Course Syllabus

University of Oklahoma Polytechnic Institute  
CYBS 3113: Operating System Fundamentals  
Spring 2025

Course Meeting Time: Tuesdays and Thursdays from 2:30 pm to 3:50 pm.

Location: OU Tulsa Campus

Instructor: Dr. John Hassell

**Contact:**[Hassell@ou.edu](mailto:Hassell@ou.edu), Admin Building, Room 1H07

**About Your Instructor**: I am an Associate Professor of Software Development and Integration, with over thirty years of industry experience that I bring to my teaching. My background includes working on both front-end and back-end commercial web application development, creating iPhone and Android mobile apps, and programming embedded systems. These experiences span various sectors, such as the oil and gas industry and projects for first responders and defense applications. I am committed to helping students develop practical skills in software development through active learning approaches. My work also includes founding ZigBeef, a student technology spinoff at the University of Oklahoma, which focuses on long-range cattle RFID technology—a direct application of my doctoral research. Additionally, I have had the opportunity to share my experiences in entrepreneurship as an adjunct professor at the University of Tulsa, where I aim to bridge the gap between academic learning and industry practice through hands-on learning experiences.

Student Support Hours: Tuesdays and Thursdays from 10:30 am to noon CST or by appointment. Virtual student support hours are also available. These hours are dedicated to you, providing a space where you can ask questions about course content, engage in deeper discussions, voice any concerns you have about the class, and explore career or graduate school options in this field with me. Many students feel hesitant about interrupting my time, but I want to assure you that your visits are welcome and encouraged! These sessions are valuable not only for your learning but also for me to understand better the questions and needs of my students, allowing me to refine my teaching methods accordingly.

Learning Management System/Website: All Materials (except the textbooks) will be available on Canvas.  Log in with your OU ID (usually the first 4 letters of your last name followed by a 4-digit number). All assignments, deadlines, grades, announcements, and course documents will be posted to the CYBS 3113 Canvas page. It is your responsibility to regularly check for updates. You can confiture Canvas to email you notifications. Click this link to go to the class website: [https://canvas.ou.edu](https://canvas.ou.edu/).

Course Prerequisites: None.

Course Description: This course provides a comprehensive introduction to operating systems, focusing on core concepts like process management, memory virtualization, file systems, synchronization, and basic I/O operations. The course begins with an introduction to C programming, followed by key operating system functionalities using "[Operating Systems: Three Easy PiecesLinks to an external site.](https://pages.cs.wisc.edu/~remzi/OSTEP/)" as the primary text. Students will engage in hands-on assignments to apply these concepts, culminating in an understanding of how operating systems operate at both theoretical and practical levels.

Course Goals: The course will cover the following:

* Students will learn about the design and implementation of an operating system.
* Students will understand interprocess communication and process synchronization.
* Students will learn virtual memory system and its implementation.
* Students will learn about security and protection in operating system.
* Students will learn disk management systems.

Learning Outcomes: Upon successful completion of the course, the student will be able to:

* Explain basic components of a modern computer-based operating system including concepts of process, thread, deadlocks, synchronization, systems calls, file systems, and file structure.
* Analyze CPU scheduling algorithms work, compare and explain their relative merits.
* Describe memory organization, physical and virtual memory, and differences between segmented and paged memory, and be able to describe their usage and relative merits.
* Explain I/O and I/O device behavior and be able to compare and explain the merits of interrupt driven vs DMA access.

ABET:

Students will increase their ability to meet the following ABET outcomes (which are outcomes tied to the accreditation of the bachelor of science degree in cybersecurity):

* Outcome 1: Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
* Outcome 3: Communicate effectively in a variety of professional contexts.
* Outcome 5: Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.

Texts and Materials:

* "Operating Systems: Three Easy Pieces" by Remzi H. Arpaci-Dusseau and Andrea C. Arpaci-Dusseau (available online for free)

**Teaching Philosophy**:

This course deliberately moves away from traditional classroom lectures in favor of a more dynamic learning environment. You will be responsible for engaging with course content (readings, videos, and other materials) before coming to class. Our class time will then be dedicated entirely to hands-on activities, collaborative problem-solving sessions, and practical applications of operating system concepts. Instead of passive note-taking, you'll spend class time working through real-world challenges, participating in group discussions, and applying theoretical concepts through interactive exercises. This approach ensures you're actively constructing your understanding of operating systems through direct experience rather than lecture-based instruction. Come to class prepared to engage, collaborate, and practice – not to listen to traditional lectures. This methodology particularly suits the technical nature of operating systems, as it maximizes our time together for practical application and deeper learning through active participation.

