

PURDUE

UNIVERSITY

**SCHOOL OF ELECTRICAL
AND COMPUTER ENGINEERING**
Graduate Office

Engineering Faculty Document 6-21
September 2, 2020
Page 1 of 1

To: The Engineering Faculty
From: School of Electrical and Computer Engineering
Re: ECE 60858 Introduction to Operating Systems

The School of Electrical and Computer Engineering has approved the following new course. This action is now submitted to the Engineering Faculty with a recommendation for approval.

ECE 60858 Introduction to Operating Systems

Semesters offered: Fall
Non-repeatable
Credit 3
Pre/Co-requisites: Graduate Status,

Course Description

This course will cover basic design principles of major components of modern Operating Systems: 1. Processes Management: processes, threads, CPU scheduling, inter-process communication, process synchronization, mutual exclusion, deadlocks; 2. Memory Management: dynamic address relocation, segmentation, paging, virtual memory, page replacement algorithms, protection, sharing; 3. File Systems: file system interface, file system implementation, including directories, disk allocation, disk scheduling, memory-mapped files, journaling file system, Network File System; 4. Storage Systems: Disk structure, disk scheduling, swap-space management, RAID. The course will additionally introduce (1) system design principles including extra-level of indirection, optimizing the common case, separation of policy and mechanism, and the principle of locality and caching, (2) advance OS topics such as Network File System, and (3) Case study of a modern OS such as Linux. Students are expected to spend at least three hours per week gaining hands-on experience building major components of a modern time-sharing operating system.

Reason

The course teaches one of the foundation subjects of Computer Engineering, and is expected to be taken by all first-year CE graduate students who specialize in the general software systems area.

History of Previous Offering

Spring 2017, Fall 2018, Fall 2019,



Milind Kulkarni, Associate Head of Teaching and Learning

ECE695: Introduction to Operating Systems

Fall 2020 Syllabus

Information About the Course

CRN:	24469
Meeting time:	12:00pm – 1:15pm Tuesday and Thursday
Meeting venue:	https://zoom.us/j/4683658957?pwd=MmY3UTVROG04MkloQmcwT1dCcnVpZz09
Course credit hours:	3
Course web page:	https://engineering.purdue.edu/~ece695x/
Piazza web page:	https://piazza.com/purdue/fall2020/ece695x (access code: notpizza)
Teaching staff email:	ece695x@purdue.edu
Class mailing list:	fall-2020-ece-69500umbychu001@lists.purdue.edu (for announcement)
Prerequisites:	ECE368 (Data Structures), ECE437 (Introduction to Digital Computer Design and Prototyping), and ECE469 (Operating Systems Engineering). Programming proficiency in C/C++ is <i>absolutely</i> required.

Information About the Instructor

Name of the instructor:	Y. Charlie Hu
Office Location:	MSEE 232
Phone number:	765 337 8990 (Cell)
Email Address:	ychu@purdue.edu
Office hours, times & location:	1:00 – 3:00pm Wednesday via Zoom: https://zoom.us/j/4683658957?pwd=MmY3UTVROG04MkloQmcwT1dCcnVpZz09

Course Description

This course will cover basic design principles of major components of modern Operating Systems:

- Processes Management: processes, threads, CPU scheduling, inter-process communication, process synchronization, mutual exclusion, deadlocks;
- Memory Management: dynamic address relocation, segmentation, paging, virtual memory, page replacement algorithms, protection, sharing;
- File Systems: file system interface, file system implementation, including directories, disk allocation, disk scheduling, memory-mapped files, Network File System
- Storage Systems: Disk structure, disk scheduling, swap-space management, RAID.

The course will additionally introduce (1) system design principles including extra-level of indirection, optimizing the common case, separation of policy and mechanism, and the principle of locality and caching, (2) advance OS topics such as Network File System, and (3) Case study of a modern OS such as Linux. Students are expected to spend at least three hours per week gaining hands-on experience building major components of a modern time-sharing operating system.

Learning Outcomes

A student who successfully fulfills the course requirements will have demonstrated

1. an understanding of basic concepts of and technologies in processes, process control, synchronization, scheduling, memory management, secondary and tertiary storage management, file systems, distributed and networked operating systems. [a, e]
2. an ability to design and modify components of an operating system. [a, b, c]
3. an ability to model and analyze the performance of OS components. [a, b]

Teaching Philosophy

As the instructor, it is my responsibility to maximize opportunities for every student in the class to learn, grow, and succeed in reaching their personal goals and desires related to the class. To meet this responsibility, I draw on the first-hand experiences teaching this course in the past two decades to develop and implement two key ingredients to the effective learning of this subject: active in-class discussions and extensive hands-on programming projects outside the classroom.

