

CS48001/SEC532 – Blockchain: Security and Applications

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CS48001/SEC532 – Blockchain: Security and Applications Spring 2022

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Instructors:[\[edit\]](#)

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Field Experts:[\[edit\]](#)

- MSKU Blockchain Research Group [\[1\]](#) members
- Field experts from different domains (military, tourism, etc.) is planned to attend the projects as well.

Lectures:[\[edit\]](#)

- Online Lectures on Mondays

Grades:[\[edit\]](#)

Grades will be weighted as follows :

20% : Lecture attendance (this includes your active participation in the class by your comments/questions)

20% : Team project demonstration grading (evaluating both function and documentation)

60% : Final project grading (evaluating the implementation quality and documentation)

Course Objectives:[\[edit\]](#)

There is a trend towards central systems to systems without intermediaries. The aim of this course is to teach students how these systems work and to gain the necessary knowledge and skills to develop codes on sample systems. Topics covered include many emerging and current topics such as p2p network fundamentals, blockchain technology, consensus protocols, deterministic programming, autonomous codes and smart contracts. Quorum platform is chosen for software development and testing in this course, however the blockchain platform that is used in this course may be changed according to the technological advancements. Software developments will be made on the blockchain test network at the university.

Platforms[\[edit\]](#)

- Quorum platform - DS4H blockchain network [\[2\]](#)
- Smart contract development - Solidity Language
- Truffle
- ChainEx/Tubu.io [\[3\]](#) - for deploying smart contracts

Course Content:[\[edit\]](#)

I. Week - Cryptography & Crypto Currency Fundamentals

II. Week - Decentralized Systems (Blockchain and derivatives) Fundamentals and Challenges

III. Week - Introduction to Enterprise Blockchain Solutions. Ethereum & Quorum Basics, Introduction to Deterministic Programming (Solidity Truffle)

IV. Week - Ethereum Mechanics & Solidity

V. Week - Team Project Proposal Presentations

VI. Week - Security and Issues

VII. Week - Security Philosophy & Blockchain usage in CyberSecurity

VIII. Week - Distributed consensus, distributed ledgers, P2P Networking Foundations, Gossip and decentralized collaboration

IX. Week - Emerging Decentralized solutions for the Data Science, Decentralized storage, content distribution

X. Week - Decentralized identity, Trust and reputation. Anonymous Communication.

XI. Week - Cryptographic Tokens & Token Economy

XII. Week - Privacy, mobile code and agents

XIII. Week - Case Studies

XIV. Week - Project Demonstrations

Anticipated Learning Outcomes:[\[edit\]](#)

1. Defines decentralized systems, consensus protocols and decentralized applications. Can explain the possible usage areas of decentralized systems.
2. Can demonstrate the current state-of-the-art knowledge in different challenges with decentralized systems.
3. Demonstrate an ability to apply knowledge in decentralized systems with different case studies.
4. Can design and implement decentralized application on the decentralized test bed via hands-on coding, debugging and testing

Project Areas[\[edit\]](#)

Project areas can be in various fields. Examples (alphabetic sorted) such as:

- AI for blockchain, Blockchain for AI
- Cryptocurrencies and DeFi (Decentralized Finance)
- Data sharing (Health care, tourism etc.) with different parties/organizations
- Decentralized identity (privacy etc.) for trusted implementations (passports, reports etc.)
- IoT + blockchain (+AI)
- Decentralized Supply chains
- And more ...

Textbook:[\[edit\]](#)

1. Karaarslan, E., Konacaklı, E. "Data Storage in the Decentralized World: Blockchain and Derivatives". Kitap Bölümü. "Who Run The World: DATA" Kitabı. Istanbul University Press, 2020 [\[4\]](#)
2. Karaarslan E, Konacaklı E. "Decentralized solutions for data collection and privacy in healthcare", In D. Gupta, S. Bhattacharya, U. Kose, and Bao Le Nguyen (Eds.) Artificial intelligence for data-driven medical diagnosis. De Gruyter. ISBN: 978-3110667813, 2021. [\[5\]](#)
3. Karaarslan, E., Aydın, D, "An AI Based Decision Support and Resource Management System for COVID-19 Pandemic", "DS for COVID-19" kitabı, Elsevier, 2021 [\[6\]](#)
4. Karaarslan, E., Birim M., "Blokzincirde Güvenli ve Güvenilir Uygulama Geliştirme Temelleri", Siber Güvenlik ve Savunma: Blokzinciri ve Kriptoloji, Nobel Yayınevi, 2021 [\[7\]](#)
5. Konacaklı E., Karaarslan, E., "Blokzincirinin Askeri Lojistik Takip Sistemlerinde Kullanılması", Siber Güvenlik ve Savunma: Blokzinciri ve Kriptoloji, Nobel Yayınevi, 2021 [\[8\]](#)
6. Karaarslan E., "Use of Blockchain Technology in the Health Sector" (Turkish), "Advanced Technology Applications in Health" Book, Nobel Publishing House, 2019
7. Kravchenko P., Skriabin B., Kurbatov O., Dubinina O. (2020). Blockchain And Decentralized Systems. Volume 1-3

8. Antonopoulos, A. M., & Wood, G. (2018). Mastering ethereum: building smart contracts and dapps. O'reilly Media.
9. Voshmgir, S. (2020). Token Economy: How the Web3 reinvents the Internet (Vol. 2). Token Kitchen.

Recommended Reading/Watching:[\[edit\]](#)

- "MSKÜ Blok Zinciri Araştırma Grubu" works, TR [\[9\]](#) - ENG [\[10\]](#) page
- Enis Karaarslan Youtube Channel - BCSI-TR: Blockchain Summer Internship 2020 [\[11\]](#) videos [\[12\]](#)

Pre/co-requisites:[\[edit\]](#)

- Algorithms and programming
- Computer Networks

Links/references:[\[edit\]](#)

- MSKU BCRG web page [\[13\]](#)