Expectations:

You can expect from me:

* To start and end class on time.
* To assign homework that covers the material and is relevant to the course.
* To reply to your emails in a timely manner.
* To keep regularly scheduled student hours and appointments.
* To provide opportunities for intellectual growth.

Students are expected:

* To be present in all class meetings and inform me in a brief e-mail if you will be absent.
* To participate actively in class discussions; be attentive and engaged; ask questions.
* To spend an adequate amount of time on projects, reading, and absorbing the material.
* To seek help from me when needed; ask early which gives us time to make corrections, not at the end of the semester when options are more limited.

**Learning Activities, Assignments, and Assessments:**

* Weekly readings from the textbook followed by in-class discussions and quizzes.
* Programming assignments in C to reinforce theoretical concepts.
* Project-based learning focusing on OS components like process schedulers or memory managers.
* A midterm and final exam covering all course material.

**Assessments (Grading):**

Grades will be calculated based on a point system. You will start with zero points and accumulate points through individual assignments, quizzes, and projects. Your final grade will reflect the total number of points you earn.

The quality of your work will determine the points you earn. Your engagement in class discussions, your contributions to group activities, and your performance in projects will also be considered in your final grade. The course will have a total of 1000 points available.

**Grade Matrix:**

| **Grade** | **Points Earned** |
| --- | --- |
| A | >895 |
| B | 795-895 |
| C | 695-794 |
| D | 595-694 |
| F | <595 |

**Course Point Allocation:**

* **Quizzes: 150 points (15.0%)**
* **Homework Projects: 450 points (45.0%)**
* **Midterm Exam: 100 points (10.0%)**
* **Final Exam: 150 points (15.0%)**
* **In-class Projects: 150 points (15.0%)**

**Types of Assignments:**

* Quizzes: Assess understanding of readings and lectures.
* Homework Projects: Occasional projects in C to apply OS concepts.
* Midterm Exam: Covers modules 1-3.
* Final Exam: Comprehensive review of all modules.
* In-class Projects: Smaller projects to be completed individually or in groups that are designed to be finished during class.

**Late Assignments:**

The quizzes (all low-stakes) must be taken during the day of the assignment, starting at the class period, with the window closing at midnight of that day. If you miss taking the quiz, you will get no points. The homework projects, due via GitHub, have built-in deadlines that will automatically close submissions at the specified time. Timely submission is crucial to avoid penalties.

This structure is designed to ensure that you are consistently engaged with the material and that you develop practical, industry-relevant skills throughout the course.

Course Policies:

**Academic Integrity and Plagiarism:**Academic honesty is incredibly important within this course. Cheating is strictly prohibited at the University of Oklahoma, because it devalues the degree you are working hard to get. As a member of the OU community, it is your responsibility to protect your educational investment by knowing and following the rules. For specific definitions on what constitutes cheating, review the [Student’s Guide to Academic Integrity](http://integrity.ou.edu/students_guide.html).

The overall goal of this course is your learning. In order to demonstrate that you have reached this goal, the work you turn in needs to be your own. This includes putting written work into your own words and citing your sources, as appropriate, to avoid plagiarism. If you work in a group, seek assistance from a tutor, use a resource on campus, and/or use online resources (including AI software – see specific AI policy below), the work you turn in must be your own, demonstrating your own understanding of the material that you have gained through the learning process.

If you have questions about academic integrity or plagiarism, please ask: my aim is to foster an environment where you can learn and grow, while also maintaining academic honesty and a clear representation of your learning and ideas. Penalties for serious offenses include a zero on the assignment and egregious offenses can even result in expulsion from the university, so it is important to understand expectations.

