UNIVERSITY of NICOSIA

Course Code	Course Title	ECTS Credits
DFIN-511	Introduction to Digital Currencies	10
Prerequisites	**Department**	**Semester**
None	Digital Innovation, School of Business	Fall/Spring
Type of Course	**Field**	**Language of Instruction**
Required	Digital Currencies	English
Level of Course 2nd Cycle	**Lecturers** Professor George M. Giaglis Mr. Andreas Antonopoulos Mr. Antonis Polemitis **Course Administrator** Mr. Demetrios Tseas	**Year of Study** 1st
Mode of Delivery	**Work Placement**	**Co-requisites**
Distance Learning	N/A	N/A

Objectives of the Course

The course provides an introductory understanding of blockchain technology and decentralized digital currencies (cryptocurrencies), such as bitcoin. The course will:
- survey the theory and principles by which digital currencies operate;
- provide practical examples of basic transactions and operations of blockchain or distributed ledger-based systems;
- explore the current and future interaction of digital currencies with banking, financial, legal and regulatory systems;
- help students understand the disruptive potential of blockchain and how this ecosystem can be perceived as an innovation;
- discuss the newest developments in the space (for example, tokenisation, DeFi and CBDCs), explore the synergies between blockchain and other disruptive technologies (such as artificial intelligence and the internet of things) and provide a vision and thesis for a decentralised future.

The course will consist of four general topics:

1. Theoretical introduction to digital currencies: This will include the history of digital currencies, the invention of decentralized consensus through proof-of-work, and a technical overview of cryptocurrencies such as bitcoin, as well as alternative/advanced uses of the blockchain.

2. Practical introduction to digital currencies: This will include practical, introductory exercises in utilizing and constructing digital currency transactions.

3. Banking, financial and regulatory implications: Overview of how blockchain technology could revolutionize the existing monetary and banking system and possible approaches to regulation and development.

4. Innovation & development: How cryptocurrencies and blockchain technology can be viewed through innovation frameworks and what possibilities exist for further developments,

including new blockchain uses (tokenization, decentralized finance [DeFi], central bank digital currencies [CBDCs], etc.) and convergence of blockchain with other technologies (most notably artificial intelligence and the internet of things) toward a decentralized future.

Learning Outcomes

After completion of the course students are expected to be able to:

- Be able to describe the Byzantine Generals' Problem (a classical problem on how to achieve a single winning strategy involving various parties, some of which may be corrupted, untrusted, or may disseminate inaccurate information) and how do blockchains address this problem.
- Understand the basics of blockchain technology, i.e. cryptographic functions (hashes), the process of mining and issuance of new currency, various consensus mechanisms including the 'Proof-of-Work' consensus mechanism used in the Bitcoin Blockchain.
- Distinguish among various types and properties of centralized, decentralized and hybrid blockchains and ascertain which of them is suitable for what purposes.
- Understand how blockchain technology creates trust among untrusted parties and immutable entries, by linking/chaining blocks of information together (thus the concept of 'blockchain').
- Distinguish the basic characteristics and key metrics of Bitcoin and altcoins (alternative cryptocurrencies issued after Bitcoin) such as Ethereum, Litecoin, XRP, Bitcoin Cash etc. Many of these altcoins may have different properties, follow different protocols and have different uses.
- Learn how to transact and store cryptocurrencies, look-up and dissect real transactions in open blockchain networks.
- Dive-in to more technical aspects of the technology such as mining pools, segregated witness, lightning network, forks and smart contracts, their uses and challenges.
- Learn why this is an innovative technology and understand its potential to disrupt a number of other industries.
- Identify some of the industries that may be disrupted by this technology, such as financial institutions, health, real estate, supply chain, academia, and others, as well as describe blockchain-related use cases.
- Understand more advanced uses of the blockchain such as escrow services, asset registration, attestation, smart contracts, digital assets, tokenization, CBDCs, DeFi and others.
- Understand what parallels and differences cryptocurrencies have with the existing monetary and banking systems.
- Evaluate how central banks or governments may issue their own digital currency, for what purposes and to what end.
- Identify some of the legal, regulatory and taxation challenges that this new technology may bring and learn how do major global regulators look at these issues.
- Understand major frameworks for regulating cryptocurrencies.
- Explore the current mega-trends towards decentralization and how blockchain and other technologies, such as AI and the IoT, fuel these trends.

Week 1: A Brief History of Money

Week 1 is an introductory week and relates to the main functions of money (medium of account, store of value and unit of account). It also explains the historical origins of money, the properties of money, how it has been used throughout the centuries and its evolution from barter trading to modern money. Students are then introduced to Bitcoin, the most popular cryptocurrency and learn how it is designed, compare Bitcoin with fiat currency and be able to discern what properties of money Bitcoin possesses and which not.

