

# CSE4/526 Description

Bina Ramamurthy

1/23/2025

## CSE4/526 Blockchain Application Development Spring 2025

### Description

This course is intended for students interested in learning about blockchain technology and developing applications using blockchain concepts. It begins by defining blockchain as a trust layer over the internet. Blockchain and its web, called web3, are used to work with distributed resources and decentralized and disintermediated control. For the first part of the course, the topics covered include the definition of a blockchain in terms of transactions, blocks, chain of blocks, data structures enabling the blockchain protocol, and operational details involving algorithms and techniques such as peer-to-peer transactions, cryptography, digital signing and hashing, and consensus mechanisms. We will also discuss important elements such as decentralized identity and wallet. All of these concepts will be illustrated using Bitcoin and Ethereum blockchains. In the second part of the course, we introduce the idea of code execution on the blockchain and the program module called smart contract, and a language Solidity will be used for writing smart contracts, compiling, deploying, and testing the smart contracts on the Ethereum blockchain. The course's last part combines the concepts into a decentralized application (DApp) stack and explores problem-solving using blockchain. This process involves designing and developing a Dapp stack with the computational logic represented by the smart contract code, a user interface, and support for external data access through oracles and decentralized file systems. Students will work on hands-on end-to-end Dapp projects using the Ethereum blockchain and Truffle integrated development environment (IDE). The course will also discuss standards, best practices, current challenges, scalability and interoperability, and solutions. On completion of the course, a student will analyze a problem and develop and implement an end-to-end blockchain solution on the Ethereum blockchain. This semester, we are focusing on Layer 2 and NFT (both on Ethereum-based networks), the new roles for decentralized systems and applications that enable the participation of all.

### Course Outcomes

Upon completing this course, a student will be able to design and implement a smart contract and a blockchain-based decentralized web application (Dapp) and work with web3 technologies. Students will have good understanding and working knowledge of the cryptocurrency ecosystems.

### Course Information

- Website for general information: <http://www.cse.buffalo.edu/~bina/cse426/spring2025>
- We will use **ublearns** for the ongoing course activities.
- Instructor: Bina Ramamurthy ([bina@buffalo.edu](mailto:bina@buffalo.edu))
- Lecture Time: TuTh 5:00PM - 6.20 PM
- Lecture Location: 114 Hochstetter
- Office Hours: Mon 1:00-2.50PM (Zoom)

## Course Prerequisite

CSE250 Data Structures, equivalent, or permission of the instructor. You should have a good foundation in problem-solving, design representation, object-oriented design methodology and application, and design and development in a high-level language. You should also be familiar with object-oriented modeling, modern code design, and debugging practices. Also, a working knowledge of JavaScript language and web stack development is essential to implement the course project.

## Text book

B. Ramamurthy. Blockchain in Action. Manning publishers. <https://www.manning.com/books/blockchain-in-action>, ISBN-13: 978-1617296338, 2020. The instructor will provide many reference material throughout the course to support the projects and blockchain application development.

## Grading Policy

Grading Distribution Final letter grades will be based on the (combined) overall percentage of all the items listed below. A (95 - ), A- (90 - 94), B+ (85 - 89), B (80 - 84), B- (75 - 79), C+ (70 - 74), C (64 - 69), C- (55 - 64), D (50 - 54), F (less than 50). This policy is subject to change. If needed, the individual components and the overall grades will be appropriately curved.

## Grade components

Component (Quantity)	Points
Attendance including pop quiz	100
Project (1)	100
Exam 1 (1)	100
Exam 2 (1)	100

## Project

You will work on one project with multiple phases. This strategy will allow for incremental development and manage your workload appropriately spread over the semester rather than rushing and panicking at the end of the semester. The due date for each project phase will be announced when it is assigned. All the source code, documentation, makefile, data files, and README files will be submitted online. The details of submission will be given along with your first project phase. You will have to follow the rules for the other phases too. I reserve the right to change the project specifications at any point before the due date to address problems that may arise during the project. The changes will be easy to implement if your design is modular. You will be given detailed grading guidelines and project specifications. Use this as a guide for your design and implementation. It is necessary to keep up with the lecture material in the class to complete the project and perform well in the exams. No late assignments will be accepted. Keep submitting partial project material as you develop them. Develop your code using incremental development techniques. Do not try to code the entire assignment in one sitting. Instead, take one section at a time, implement, test it, back up the code, and move on to the next section. You will turn in each phase before 11:59 PM on the due date via the departmental submit command. You must also include appropriate testing programs to show the validity of your solution. In addition, you must include external documentation discussing the “hows and whys” of your design and implementation. You will be required to demonstrate your lab to your TA. The TA will test examples against your code to check your solution’s correctness. The TA will provide a demo schedule. You are responsible for demoing your project, or you will receive a zero for that portion of

the grade. When your grade is assigned for the project phases, the TA will indicate critical areas that must be fixed to solve the next phases.

