube and the link is posted on UBLearns. Do not skip watching them and do not postpone watching them.

Every week you are required to watch 2 sessions which mostly are on a single topic. (Consider Projcet-2 video for 2 sessions and skip Project-3 video.)

When attending/watching lectures, close other applications, and turn off push notifications. Avoid checking emails, messages, etc. for the time you are attending/watching lectures. If you get bored and can't help the urge to check another tab or your emails/messages, be mindful and pause the lecture video.

To ensure that you are keeping up with the course pace, each **week** we have a quiz **through UBLearns**. You can take them on your computer or phone, **set an alarm for yourself since it is available only for a few minutes**. No makeup quizzes will be given, no exceptions.

Everyone is required to score 100 on Quiz-0. You may re-take the Quiz-0. Failing to participate and achieving 100 in this quiz may lead to failure in the course.

Exams:

There will be one mid-term exam taken during one of the lectures, and a final exam at the end of the semester. All tests are to be taken individually and without the use of any resource except those allowed by the instructor. Exams are recorded and/or students

may be required to record themselves during exams. These videos are not meant to be uploaded anywhere. But they are to ensure the integrity of the test.

Homework: There will be 5 homework assignments throughout the semester. The format of the homework questions will be similar to the exercises at the end of each chapter in the Silberschatz book. The homework assignments aim to ensure that you study regularly for the material covered in class. Assignments must be completed by hand (not typed), and a scanned version is submitted online. Digital handwriting (using touch pen) is also accepted.

Projects: There will be two projects (programming assignments, PAs) throughout the course. These projects aim to implement some core Operating System components for better understanding the concepts, and they require programming background in C and UNIX programming experience.
Programming assignments form a major component of your grade. They are time consuming and need your **very early engagement**. The projects are meant to be completed by a group of students and not individuals. Proper communication, planning, and task delegation is required to achieve good results. Keep major communications in written format (e.g. email), and make sure each member's contributions are clear.

Late Submission Policy:

* Projects and homework assignments are due at 11:59 PM, submissions after the deadline but within 24 hours, will incur a 20% penalty. Submissions after 24 hours of the deadline are not accepted.

Both for programing assignments and homework assignments, you can make unlimited submissions. Especially for programming assignments, you should NOT wait for a single submission right before the deadline. Technical issues arise and you will lose grade. Instead, you must make incremental submissions (There is no downside in making multiple submissions). Only the latest submission is considered, both in terms of timestamp, and grade.

Exam Policy:

* No makeup exams will be given except in provably extreme circumstances.
* Notify your instructor 24 hours prior to the exam via e-mail if you are going to miss an exam. If it is medically impossible for you to give prior notice, please obtain a note from a physician detailing the period (and the reason) you were medically incapable of communicating with the instructor.
* If you miss an examination because of sickness or similar reasons, visit a physician and obtain a note detailing the period and the reason you were medically incapable of taking the exam.
* You are responsible for knowing about the exam dates, please plan accordingly.

* For online exams, you are required to record yourself/paper/screen while taking the exam, it is your responsibility to notify the instructor at the start of semester if this is not feasible or of your concern.
* Exam times are stressful and one could forget about the exam time. Please make sure you arrange for multiple reminders so that you do not forget about the exams.

Zoom/Webex Decorum:

We may utilize Zoom/Webex for online discussions and office hours.
Even though we are communicating in an online platform, one's words and use of language should be temperate and within acceptable bounds of civility and decency. You should be mindful of what you say, or share on the online platform. Active participation is encouraged, however, use of voice and chat during open sessions should be with care and respect, so to prevent disturbance.
It is expected that the videos are turned on when possible. Proper clothing is required.

Grading Policy:

Each student's grade is computed from a weighted average of the following items:

Project-1:	20% (Split into three uneven parts)
Project-2:	30% (Split into three uneven parts)
Midterm Exam:	20%
Final Exam:	20%
Quizzes:	10%
Homework:	10% (5 Homework assignments)

10% is considered extra.

