

## Syllabus -- Fall 2023

### Course Info

**Title.** Blockchain Technology I

**Credits.** 3.00 credits

**Format.** In person

**Prerequisites.** CSE 2050. Recommended preparation: CSE 3140

**Meeting time.** Tue/Thu 9:30 - 10:45 am

**Meeting location.** MCHU 109

### Course Description

This course is about a topic that gained wide interest lately—blockchain technology. This technology is an emerging economic force with a large variety of potential applications. Although early systems focused only on providing a virtual currency exchange medium, i.e., building cryptocurrencies, nowadays there is increasing interest in providing various distributed services on top of this medium. Furthermore, blockchains have found new applications beyond supporting public verifiability in a cryptocurrency system, with influencing impact on issues such as privacy, regulation, social and environmental aspects. The course will cover the semantics of blockchains, cryptocurrencies, types of blockchains and consensus algorithms, wallet operation, privacy, threat modeling and security aspects of blockchains and cryptocurrencies, the paradigm of decentralized internet, and some ethical and environmental concerns from a technical lens.

**Course goals.** By the end of this course, you will be able to:

- Understand and track the rapid technical development in the fields of blockchains and cryptocurrencies.
- Analyze the security of blockchain-based systems.
- Identify and build use cases of blockchains and cryptocurrencies.
- Assess the impact of these systems on other fields and sectors.

### Instructor and Contact Info

Ghada Almashaqbeh, email: [ghada@uconn.edu](mailto:ghada@uconn.edu)

**Office Hours.** Tuesday at 12 - 1 pm in ITE 255 (any changes will be announced on HuskyCT), or by appointment (if you have questions and cannot make it please email me to arrange another time).

### TA

Mohamed Najd, email: [menajd@uconn.edu](mailto:menajd@uconn.edu)

**Office Hours.** Every Thursday 2 - 3 pm in ITE 114

### Communication

The lecture slides and reading material will be posted on the course website (usually the night before the class): <https://ghadaalmashaqbeh.github.io/teaching/> . Syllabus, announcements, problem sets, solutions, homework submission, project description and submission will be done on HuskyCT. We will have a discord

server to ease communication. Please post any questions there, especially those that may benefit multiple students. I will be answering questions on discord once a day (usually around the end of the day). For emails, I will answer in 24 - 48 hours once I receive your email. If for some reason you do not hear back from me within this timeframe, please feel free to send me a reminder. I will not answer emails or view discord over the weekend (Friday 5 pm until Monday 8 am).

## Suggested Textbooks

- *Mastering Bitcoin: Programming the Open Blockchain*, by Andreas M. Antonopoulos (2nd edition, 2017).
  - Available on github: <https://github.com/bitcoinbook/bitcoinbook/blob/develop/book.asciidoc>
- *Mastering Ethereum: Building Smart Contracts and DApps*, by Andreas M. Antonopoulos and Gavin Wood (1st edition, 2018).
  - Available on github:  
<https://github.com/ethereumbook/ethereumbook/blob/develop/book.asciidoc>
- *Bitcoin and Cryptocurrency Technologies*, by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.
  - A pre-published pdf version can be found at:  
[https://d28rh4a8wq0iu5.cloudfront.net/bitcointech/readings/princeton\\_bitcoin\\_book.pdf](https://d28rh4a8wq0iu5.cloudfront.net/bitcointech/readings/princeton_bitcoin_book.pdf)

## Grading and Course Work

Homeworks	45%
Term Project	35%
In-class Discussion	10%
Quizzes	10%

**Homeworks** will consist of a small number of problems. These may include questions to test understanding of the concepts covered in the course, explore further concepts extending these covered in class, and some programming assignments to apply the tools we study, develop decentralized applications, and experiment with various technologies introduced in class. We will have 4 or 5 homeworks, depending on class progress.

### **Submission and late policy.**

You will have a free 5 days delay throughout the whole semester that you can use without any deductions if needed. For each homework, a late submission can be made within 3 days only (either you use some of your free days, or if already used, a late submission will receive a 10% deduction of its score per day), i.e., any late homework can be submitted within up to three days at maximum after the deadline. **After that, no late submissions will be accepted!** Assignments will be graded no more than two weeks after they are due and the key solution will be posted.

**Collaboration.** Homeworks are done and submitted individually. However, students are encouraged to discuss high level ideas with each other given that they write their solutions individually and list the names of the students with whom they discussed/collaborated in the submission. Copied solutions are considered cheating. You can collaborate with another two students at maximum (i.e., total is three students). I

encourage you to solve the problems on your own first and then resort to group discussion for further understanding and brainstorming.

**Term project** consists of: group formation and proposal, progress report, presentation, and final report submission. Each group (maximum 3 students) will submit one page proposing a project to work on by no later than **9/29/2023** (a list of suggested topics will be distributed later). I encourage you to start this process as early as possible. Then, each group will submit a progress report (no later than **10/31/2023**) to track the work status and get preliminary feedback from the instructor. Project presentations (a 15 - 20 min long presentation) will be during the last week of classes (the week of **12/4/2023**), and the final report submission will be due on the last day of class **12/8/2023**. The project grade will be based on the progress report, presentation and the final report (5%, 10%, and 20%, respectively).

**In-class discussion**, students will lead discussions in class concentrated around any of the following:

- An article/paper about a related topic to cryptocurrency and blockchains (applications, attacks, new technologies, effect on society, etc.).
- A meetup/workshop/conference the student attended about a related topic as above.
- A personal experience in dealing with cryptocurrencies/blockchains.