How to Succeed in this Course

If you want to be a successful student:

- Be self-motivated and self-disciplined.
- Be open-minded and have curiosity
- Be good at time management as programming projects (3) come in large chunks
- Be effective working as a team (of 2).
- Be willing to “speak up” if problems arise.
- Be willing and able to commit to 5 to 10 hours per week.
- Accept critical thinking and decision making as part of the learning process.

Learning Resources, Technology, & Texts

- Textbook: Silberschatz, Galvin, and Gagne, *Operating System Concepts*, 10th (or Essentials, 8th, 7th) edition, John Wiley & Sons.
 - You will read approximately 500 pages of the textbook that cover the topics discussed in class
- Lecture note: If available, notes for the lectures will be made available on the Web at engineering.purdue.edu/~ece695x/lectures. These notes are not necessarily self-contained, complete, or coherent. They are provided to aid you in your own note-taking. They are certainly not a substitute for attending class.
- Software: We will be using DLXOS, an OS emulator for doing the programming projects.

Course Logistics

- The lectures will be delivered online synchronously during the class hours via Zoom.
- There are no homeworks in this class.
- We will have up to three pop quizzes during class.

- All programming projects are due on Sunday midnights. No extensions will be given except for medical and other emergency reasons, as typically the next project starts right after the previous project is due.
- The midterm and final exams will be open book but with fixed duration.

Instructor’s Email Availability and Policies

The Instructor will be available via email daily, and try to respond as soon as possible (generally within 24) hours. When emailing me, please place the course number/section and the topic in the subject line of the email (e.g., ECE695 – Lecture 3 Question). This will help me tremendously in locating and responding to your emails quickly.

Virtual Office Hours

Virtual Office Hours are a synchronous session (through Zoom) to discuss questions related to weekly lectures, exams, or programming projects.

Office hours will be held Wednesdays from 1:00-3:00 pm EST. To connect to the weekly session, go to the instructor’s Zoom room: <https://zoom.us/s/4683658957s>

Assignments and Points

Your learning will be assessed through a combination of programming projects, a midterm and a final exam, and class interactions (such as pop quizzes). Details on these assignments and exams will be posted on the course website.

Assignments	Due	Points
Pop quizzes	Throughout the semester	Up to 10
Programming project 1	September 6 (1 week)	0 (not graded)
Programming project 1	October 4 (4 weeks)	20
Programming project 2	November 1 (4 weeks)	15
Programming project 3	November 29 (4 weeks)	15
Midterm exam	October 6	25
Final exam	December 8	25
(none)	(n/a)	Total: 200

* Final exam will be non-cumulative – it will only cover topics discussed after the Midterm exam.

Programming Projects

The programming projects in this course are to build an operating system for a simulated architecture using Linux machines (Linux is a POSIX-compliant version of UNIX which runs on x86 architectures). The students will be building three major components of modern operating systems (e.g. virtual memory, file system). The projects are to be done in groups of two students, but you have the option to work independently.

Questions and Answers Regarding Programming Projects

This term we will be using Piazza to share both the questions and the answers to common problems encountered in doing the programming projects (Solutions should by no means be shared.) The system is highly catered to getting you help fast and efficiently from classmates and the TA. Rather than emailing questions to the teaching staff, I encourage

you to post your questions on Piazza. If you have any problems or feedback for the developers, email team@piazza.com. Find our class piazza signup link at: <https://piazza.com/purdue/fall2020/ece695x> (signup code: notpizza)

Examinations

There will be two exams: midterm and final. They will cover the material discussed during the first and second half of the class, respectively, (i.e., they are not cumulative), including material from lectures, required readings, and the programming projects.

The midterm and the final exams will be open-book (work from home) but fixed duration.

Missed or Late Work

Deadline-missed programming projects may only be made up if (1) it was due to medical or other emergency reasons and (2) when you notify me ahead of time with an explanation and plan for completion. These requests will be accepted at my discretion and may include a point penalty of 5% per day late.

