EAS 5830: Blockchains

Spring 2025

Instructor

Dr. Brett Hemenway Falk, Research Assistant Professor

Course Description

This course is an introduction to the technology that powers blockchains like Bitcoin and Ethereum. We will cover the key cryptographic tools that enable blockchains – collision-resistant hash functions and digital signature schemes. We'll learn about the architecture of different blockchains, their consensus mechanisms, economics and how to interact with them. The assignments in this course are primarily coding-based. We will learn to read and write from the blockchain using Python libraries, and write our own smart contracts in Solidity. At the end of this course, students should understand the power and limitations of blockchain technology, and be able to develop software that interacts with current blockchain platforms.

Course Learning Objectives

- Learn the foundations and applications of blockchain technology
- Learn how to read and write Ethereum-compatible blockchains using Python
- Learn how to write smart contracts in Solidity

Course Prerequisites

CIT 5910 Introduction to Software Development
CIT 5920 Mathematical Foundations of Computer Science

Course Textbook

There is no assigned textbook for this course. Optional supplementary readings can be found linked in each lecture slide deck.

Grading & Assessment

You must attempt all graded assignments to pass the course. If you have any questions or concerns about grading or progress in the course, please reach out to your instructor.

This course will use a variety of assessments to determine whether learners understand and can apply the key concepts and skills that the course teaches. This includes:

Type	%	Description
Weekly Coding Homeworks	50%	This course contains 10 weekly homework assignments divided over Weeks 1-5 of the course, completed in Codio.
Course Project	25%	This course contains a 5-part project completed in Codio, with weekly segments to complete in Weeks 3-7.
Exam	20%	This timed exam will use live online proctoring.
Weekly Quizzes	5%	Quizzes with unlimited attempts are assigned at the end of each week.

This course also contains optional practice assignments in Codio, which are not worth any percentage of your grade.

Please read the instructions for each assignment very carefully to make sure you know where to submit to receive credit!

Late Policy

The instruction staff is committed to your success and understands how challenging it can be to learn online while balancing other commitments. Despite students' best intentions, sometimes life gets in the way and a little extra time to complete an assignment may be necessary.

If you need extra time on an assignment, you can obtain an extension for extenuating circumstances. If an extension is not approved, an assignment that is turned in late will receive a 10% grade reduction per day up to 5 days. After the 5th day, no credit will be given. For extensions please fill out the extension request form linked in the Course Resources tab in Canvas. Please fill out this form for any and all extension requests you wish to submit. These extension requests must be submitted at least 24 hours before the

assignment deadline. If your request is granted, you will see updated deadlines reflected in Canvas by Mondays at 5 pm ET

Regrade Requests

Regrade requests are handled on a case-by-case basis and are allowed up to 1 week after the grades are released. Requests must be created through a private post on EdDiscussion, which must be made visible to "all instructors." Requests must be appropriately tagged with the "regrade" tag, otherwise, your regrade will not be processed. Any requests made to an individual Professor or TA will not be regraded until the visibility is set to "all instructors." Regrade requests may take up to a week to process at the discretion of the faculty. When submitting a regrade request, please explain (in detail) why you feel the score you received is incorrect.

Extra Credit

There is no opportunity for extra credit in this course.

Other Course Activities

The following activities are not mandatory, but will greatly support your success on the graded assignments.

Discussion Forum

Discussion forums (on Ed Discussion) are designed to give you optional extra practice with the material and to see examples of how your classmates are thinking and working. In addition, you can use the discussion forums to ask questions about upcoming assignments and logistical concerns. Course staff will make their best effort to reply within 24 hours to these posts.

Ed Discussion allows for both public and private posting of questions, comments, and concerns. Private posts should be used anytime you need to discuss sensitive information such as grades, personal issues, or solutions to assignments or exams. Due to the volume of Ed Discussion posts received on a daily basis, our course staff prioritizes the responses to public posts as well as private posts containing sensitive information. It is highly encouraged that you create a public post when discussing information that could benefit a wider audience such as assignment and course logistics, or content-related questions. If you wish to create a public post without having your name attached to it you can create a public post anonymously. Please be aware, course staff reserves the right to flip private posts to public and change your identity to

anonymous if the post does not contain sensitive information and our course staff believes the content of your post could be beneficial to other students.