Plagiarism as defined by the [OU Integrity Office](https://www.ou.edu/integrity/students#OU-and-Integrity) includes:

* Copying words and presenting them as your own writing.
* Copying words, even if you give the source, unless you also indicate that the copied words are a direct quotation
* Copying words and then changing them a little, even if you give the source.
* Even if you express it in your own words, it is plagiarism to use someone else’s idea as your own.

Visit the [OU Integrity Office](https://www.ou.edu/integrity/students#OU-and-Integrity) for more information on what constitutes plagiarism.

**Artificial Intelligence Policy**: I hope that this course aids you in a creative exploration of Generative AI tools and how they can be used to assist you in accomplishing the goals of this course. In this course, you:

* May use any **free** Generative AI tools, including those provided to you by the university. This will allow everyone in the course to have the same access to Generative AI. Using AI does not negate or change the Academic Integrity and Plagiarism guidance.
* Must appropriately acknowledge its use and provide a statement describing how and why it was used, and how you verified the accuracy of its output. You are expected to cite your usage of Generative AI, including any direct quotes or paraphrasing of ideas/content generated by AI. But remember, AI can be wrong, so verify the output.
* **Cannot** use it to write any papers and submit as your own work. You can use it to give you ideas; however, I will be asking you to explain your work and I will ask questions about the topic – studying the material is the only way to really learn.

Usage of generative AI without appropriate acknowledgment will be considered a violation of the academic integrity policy for this course.

Absences and Make-up Policy: Students must attend classes to keep up with the course material. If you miss class, you are expected to contact me. For this course, you have one automatically excused absence, no questions asked – which cannot be used on presentation days, exam review, or exam days. Any assignments that are due on the day would still need to be completed in accordance with the late work policy. Makeup tests are given only if solid evidence of a medical or serious emergency prevents the student from participating in the exam.

In addition to your automatic excused absence, I will also excuse additional absences due to accommodations, as communicated with Accessibility and Disability Resource Center (ADRC), medical emergencies (including mental or physical, with a doctor’s, counselor’s, or ADRC note), illness or death in a close relation, and university sponsored activities. If you have childcare/eldercare or other issues that may prevent you from being as active of a participant during class discussion as you normally would be, please notify me so that we can discuss another way in which you can demonstrate your participation that day.

If in doubt on whether an absence would be excused or not, I want you to talk with me. Additional excused absences are at my discretion. If you have three or more unexcused absences in the course, you will receive a reduction in your final letter grade of ten points (e.g. a C would become a D) since active in-class participation is an expectation of the course. The final exam will not have a makeup test and must be taken. Failure to take the final exam will result in an automatic F.

Land Acknowledgement Statement Provided by OU’s Tribal Liaison office:

Long before the University of Oklahoma was established, the land on which the University now resides was the traditional home of the “Hasinais” Caddo Nation and “[Kirikirʔi:sLinks to an external site.](http://www.wichitatribe.com/media/18910/wichita.mp3)” (audio available when opened in Chrome) Wichita & Affiliated Tribes. We acknowledge that this territory once also served as a hunting ground, trade exchange point, and migration route for the Apache, Comanche, Kiowa, and Osage nations.  Today, 39 tribal nations dwell in the state of Oklahoma due to settler and colonial policies designed to assimilate Native people. The University of Oklahoma recognizes our university's historical connection with its indigenous community. We acknowledge, honor and respect the diverse Indigenous peoples connected to this land. We fully recognize, support, and advocate for the sovereign rights of all of Oklahoma’s 39 tribal nations. This acknowledgment is aligned with our university’s core value of creating a diverse and inclusive community. It is an institutional responsibility to recognize and acknowledge the people, culture, and history that make up our entire OU Community.

University Policies

Mental Health Support Services

Support is available for any student experiencing mental health issues that are impacting their academic success.  Students can either been seen at the University Counseling Center (UCC) located on the second floor of Goddard Health Center or receive 24/7/365 crisis support from a licensed mental health provider through [TELUS](https://www.ou.edu/ucc/online-therapy) Health.  To schedule an appointment or receive more information about mental health resources at OU please call the UCC at 405-325-2911 or visit  [University Counseling Center](https://www.ou.edu/ucc). The UCC is located at 620 Elm Ave., Room 201, Norman, OK 73019. Given we are in Tulsa, please contact Student Affairs in the Founders Student Center, or email them at TulsaSA@ou.edu, or call them at 918-660-3100.