Grading Scale

In this class, the grades reflect the sum of your achievement throughout the semester. You will accumulate points as described in the assignments portion above, with each assignment graded according to a rubric. At the end of the semester, final grades will be calculated by adding the total points earned and translating those numbers (out of 100 plus bonus points) into the following letters (fraction points will be rounded up):

- A+: > 95
- A: [91, 95]
- A-: [86, 90]
- B+: [82, 85]
- B: [79, 81]
- B-: [76, 78]
- C+: [72, 75]
- C: [69, 71]
- C-: [66, 68]
- D: [56, 65]
- F: 55 or below

Incompletes

A grade of incomplete (I) will be given only in unusual circumstances. To receive an "I" grade, a written request must be submitted prior to December 1, and approved by the instructor. The request must describe the circumstances, along with a proposed timeline for completing the course work. Submitting a request does not ensure that an incomplete grade will be granted. If granted, you will be required to fill out and sign an "Incomplete Contract" form that will be turned in with the course grades. Any requests made after the course is completed will not be considered for an incomplete grade.

Course Schedule

Week	Topic & Readings	Book Chapters
1	Intro to OS	1-2
2	Processes	3-4
2, 3, 4	Process Synchronization	6
4	CPU Scheduling	5
5	Deadlocks	7
5, 6, 7, 8	Memory Management	8-9
9	Threads	Lecture notes
10, 11, 12, 13	File System	10-13
14	Storage System	14
15	Network File System	Lecture notes
16	Distributed System	Lecture notes

* Schedule and assignments subject to change. Any changes will be posted in the learning management system.

Attendance Policy

The University's regulation on class attendance can be found [here](#). While absences for a variety of reasons are expected, the student bears the responsibility of informing the instructor in a timely fashion, when possible. Ultimately students are responsible for all required coursework and bear full responsibility for any academic consequences that may result due to absence.

Attendance Policy during COVID-19

Students should stay home and contact the Protect Purdue Health Center (496-INFO) if they feel ill, have any symptoms associated with COVID-19, or suspect they have been exposed to the virus. In the current context of COVID-19, in-person attendance will not be a factor in the final grades, but the student still needs to inform the instructor of any conflict that can be anticipated and will affect the submission of an assignment or the ability to take an exam. Only the instructor can excuse a student from a course requirement or responsibility. When conflicts can be anticipated, such as for many University-sponsored activities and religious observations, the student should inform the instructor of the situation as far in advance as possible. For unanticipated or emergency conflict, when advance notification to an instructor is not possible, the student should contact the instructor as soon as possible by email, through Brightspace, or by phone. When the student is unable to make direct contact with the instructor and is unable to leave word with the instructor's department because of circumstances beyond the student's control, and in cases of bereavement, quarantine, or isolation, the student or the student's representative should contact the Office of the Dean of Students via [email](#) or phone at 765-494-1747. Our course Brightspace includes a link on Attendance and Grief Absence policies under the University Policies menu.

Academic Guidance in the Event a Student is Quarantined/Isolated

If you become quarantined or isolated at any point in time during the semester, in addition to support from the Protect Purdue Health Center, you will also have access to an Academic Case Manager who can provide you academic support

during this time. Your Academic Case Manager can be reached at acmq@purdue.edu and will provide you with general guidelines/resources around communicating with your instructors, be available for academic support, and offer suggestions for how to be successful when learning remotely. Importantly, if you find yourself too sick to progress in the course, notify your academic case manager and notify me via email or Brightspace. We will make arrangements based on your particular situation. The Office of the Dean of Students (odos@purdue.edu) is also available to support you should this situation occur.

Classroom Guidance Regarding Protect Purdue

This classroom guidance from the university does not apply to our online course this semester.

The [Protect Purdue Plan](#), which includes the [Protect Purdue Pledge](#), is campus policy and as such all members of the Purdue community must comply with the required health and safety guidelines. Required behaviors in this class include: staying home and contacting the Protect Purdue Health Center (496-INFO) if you feel ill or know you have been exposed to the virus, properly wearing a mask [in classrooms and campus building](#), at all times (e.g., mask covers nose and mouth, no eating/drinking in the classroom), disinfecting desk/workspace prior to and after use, maintaining appropriate social distancing with peers and instructors (including when entering/exiting classrooms), refraining from moving furniture, avoiding shared use of personal items, maintaining robust hygiene (e.g., handwashing, disposal of tissues) prior to, during and after class, and following all safety directions from the instructor.