Additional Segments

The professor may add additional optional segments to support the class as needed.

Creating an Inclusive Environment

All members of the course community – the instructor, TAs, and students – are expected to work together to create a supportive, inclusive environment that welcomes all students, regardless of their race, ethnicity, gender identity, sexuality, religious beliefs, physical or mental health status, or socioeconomic status. Diversity, inclusion, and belonging are all core values of the MCIT Online program, the instruction staff, and this course. **All participants in this course deserve to and should expect to be treated with respect by other members of the community.**

Discussion boards, messaging channels, recitations, office hours, and group working time should be spaces where everyone feels welcome and safe. In order to facilitate a welcoming environment, students of this course are expected to:

- Exercise consideration and respect in their speech and actions
- Attempt collaboration and consideration, including listening to opposing perspectives and authentically and respectfully raising concerns, before conflict
- Refrain from demeaning, discriminatory, or harassing behavior and speech

All members of the course community are expected to be familiar with and abide by the University's guidelines on general conduct and sexual harassment:

- University Code of Conduct: https://catalog.upenn.edu/pennbook/code-of-student-conduct/
- University Sexual Harassment Policy: http://www.upenn.edu/affirm-action/introsh.html

Students should also be familiar with other University guidelines regarding personal conduct:

- Conduct & Personal Responsibility guidelines in Pennbook: https://catalog.upenn.edu/pennbook/#policiesbytopictext
- University Principles of Responsible Conduct: http://www.upenn.edu/audit/oacp_principles.htm

If you are a victim of, witness, or are otherwise affected by unacceptable behavior:

- In cases of sexual harassment or assault, please consult DPS Special Services (https://www.publicsafety.upenn.edu/about/special-services/sensitive-crimes/ at 215-573-3333; this is a confidential resource.
- To report other bias incidents, contact the Penn Office of Diversity: https://diversity.upenn.edu/diversity-at-penn/bias-motivated-incident-report

- For other violations of the code of student conduct, the Center for Community Standards and Accountability has an incident reporting form at https://csa.upenn.edu/community-standards/refer-caserequest-consultation

If you are unsure which office to contact, please contact the instructor or any Penn Engineering Online Learning staff member.

Getting and Giving Help

TA and Faculty Support

TAs will hold office hours weekly, when they will offer 15-minute time slots on a sign-up basis. Your professor will be available for a limited number of private meetings per week, depending on the needs of the class.

Collaboration Guidelines

In the professional world of software development, collaboration—including using code that others have written—is both practical and ubiquitous.

However, to prepare for entering that professional context, you need to develop a full set of software development skills so that you are both able to create your own code and evaluate the quality of someone else's code that you might use.
In the context of this course, independent work and evaluation is critical. **Do not collaborate with others on individual graded assignments unless it is explicitly indicated.** Inappropriate collaboration will be considered cheating and considered under Penn's Code of Academic Integrity.

Please note that searching for solutions or code online is a violation of academic integrity. Sharing solutions or code with another student (unless working on a group project or other collaborative assignment) is also a violation of academic integrity. This includes posting solutions and code publicly online, even after you've completed the course. If you discover publicly viewable solutions for the

assignments of this course, please let the course staff know immediately.

Discussion forums and recitations *are* collaborative—please take advantage of those times to work with your colleagues. For general communication with your colleagues, use your Slack channels or Slack direct messages.

Guidelines for the Use of Generative AI in this Course

We recognize the increasing prevalence and power of Artificial Intelligence (AI) tools, and encourage their responsible and ethical use to enhance your learning experience. However, it's essential to develop a strong understanding of fundamental processes before relying on AI. With this in mind, here are guidelines for acceptable and unacceptable uses of AI in this course:

Examples of acceptable uses of AI

- **Comprehension and Expansion:** You are encouraged to use AI to clarify and expand your understanding of course materials.
- **Research and Information Gathering**: AI can supplement your research and information gathering, aiding your exploration of complex concepts.
- **Assignment Support:** While the primary emphasis remains on individual effort, you are allowed to use AI for generating code snippets or text fragments to support your assignments. However, it is imperative to ensure that your understanding of the generated content is comprehensive, and the final assignment output reflects your own understanding and interpretation.