The final letter grade is based upon the following cutoffs:

93+	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
60-66	D
0-59	F

*If you score less than 10% in **ANY** of the programming assignments' coding grade (EXCLUDING grade from design document), you will **fail** the course independent of overall grade.
* If necessary, the instructor may revise these cutoffs downward.

* There will be separate curves for graduate and undergraduate students at the end of the semester to address inconsistencies or hardships that arise. Grades will not be curved/adjusted during the semester.
* Attending the class and active participation is highly recommended and expected.
* If there is any issue with grading, contact the teaching staff within 2 weeks of posting them.
* Students will receive a grade of “F” if they are found in violation of the academic integrity policy. Please make sure to thoroughly read and understand the policy for this course.

Incompletes (I/IU): The course follows the university undergraduate incomplete policy.
A grade of incomplete (“I”) indicates that additional coursework is required to fulfill the requirements of a given course. Students may only be given an “I” grade if they have a passing average in coursework that has been completed and have well-defined parameters to complete the course requirements that could result in a grade better than the default grade. An “I” grade may not be assigned to a student who did not attend the course.
Prior to the end of the semester, students must initiate the request for an “I” grade and receive the instructor’s approval. Assignment of an “I” grade is at the discretion of the instructor. Upon assigning an “I” grade, the instructor shall provide the student specification, in writing or by electronic mail, of the requirements to be fulfilled, and shall file a copy with the appropriate departmental office. Students must not re-register for courses for which they have received an “I” grade

Failure for Non-Attendance (FX): Students who have earned a failing grade due to lack of attendance (or participation where attendance is no applicable) will be awarded an “FX”.

Academic Integrity Policy:
Academic integrity is a fundamental university value. Through the honest completion of academic work, students sustain the integrity of the university while facilitating the university's imperative for the transmission of knowledge and culture based upon the generation of new and innovative ideas.
Students will abide by the CSE Academic Integrity Policy, the University Academic Integrity Policy, and the Undergraduate or Graduate amendments thereof, as appropriate. All resources used in completing assignments for this class must be given appropriate attribution, and the only resources allowed for the completion of programming assignments without specific permission are as follows.

- The course textbook
- Lecture material from this course
- Resources provided by the teaching staff for assignments.

In particular, Stack Exchange (or similar web pages), code from other students in the course or students who have completed this course or related courses at other universities in previous semesters, GitHub repositories, code or

algorithms from other web sites or books, and other resources are not allowed without explicit permission from the instructor.
If there is any question about whether a resource is acceptable for use in completing a course assignment, students are encouraged to ask the instructor or a TA before making use of it. Asking about a resource is not a violation of academic integrity, even if the resource is not allowed for the course.
Violation of these policies will result in a failing grade for the course and referral upward for additional sanctions according to University policy.

As an engineer or computer scientist, you have special ethical obligations. As per the NSPE Code of Ethics, “engineers shall avoid deceptive acts” and “shall conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession (https://www.nspe.org/resources/ethics/code-ethics). Similar sentiments of honesty, integrity, fairness, and responsibility are fundamental to the ACM Code of Ethics (https://www.acm.org/code-of-ethics).

Note: We use professional software which can easily detect any cheating attempts in programming projects. The results generated by this software is considered as official evidence for cheating from another student, or from internet sources.

Academic Integrity Amnesty:
A student who has committed a violation of this academic integrity policy may receive limited amnesty for the violation by *notifying me, in writing*, of the violation **before I download the assignments for assessment**. This notification must include the student’s name, person number, UBITname, and state the assignment in question and the nature of the violation. Upon submitting such a statement, the student will receive no credit for the violating assignment, but *no further sanctions will be taken, and the violation will not be reported.* Once I have begun assessing the assignment in question, no such statements will be permitted. Since it may not be obvious to students when assessment begins, such statements should be submitted as soon as possible after the violation occurs. While assessment may begin at any time, in general I will not look at student submissions until a project deadline has passed.