Title IX Resources and Reporting Requirement

The University of Oklahoma faculty are committed to creating a safe learning environment for all members of our community, free from gender and sex-based discrimination, including sexual harassment, domestic and dating violence, sexual assault, and stalking, in accordance with Title IX. There are resources available to those impacted, including: speaking with someone confidentially about your options, medical attention, counseling, reporting, academic support, and safety plans. If you have (or someone you know has) experienced any form of sex or gender-based discrimination or violence and wish to speak with someone confidentially, please contact [OU Advocates](https://www.ou.edu/gec/gender-based-violence/advocates)(available 24/7 at 405-615-0013) or [University Counseling Center](http://ou.edu/ucc) (M-F 8 a.m. to 5 p.m. at 405-325-2911)

Because the University of Oklahoma is committed to the safety of you and other students, and because of our Title IX obligations, I, as well as other faculty, Graduate Assistants, and Teaching Assistants, are mandatory reporters. This means that we are obligated to report gender-based violence that has been disclosed to us to the Institutional Equity Office. This includes disclosures that occur in: class discussion, writing assignments, discussion boards, emails and during Student/Office Hours. You may also choose to report directly to the Institutional Equity Office. After a report is filed, the Title IX Coordinator will reach out to provide resources, support, and information and the reported information will remain private. For more information regarding the University’s Title IX Grievance procedures, reporting, or support measures, please visit [Institutional Equity Office](https://www.ou.edu/eoo)at 405-325-3546.

Reasonable Accommodation Policy

The University of Oklahoma (OU) is committed to the goal of achieving equal educational opportunity and full educational participation for students with disabilities. If you have already established reasonable accommodations with the Accessibility and Disability Resource Center (ADRC), please [submit your semester accommodation request through the ADRC](https://www.ou.edu/adrc/students/adrc-registered-students/accommodation-request) as soon as possible and contact me privately, so that we have adequate time to arrange your approved academic accommodations.

If you have not yet established services through ADRC, but have a documented disability and require accommodations, please complete [ADRC’s pre-registration formLinks to an external site.](https://forms.office.com/pages/responsepage.aspx?id=neB9nDSQwUS0YsRk_s4gSiXtB4DC5XxJhwAGd7Un1f5UNFU2WDE3UEVENTFIMkgyWFkzV0lGM1NPVCQlQCN0PWcu) to begin the registration process.  ADRC facilitates the interactive process that establishes reasonable accommodations for students at OU.  For more information on ADRC registration procedures, please review their [Register with the ADRC](https://www.ou.edu/adrc/about/registering-with-the-adrc) web page.  You may also contact them at (405)325-3852 or [adrc@ou.edu](mailto:adrc@ou.edu), or visit [www.ou.edu/adrc](http://www.ou.edu/adrc) for more information.

Note: disabilities may include, but are not limited to, mental health, chronic health, physical, vision, hearing, learning and attention disabilities, pregnancy-related.  ADRC can also support students experiencing temporary medical conditions.

Religious Observance

It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

[[See Faculty Handbook 3.15.2]](https://apps.hr.ou.edu/FacultyHandbook/#3.15.2)

Adjustments for Pregnancy/Childbirth Related Issues

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact the Accessibility and Disability Resource Center at 405/325-3852 and/or the Institutional Equity Office at 405/325-3546 as soon as possible. Also, see the Institutional Equity Office [FAQ on Pregnant and Parenting Students’ Rights](https://www.ou.edu/content/dam/eoo/documents/faqs/faqs-pregnant-and-parenting-students.pdf) for answers to commonly asked questions.

Final Exam Preparation Period

Pre-finals week will be defined as the seven calendar days before the first day of finals. Faculty may cover new course material throughout this week. For specific provisions of the policy please refer to OU’s [Final Exam Preparation Period policy](https://apps.hr.ou.edu/FacultyHandbook#4.10).

Emergency Protocol

During an emergency, there are official university [procedures](https://www.ou.edu/campussafety/policy-and-procedures) that will maximize your safety.