Based on the number of enrolled students, we will have 1 student discussion per week (last 10 or 15 minutes of class). A schedule will be distributed so each student can sign up for a date.

**Quizzes.** There will be 4-5 quizzes (based on course progress) each spanning 10 minutes (quiz dates will be announced). The quiz will be open on HuskyCT immediately after class on the assigned date until midnight, you can take it anytime during that period but once you start the quiz you have to submit within 10 min. A quiz will cover the material of the same lecture of the quiz date and the previous one.

### **Course Content (Tentative, will be adjusted as needed)**

This course will provide an extensive treatment of the blockchain technology covering the following topics:

- Semantics of blockchain-based systems.
- Essential cryptographic primitives used in cryptocurrency and blockchain-based systems.
- Bitcoin, the first successful cryptocurrency, including its consensus protocol, blockchain design, transactions, and its security.
- Ethereum, a more generalized cryptocurrency that provides a rich feature set with a variant blockchain design and consensus protocol.
- A closer look into the types of consensus protocols, blockchains, and wallets including their basic operation, features, and security aspects.
- Blockchain-based decentralized services.
- Threat modeling for cryptocurrency-based systems.
- Decentralized micropayments.
- Privacy preserving cryptocurrencies.
- Applications of cryptocurrencies and blockchains.
- Social and financial aspects of blockchain and cryptocurrencies.

**Course Schedule.** (Tentative, will be adjusted as needed based on class progress)

Week of	Topic
8/28/2023	Course overview, the history of blockchains and cryptocurrencies, and some useful resources. Semantics of blockchain-based systems and overview of basic cryptographic primitives.
9/4/2023	Bitcoin (work model, participants, transactions, blockchain, mining, consensus protocol).
9/11/2023	Bitcoin (scripting language, transaction processing, scalability, security issues)
9/18/2023	Ethereum (work model, blockchain, consensus protocol, smart contracts)
9/25/2023	Ethereum (more about smart contracts and tokens on top of Ethereum) Smart contracts security issues
10/2/2023	Types of mining and consensus protocols
10/9/2023	Types of blockchains Wallets
10/16/2023	Blockchain-based decentralized services
10/23/2023	Threat modeling for blockchain-based decentralized systems Decentralized micropayments
10/30/2023	Privacy preserving cryptocurrencies
11/6/2023	More applications of the blockchain model
11/13/2023	Environmental and/or social considerations of blockchain-based systems Decentralized Finance (DeFi)
11/20/2023	<i>Thanksgiving Recess, No classes!</i>
11/27/2023	Buffer (either for other classes and/or term project presentations)
12/4/2023	<b><i>Term project presentations</i></b>

## **Policies**

**Academic honesty.** This course expects all students to act in accordance with the Guidelines for Academic Integrity at the University of Connecticut. Additionally, consult UConn's guidelines for academic integrity. The collaboration policy described above is designed to allow students the resources to succeed while ensuring they learn and master the material. If you are unsure if something is acceptable according to the collaboration policy, talk to me!

Violations of this policy will be considered violations of the academic integrity policy and will be reported to the Academic Integrity Hearing Board. Consequences may include (but are not limited to) failure of the class. Example violations include: not reporting collaborators, jointly writing solutions, copying or plagiarizing solutions and projects from other sources.

**Student conduct code.** Students are expected to conduct themselves in accordance with UConn's student conduct code (<https://community.uconn.edu/the-student-code/>).

**Copyright.** My lectures, notes, handouts, and displays are protected by state common law and federal copyright law. They are my own original expressions. Students may take notes. In addition, students will be consulted before using their solutions either with or without their name.

**Students with Disabilities.** The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. If you are a student with approved academic accommodations through the Center for Students with Disabilities (CSD), please let me know immediately so we can discuss implementation. If you anticipate or experience any physical or academic barriers based on disability or pregnancy, you should contact the CSD to request accommodations at [csd@uconn.edu](mailto:csd@uconn.edu) or (860) 486-2020. Information about requesting accommodations is available on the CSD website at <http://csd.uconn.edu/>

**Resources for Students Experiencing Distress.** The University of Connecticut is committed to supporting students in their mental health, their psychological and social well-being, and their connection to their academic experience and overall wellness. The university believes that academic, personal, and professional development can flourish only when each member of our community is assured equitable access to mental health services. The university aims to make access to mental health attainable while fostering a community reflecting equity and diversity and understands that good mental health may lead to personal and professional growth, greater self-awareness, increased social engagement, enhanced academic success, and campus and community involvement.

Students who feel they may benefit from speaking with a mental health professional can find support and resources through the [Student Health and Wellness-Mental Health](#) (SHaW-MH) office. Through SHaW-MH, students can make an appointment with a mental health professional and engage in confidential conversations or seek recommendations or referrals for any mental health or psychological concern.

Mental health services are included as part of the university's student health insurance plan and also partially funded through university fees. If you do not have UConn's student health insurance plan, most major insurance plans are also accepted. Students can visit the Student Health and Wellness-Mental Health located in Storrs on the main campus in the Arjona Building, 4th Floor, or contact the office at (860) 486-4705, or <https://studenthealth.uconn.edu/> for services or questions.

**Accommodations for Illness or Extended Absences.** Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify your instructor as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with your instructor to determine how you will complete coursework during your absence.

If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at [dos@uconn.edu](mailto:dos@uconn.edu) to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.