Introduction to Blockchain and Cryptocurrencies  
Spring 2022 Syllabus

INSTRUCTORS  
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Course Description  
This course will introduce the fundamental building blocks of blockchain technology as well as its application in cryptocurrencies, stablecoins, decentralized finance and non-fungible tokens (NFTs). It will begin by covering the fundamentals of money, banking, and payment systems, as well as relevant areas of computer science such as cryptography and distributed systems. Special attention will be paid to the different building blocks of the Bitcoin network and how they work together, and the unique attributes of the Ethereum platform.

The course will then shift towards specific applications beyond cryptocurrency, including stablecoins, central bank digital currencies, decentralized finance, non-fungible tokens, social tokens and Layer 2 solutions. It will wrap up with a focus on the legal and regulatory implications of this new approach to building a financial system.

Course Co-Requisites  
Capital Markets and Investments (B8306/B7306)

Grading  
There will be reading and homework assignments throughout the course, some of which will be completed in groups. A written midterm exam will be given. For the final, each group will make a class presentation & submit a write up, the topic for which can fall into one of two categories: (i) A critical review of an existing protocol or a decentralized application; (ii) a business plan for a new blockchain-based project. The final project grade will be based on comprehension of the problem solved, followed by analysis of the economics of the solution, governance and the go-to-market strategy.

Tentatively, course grades will be determined as follows: 30% final project, 30% assignments, 20% midterm and 20% participation.

TENTATIVE OUTLINE:

Class 1 – Money, banking & payment systems, Challenges of digitization  
This session will provide theories on the origins of money and its history. It will cover the generally accepted functions of money as well as its characteristics. It will discuss the basics of
banking and the design of payment systems. It will end with a review of the challenges of digitization that Bitcoin was invented to solve.

**Class 2 – Consensus, hash functions & symmetric cryptography**

The primary focus of this class will be the computer science foundations of blockchain & cryptocurrencies. We will cover distributed systems and the challenges of reaching consensus. We will also review hash functions and public-key cryptography.

**Class 3 – Bitcoin**

We will begin by learning about the invention of blockchain and how it predated Bitcoin. We’ll then shift gears to Bitcoin, with a focus on Nakamoto Consensus, its use of economic incentives, mining & transaction fees, cryptographic identity and algorithmic inflation.

**Class 4 – Ethereum, Smart contracts and tokens**

This session will cover conditional transactions as enabled by the second most prominent blockchain platform, tokens, and the notion of trustless computing. It will provide a history of the Ethereum ecosystem, discuss its challenges, and review several prominent applications built on top of it.

**Class 5 – The user’s perspective; Vulnerabilities**

This session will cover the different aspects of owning cryptocurrency and interacting with a blockchain, including buying and selling, wallets, supportive infrastructure such as exchanges and custodians, and the dangers of a digital bearer asset. We will also discuss the risks and tradeoffs of decentralized networks, including possible attack vectors and 51% attacks, with a review of several successful breaches. Soft and hard forks will be covered.

**Class 6 – Midterm review + PoS & L2**

This session will begin with a review of everything covered so far and an opportunity for students to ask their most pressing questions. We’ll then shift our focus to Proof of Stake consensus, as well as the various Layer 2 solutions being deployed for Bitcoin and Ethereum.

**Class 7 – Stablecoins**

This class will cover blockchain tech as applied to fiat currency, the difference between token and ledger money, similarities and differences with existing payment solutions, and the possible disruption of the payments industry.

**Class 8 – Central Bank Digital Currencies**
This class will begin with covering the distinction between central bank money and private money. It will then shift to the emerging field of CBDCs, the different models being considered, the Digital Yuan and the proposed Digital Euro, and the role the state should play in the financial system. It will also cover the role that banks play in society and it might be affected.

**Class 9: Decentralized finance; Tokenization of capital markets**

This session will cover decentralized applications for credit creation, money markets and synthetic assets on the Ethereum blockchain, with a deep dive into several existing projects. It will cover the emergence of new financial primitives, yield farming and the power of composability. It will end with the potential impact on existing capital markets.

**Class 10 – Non-Fungible tokens, social tokens and online communities**

This session will focus on the emergence of NFTs and the potential impact on the worlds of content creation, digital art, collectibles and pop culture. It will review prominent NFT projects, social tokens, token-enabled curation models and different applications for token-gating content.

**Class 11 – Regulatory & legal issues**

This session will cover the legal and regulatory implications of different kinds of digital currencies, from Bitcoin to stablecoins to CBDCs. It will review how this new approach to building a financial system challenges existing laws and why new ones might be needed.

**Class 12 – Student presentations of their final projects**