**Severe Weather:**If you receive an OU Alert to seek refuge or hear a tornado siren that signals severe weather.

1. Look for severe weather refuge location maps located inside most OU buildings near the entrances.
2. Seek refuge inside a building. Do not leave one building to seek shelter in another building that you deem safer. If outside, get into the nearest building.
3. Goto the building’s severe weather refuge location. If you do not know where that is, go to the lowest level possible and seek refuge in an innermost room. Avoid outside doors and windows.
4. Get in, Get Down, Cover Up
5. Waitfor official notice to resume normal activities.

Additional [Weather Safety Information](https://www.ou.edu/campussafety/divisions#management) is available through the Department of Campus Safety.

The University of Oklahoma Active Threat Guidance

The University of Oklahoma embraces a Run, Hide, Fight strategy for active threats on campus. This strategy is well known, widely accepted, and proven to save lives. To receive emergency campus alerts, be sure to update your contact information and preferences in the account settings section at [one.ou.edu](http://one.ou.edu/).

RUN: Running away from the threat is usually the best option. If it is safe to run, run as far away from the threat as possible. Call 911 when you are in a safe location and let them know from which OU campus you’re calling from and location of active threat.

HIDE: If running is not practical, the next best option is to hide. Lock and barricade all doors; turn of all lights; turn down your phone’s volume; search for improvised weapons; hide behind solid objects and walls; and hide yourself completely and stay quiet. Remain in place until law enforcement arrives. Be patient and remain hidden.

FIGHT: If you are unable to run or hide, the last best option is to fight. Have one or more improvised weapons with you and be prepared to attack. Attack them when they are least expecting it and hit them where it hurts most: the face (specifically eyes, nose, and ears), the throat, the diaphragm (solar plexus), and the groin.

*Please save OUPD’s contact information in your phone.*

NORMAN campus:  *For non-emergencies call (405) 325-1717. For emergencies call (405) 325-1911 or dial 911.*

TULSA campus:*For non-emergencies call (918) 660-3900. For emergencies call (918) 660-3333 or dial 911.*

Fire Alarm/General Emergency

If you receive an OU Alert that there is danger inside or near the building, or the fire alarm inside the building activates:

1. *LEAVE*the building. Do not use the elevators.
2. *KNOW*at least two building exits
3. *ASSIST* those that may need help
4. *PROCEED*to the emergency assembly area
5. *ONCE safely outside, NOTIFY first responders of anyone that may still be inside building due to mobility issues.*
6. *WAIT*for official notice before attempting to re-enter the building.

[*OU Fire Safety on Campus*Links to an external site.](https://vimeo.com/125093634)

Office of Access and Opportunity’s Belonging Statement

**Why You Belong at the University of Oklahoma: The University of Oklahoma, fosters an inclusive culture of respect and civility, belonging, and access, which are essential to our collective pursuit of excellence and our determination to change lives. The unique talents, perspectives, and experiences of our community enrich the learning, and working environment at OU, inspiring us to harness our innovation, creativity, and collaboration for the advancement of people everywhere.**

Course Reflection Survey

You’ll receive a Course Reflection Survey at the end of each semester for each course that you are enrolled in. I strongly encourage you to complete this survey. Your feedback can help me adjust my class for future semesters to help other students be successful. Your feedback is confidential, and I will only receive it after final grades are due. Course Reflection Survey results may also factor into teaching evaluations and annual performance reviews and are shared with department and program chairs.

Copyright Statement

Sessions of this course may be recorded or live-streamed. These recordings are the intellectual property of the individual faculty member and may not be shared or reproduced without the explicit, written consent of the faculty member. In addition, privacy rights of others such as students, guest lecturers, and providers of copyrighted material displayed in the recording may be of concern. Students may not share any course recordings with individuals not enrolled in the class or upload them to any other online environment.

Course Overview (subject to change):

**Module 1: Introduction to Operating Systems**

1. **Class 1–6 (Jan 14 – Jan 30, 2025)**: C Programming Introduction (Not covered in textbook)
2. **Class 7 (Feb 4, 2025)**: Introduction to Operating Systems
   * **Reading**: Chapters 1–2 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: What an OS does, process virtualization, system design.
3. **Class 8 (Feb 6, 2025)**: Processes
   * **Reading**: Chapter 4 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Process lifecycle, process management.