Students who are not engaging in these behaviors (e.g., wearing a mask) will be offered the opportunity to comply. If non-compliance continues, possible results include instructors asking the student to leave class and instructors dismissing the whole class. Students who do not comply with the required health behaviors are violating the University Code of Conduct and will be reported to the Dean of Students Office with sanctions ranging from educational requirements to dismissal from the university.

Any student who has substantial reason to believe that another person in a campus room (e.g., classroom) is threatening the safety of others by not complying (e.g., not wearing a mask) may leave the room without consequence. The student is encouraged to report the behavior to and discuss next steps with their instructor. Students also have the option of reporting the behavior to the [Office of the Student Rights and Responsibilities](#). See also [Purdue University Bill of Student Rights](#).

Academic Integrity

As a student at Purdue you are subject to the [Purdue University Student Code of Conduct](#), which enjoins you to respect the highest standards of honesty and integrity. All work that you submit in this course must be your own; unauthorized group efforts are considered academic dishonesty. See the online brochure [Student guide for academic integrity](#) for definitions and sanctions. Academic dishonesty is a serious offense which may result in suspension or expulsion from the University. In addition to any other action taken, such as suspension or expulsion, a **grade of F** will normally be recorded on the transcripts of students found responsible for acts of academic dishonesty.

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breaches of this value by either [emailing](#) or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.

The [Purdue Honor Pledge](#) "As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue"

Nondiscrimination Statement

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. [Link to Purdue's nondiscrimination policy statement.](#)

Students with Disabilities

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options. You are also encouraged to contact the Disability Resource Center at: drc@purdue.edu or by phone: 765-494-1247.

Emergency Preparation

In the event of a major campus emergency, course requirements, deadlines and grading percentages are subject to changes that may be necessitated by a revised semester calendar or other circumstances beyond the instructor's control. Relevant changes to this course will be posted onto the course website or can be obtained by contacting the instructors or TAs via email or phone. You are expected to read your @purdue.edu email on a frequent basis.

You are encouraged to familiarize yourself with Purdue University [Key Emergency Preparedness Resources](#).

Guidelines regarding ensuring access to emergency information during class time:

- Keep your cell phone on to receive a Purdue ALERT text message, or
- Log into a Purdue computer connected to the network to receive any Desktop Popup Alerts.

Mental Health Statement

- **If you find yourself beginning to feel some stress, anxiety and/or feeling slightly overwhelmed, try [WellTrack](#).** Sign in and find information and tools at your fingertips, available to you at any time.
- **If you need support and information about options and resources,** please see the [Office of the Dean of Students](#) for drop-in hours (M-F, 8 am- 5 pm).
- **If you're struggling and need mental health services:** Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of mental health support, services are available. For help, such individuals should contact [Counseling and Psychological Services \(CAPS\)](#) at 765-494-6995 during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Violent Behavior Policy

Purdue University is committed to providing a safe and secure campus environment for members of the university community. Purdue strives to create an educational environment for students and a work environment for employees that promote educational and career goals. Violent Behavior impedes such goals. Therefore, Violent Behavior is prohibited in or on any University Facility or while participating in any university activity.

See the [University's full violent behavior policy](#) for more detail.

Diversity and Inclusion

In our discussions, structured and unstructured, we will explore a variety of challenging issues, which can help us enhance our understanding of different experiences and perspectives. This can be challenging, but in overcoming these challenges we find the greatest rewards. While we will design guidelines as a group, everyone should remember the following points:

- We are all in the process of learning about others and their experiences. Please speak with me, anonymously if needed, if something has made you uncomfortable.
- Intention and impact are not always aligned, and we should respect the impact something may have on someone even if it was not the speaker's intention.
- We all come to the class with a variety of experiences and a range of expertise, we should respect these in others while critically examining them in ourselves.

Course Evaluation

During the last two weeks of the course, you will be provided with an opportunity to evaluate this course and your instructor. Purdue uses an online course evaluation system. You will receive an official email from evaluation administrators with a link to the online evaluation site. You will have up to two weeks to complete this evaluation. Your participation is an integral part of this course, and your feedback is vital to improving education at Purdue University. I strongly urge you to participate in the evaluation system.

Disclaimer

This syllabus is subject to change. The Instructor will announce and share changes made to the syllabus via the class mailing list (which you are all automatically subscribed to).