Copyright Policy:

Materials used in connection with this course may be subject to copyright protection under Title 17 of the United States Code. Under certain Fair Use circumstances specified by law, copies may be made for private study, scholarship, or research. Electronic copies should not be shared with unauthorized users. If a user fails to comply with Fair Use restrictions, he/she may be liable for copyright infringement.

Critical Campus Resources:

Sexual Violence: UB is committed to providing a safe learning environment free of all forms of discrimination and sexual harassment, including sexual assault, domestic and dating violence and stalking. If you have experienced gender-based violence (intimate partner violence, attempted or completed sexual assault, harassment, coercion, stalking, etc.), UB has resources to help. This includes academic accommodations, health and counseling services, housing accommodations, helping with legal protective orders, and assistance with reporting the incident to police or other UB officials if you so choose. Please contact UB's Title IX Coordinator at 716-645-2266 for more information. For confidential assistance, you may also contact a Crisis Services Campus Advocate at 716-796-4399.

Mental Health: As a student you may experience a range of issues that can cause barriers to learning or reduce your ability to participate in daily activities. These might include strained relationships, anxiety, high levels of stress, alcohol/drug problems, feeling down, health concerns, or unwanted sexual experiences. Counseling, Health Services, and Health Promotion are here to help with these or other issues you may experience. You can learn more about these programs and services by contacting:

Counseling Services:

* 120 Richmond Quad (North Campus), 716-645-2720
* 202 Michael Hall (South Campus), 716-829-5800

Health Services:

* Michael Hall (South Campus),716-829-3316

Health Promotion:

* 114 Student Union (North Campus),716-645-2837

Acknowledgments:

Some language in this syllabus is drawn from University policies (as noted), the UB Course Syllabi Requirements document, department guidelines, and other University resources. Some language and structure in this syllabus is drawn from syllabi of CSE faculty members: Dr Tevfik Kosar, Dr Karthik Dantu, Dr Ethan Blanton, Dr Jennifer Winikus, Dr Mathew Hertz, Dr Carl Alphonce.

All content in the syllabus is subject to change based on the needs of the class and the discretion of the instructor

Lecture and Assignment Tentative Schedule

This schedule is subject to change.

Please check Piazza for announcements and course material.

Date/Day		Session	Online (Class time)	Offline (flexible)	Assignments
		1	Introduction		
		2	Lecture and Discussion	OS Structures	
		3	Quiz, Discussion	Processes	
		4	Project Discussion	Threads	
		5	Quiz, Discussion	Synchronization_1	
		6	Project Discussion	Synchronization_2	
		7	Quiz, HW solution, Discussion	CPU Scheduling_1	
		8	Project Discussion	CPU Scheduling_2	
		9	Quiz, Discussion	Deadlocks_1	
		10	Project Discussion	Deadlocks_2	
		11	Quiz, HW solution, Midterm Review	Main Memory_1	
		12	Project Discussion	Project	
		13	Midterm Exam	Main Memory_2	
		14	Project Discussion	Project	
		15	Quiz, Discussion	Virtual Memory_1	
		16	Project Discussion	Virtual Memory_2	
		17	Quiz, Discussion	File Systems_1	
		18	Project Discussion	File Systems_2	
		19	Quiz, HW solution, Discussion	Project	
		20	Project Discussion	Mass Storage & I/O_1	
		21	Quiz, Discussion	Mass Storage & I/O_2	
		22	Project Discussion	Project	
		23	Quiz, Discussion	Distributed Systems_1	
		24	Project Discussion	Distributed Systems_2	
		25	Quiz, HW solution, Discussion	Protection and Security	
		26	Project Discussion	Project	
		27	HW solution, Final Review	Project	
		28	Project Discussion	Project	
			Final Exam		