**Module 2: Memory Virtualization**

1. **Class 9 (Feb 11, 2025)**: Processes and Scheduling Basics
   * **Reading**: Chapters 5, 7 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Process API, CPU scheduling basics.
2. **Class 10 (Feb 13, 2025)**: Memory Virtualization Fundamentals
   * **Reading**: Chapter 13 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Address translation, memory management.
3. **Class 11 (Feb 18, 2025)**: Paging
   * **Reading**: Chapters 14, 15 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Paging mechanisms, page tables, TLBs.
4. **Class 12 (Feb 20, 2025)**: Advanced Paging Concepts
   * **Reading**: Chapter 16 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Demand paging, page replacement policies.
5. **Class 13 (Feb 25, 2025)**: Advanced Memory Virtualization
   * **Reading**: Chapter 18 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Multi-level page tables, memory efficiency.

**Module 3: File Systems**

1. **Class 14 (Feb 27, 2025)**: File Systems Introduction
   * **Reading**: Chapter 39 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: File organization, storage.
2. **Class 15 (Mar 4, 2025)**: File System Implementation
   * **Reading**: Chapters 40, 41 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Inodes, blocks, crash consistency.

**Midterm Exam**

1. **Class 16 (Mar 6, 2025)**: Midterm Exam
   * **Content**: Covers Modules 1–3, including processes, scheduling, memory virtualization, and file systems.

**Module 4: Synchronization and Deadlocks**

1. **Class 17 (Mar 11, 2025)**: Synchronization Basics
   * **Reading**: Chapter 26 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Critical sections, race conditions, locks, semaphores.
2. **Class 18 (Mar 13, 2025)**: Scheduling Revisited
   * **Reading**: Chapter 8 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Multi-level feedback queue scheduling.
3. **Class 19 (Mar 25, 2025)**: Synchronization Advanced
   * **Reading**: Chapter 27 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Condition variables, complex synchronization.
4. **Class 20 (Mar 27, 2025)**: Deadlocks
   * **Reading**: Chapters 28, 29 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Deadlock conditions, prevention, recovery.

**Module 5: Input/Output and Virtualization**

1. **Class 21 (Apr 1, 2025)**: Input/Output Basics
   * **Reading**: Chapters 37, 38 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: OS interaction with I/O devices, scheduling algorithms for I/O.
2. **Class 22 (Apr 3, 2025)**: Virtual Machines
   * **Reading**: Chapter 49 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Hypervisors, benefits and challenges of virtualization.

**Module 6: Advanced Topics**

1. **Class 23 (Apr 8, 2025)**: Security in Operating Systems
   * **Reading**: Chapter 50 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Authentication mechanisms, permissions, preventing unauthorized access.
2. **Class 24 (Apr 10, 2025)**: Networking Basics
   * **Reading**: Chapters 51, 24 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: TCP/IP basics, networking integration in OS.
3. **Class 25 (Apr 15, 2025)**: Advanced File Systems
   * **Reading**: Chapter 42 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Log-structured file systems, garbage collection.
4. **Class 26 (Apr 17, 2025)**: Fault Tolerance and Journaling
   * **Reading**: Chapters 41, 42 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Crash consistency, journaling, fault tolerance.

**Module 7: Review and Final Preparation**

1. **Class 27 (Apr 22, 2025)**: Review and Problem-Solving
   * **Preparation**: Review all assigned chapters.
   * **Key Topics**: Revisit virtualization, concurrency, file systems.
2. **Class 28 (Apr 24, 2025)**: Advanced Synchronization Techniques
   * **Reading**: Chapters 27, 28 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Monitors, advanced synchronization problems.
3. **Class 29 (Apr 29, 2025)**: Distributed Systems Basics
   * **Reading**: Chapters 52, 53 (*Operating Systems: Three Easy Pieces*)
   * **Key Topics**: Consistency, reliability, two-phase commit, Paxos.
4. **Class 30 (May 1, 2025)**: Final Exam Preparation
   * **Preparation**: Solve problems, revisit challenging concepts.
   * **Key Topics**: Comprehensive review of all course topics.