Examples of unacceptable uses of AI

- **Exam Assistance:** Do not seek AI help for proctored exams or assessments.
- **Academic Integrity:** Do not present AI-generated content without citation and as your own work.

Engaging in unacceptable use of AI tools will result in academic consequences, which may include grade penalties, academic warnings, or other actions as determined by your instructor and the university's academic integrity policies.

Note that these guidelines may differ from those in other courses. If you have questions or concerns, don't hesitate to reach out. Ultimately, AI can be a valuable educational tool when used responsibly and aligned with our course policies.

Plagiarism Policy

Students found plagiarizing on any assignment will automatically receive a zero on that assignment. The first offense of plagiarism on an assignment will be handled by the instructor. Only in extenuating circumstances, or if the plagiarism was committed on an exam, will a first offense be turned over to the University of Pennsylvania Center for Community Standards and Accountability.

A second offense, or, exam plagiarism will be turned over immediately to the University of Pennsylvania Center for Community Standards and Accountability.

A report being submitted to the University of Pennsylvania Center for Community Standards and Accountability will result in a failure of the course (regardless of current course average), and a potential permanent notation on your academic record that will follow you to all future academic institutions and possibly future employers. If you are unfamiliar with what constitutes plagiarism at Penn, visit Penn's Code of Academic Integrity.

Recording Notice

Public office hours, recitations, and other live events will be recorded, used, and may be made available to class participants during the current semester as well as students who take the class in future semesters.

Private office hours will also be offered and are not recorded. Students who do not wish to attend the publicly-recorded office hour may attend the private office hours.

Access to Materials and Content Before and After Graduation

If you would like to retain copies of your submitted assignments, you must download them from Gradescope, Coursera, Codio, and any other platforms that you submit to during the semester in which you are taking that course.

Access to course materials and your submissions is not guaranteed after the completion of a course. Therefore, we recommend that students download any assignments or materials they would like to keep before a course concludes.

Penn Engineering
ONLINE LEARNING

Spring 2025 Course Schedule and Important Dates

Dates are subject to change. Please check Ed Discussion for announcements regarding schedule changes. Note: weeks run Monday through Sunday.

Monday, 03/03 - Sunday, 03/09 *Spring Break: 03/10 - 03/16*	**Module 1**	**Topic(s)** Intro to blockchains and cryptocurrencies, IPFS
Monday, 03/17 - Sunday, 03/23	**Module 2**	**Topic(s)** Smart contracts, EVM, Solidity **Week 1 Homework assignments due on Monday 03/17**
Monday, 03/24 - Sunday, 03/30	**Module 3**	**Topic(s)** Bitcoin scripting, hash functions, virtual machines **Week 2 Homework assignments due on Monday 03/24**
Monday, 03/31 - Sunday, 04/06	**Module 4**	**Topic(s)** Proof of work, proof of stake, consensus **Week 3 Homework assignments due on Monday 03/31** **Bridge I due on Monday 03/31**
Monday, 04/07 - Sunday, 04/13	**Module 5**	**Topic(s)** DeFi, Uniswap, decentralized exchanges **Week 4 Homework assignments due on Monday 04/07** **Bridge II due on Monday 04/07**
Monday, 04/14 - Sunday, 04/20	**Module 6**	**Topic(s)** Scaling solutions, optimistic rollups, ZK rollups **Bridge III due on Monday 04/14** **Week 5 Homework assignments due on Monday 04/14** **Exam open Friday 04/18 – Sunday 04/20**

Monday, 04/21 - Sunday, 04/27	**Module 7**	**Topic(s)** Privacy, zero-knowledge proofs, ZCash, the discrete log problem **Bridge IV due on Monday 04/21** **Bridge V due on Sunday, 04/27**