## **Exams and quizzes**

There will be a midterm that will be administered and graded before the resignation date. Exam 1 will cover all lecture and reading assignments before the exam and concepts from the lab assignments. Exam 2 is a comprehensive exam covering all lectures, labs, and homework areas. All exams are closed books, closed notes, and closed neighbors. We do not give makeup exams for any reason. If you miss an exam, you will receive a zero for that portion of the grade.

Quizzes will be pop quizzes and may be unannounced. No makeup quizzes will be given.

## **Attendance Policy**

You are responsible for the contents of all lectures. If you know you will miss a lecture, have a reliable friend take notes for you. Of course, there is no excuse for missing due dates or exam days. Attendance will be taken and will determine the attendance grade component to compute your final grade.

During lectures, we will be covering material from the textbook. We will also work out several of the problems from the text. Lectures will feature exploring several real-world problems not covered in the book. Lecture dynamics will depend very much on students' participation, and students are strongly encouraged to ask questions related to the material covered in the class. You will be given a reading assignment for the next class at the end of each lecture.

Office hours are designed to review complex class concepts and spend additional time discussing the lab work required for the course. This time is your time to communicate with your TA about the course, project, exams, quizzes, etc. Use the opportunity to the fullest.

## **Office Hour Policy**

If you can't meet during the designated office hours, you will have to communicate via Email. Office hours are intended to resolve questions about the material that could not be answered in lectures or recitation. Come to office hours prepared! Office hours are NOT for repeating missed lecture material or having the instructor or TA solve an assigned problem for you. We will NOT write or debug your code for you during office hours! Instead, we will direct you to where to concentrate your debugging efforts.

## **Grading Policy**

All assignments will be graded and returned promptly. When an assignment is returned, you will have one week to contest any portion of the grade. The TA who graded your project will be the first to resolve a grading conflict. The instructor will mediate the dispute if the conflict cannot be resolved. The judgment of the instructor will be final in all such cases. When contesting a grade, you must demonstrate how your particular solution is correct. Also, when contesting a grade, the instructor or TA reserves the right to reevaluate the entire lab or exam, not just the portion in dispute.

## **Incomplete Policy**

We only grant incompletes in this course under the direst of circumstances. An incomplete is warranted if the student cannot complete the course satisfactorily, such as a traumatic event that has interfered with their ability to finish within the semester's timeframe. Incompletes are not designed as a stalling tactic to defer a poor performance in a class.

## Academic Integrity Policy

UB's definition of Academic Integrity in part is, "Students are responsible for the honest completion and representation of their work." It is required as part of this course that you read and understand the departmental academic integrity policy located at the following URL: <https://www.buffalo.edu/academic-integrity/policies.html> There is a fine line separating conversations about concepts and academic dishonesty. You are allowed to converse about general ideas, but in no way are you allowed to share code or have one person do the work for others. You must abide by the UB and Departmental Academic Integrity policy at all times. NOTE: Remember that the academic integrity policy also covers items taken from the Internet! If you are unsure if a particular action violates the academic integrity policy, assume that it does until you receive clarification from the instructor.

## Ublearns and Piazza

The CSE426/526 ublearns should be checked frequently for important news. Course assignments, slides, grade reporting, and general hints and tips will be posted on the ublearns blackboard LMS system. There is a licensed version of piazza for your class discussions. Please enroll in it and make the best use of it. Piazza is only for **public discussion related to the course**, so be civil. Also, do not post any code publicly on Pizza. Piazza cannot solve any individual grading question. In this case, you should contact your TA or the instructor for grading questions.

## Students with Accessibility Issues

If you have special needs due to a disability, you must be registered with the Office of Student Accessibility. If you are registered with them, please let your instructors know about this so that they can make special arrangements for you.

## Piracy and illegal use of course material

All materials I prepared and/or assigned for this course are for the students' educational benefit. Other than for permitted collaborative work, students may not photograph, record, reproduce, transmit, distribute, upload, sell or exchange course materials without my prior written permission. "Course materials" include, but are not limited to, all instructor-prepared and assigned materials, such as lectures; lecture notes; discussion prompts; study aids; tests and assignments; and presentation materials such as PowerPoint slides, Prezi slides, or transparencies; and course packets or handouts. Public distribution of such materials may also constitute copyright infringement in violation of federal or state law. Violation of this policy may additionally subject a student to a finding of "academic dishonesty" under the Academic Integrity Policy and/or disciplinary charges under the Student Code of Conduct.

## Violations

Students who violate this policy will be required to complete an educational sanction about the value of intellectual property. More serious and/or repeat violations of this policy may be treated as acts of "academic dishonesty" under the Academic Integrity Policy at (<https://www.buffalo.edu/academic-integrity/policies.html>) or subject a student to disciplinary charges under the Student Code of Conduct.