Week 2: The Byzantine' General's Problem

Week 2 relates to understanding the role of ledgers and their historical path from singly-entry, to double-entry accounting ledgers. It also explains the concepts of centralized ledgers and analyses the challenges and weaknesses of centralized ledgers such as corruption or central points of failure and consequent loss or tampering of data. Bitcoin is a technical breakthrough and an innovation with implications far-exceeding digital currency, since it brings in a triple-entry accounting ledger, introducing cryptography, tamper-proof transactions and publicly available decentralized ledgers. Bitcoin also provides a solution to what is referred to as the Byzantine Generals' Problem, establishing trust within unknown and untrusted parties via the Proof-of Work concept. Some key metrics are finally provided regarding Bitcoin.

Week 3: Basics of Cryptocurrency

Week 3 will introduce some of the history of Bitcoin i.e. Satoshi Nakamoto's original paper in 2008 and other important milestones in its development. Some more technical aspects of Bitcoin will also be explained, pertaining to the use of cryptography, cryptographic algorithms and hashes, and how exactly are they used in creating addresses, public and private keys, used in turn to digital sign a message via blockchain. Basic analysis is provided regarding the mechanisms via which we reach an agreement for the status of the transactions and the ledger, called 'consensus mechanism'. The basic Consensus Mechanism in Bitcoin: Proof-of-Work, is being explained as well as some other alternative consensus mechanisms, and how all of the above come together in what is called Bitcoin Mining, thus the process of creating new blocks and linking them in blockchain.

Week 4: Bitcoin in practice – Part 1: Bitcoin Core, online wallets, sending – receiving, paper wallets/cold storage

Week 4 provides some technical insights regarding crypto transaction such as explaining bitcoin client, which is an end-user software that provides access to the Bitcoin network, how to use crypto-exchanges or Bitcoin ATMs to purchase cryptocurrencies, how to conduct a transaction, how to store your cryptocurrencies, what is a wallet, what types of wallets exist and how to rank wallets in terms of the security provided. We will also see how to search and analyse Bitcoin transactions via online explorers and learn the concepts of 'cold storage' and 'paper wallets'.

Week 5: Bitcoin in practice – Part 2: Constructing a transaction, mining

Week 5 provides the technical instructions on how to download Bitcoin Core, exploring the Command Line Interface, and learning some of the most useful commands. We will also introduce scaling proposals such as SegWit and the Lightning Network. Some further details are provided regarding Mining Pools and rewards, Soft and Hard Forks.

Week 6: Blockchain Types

In week 6 we aim to take a closer look at various blockchain types and understand their characteristics and purposes: open, public and permissionless blockchains such as Bitcoin, introduce Ethereum Blockchain (another open, public and permissionless blockchain) and explore the concept of smart contract. We will also explore other blockchain types such as open, public and permissioned (Ripple), consortium blockchains (Quorum, R3, Hyperledger, EEA), enterprise blockchains and hybrid blockchains such as Dragonchain which combine properties from other blockchains. Finally, we will approach the question 'How many blockchains are there? and go through some other notable blockchains.

Week 7: Cryptocurrencies Taxonomy

During week 7 we will take a look at alternative uses of the digital currencies and understand that aside of bitcoin and Ethereum, more than 5.000 of cryptocurrencies and tokens exist. We will provide a framework for classifying these cryptocurrencies and tokens and will explore alt-coins, stablecoins, colored coins, security tokens, non-fungible tokens, learn some key properties and differences in each category, understand why they are important and explore some notable cryptocurrencies in each category.

Week 8: Cryptocurrency, Financial Institutions and Central Banking

Week 8 provides an overview of how blockchain disrupts global finance. We summarize the existing financial services industry, which is an extremely complex industry, protected by significant barriers to entry. Financial services in their present form serve the needs of developed world consumers reasonably well, but leave a large percentage of the population unbanked and impose significant mutualized losses on customers and taxpayer. Week 8 also explores cryptocurrency financial services as they are at the moment, i.e. exchange centers, merchants and wallets for cryptocurrencies and highlights the opportunities behind payments as a process with the use of cryptocurrencies. Furthermore, we explore how central banks work and what are their functions. Examine how public cryptocurrencies may or may not replicate certain functions of a central bank. We will dive into the topic of Central Bank Digital Currencies (CBDC's) and learn that several central banks are already considering issuing their own CBDC's. We will be going through some reasons why a central bank would consider issuing CBDC, what are some of the challenges and some of the possible benefits.

Week 9: Regulatory and tax treatment

The financial services industry is a very highly regulated industry. Decentralized digital currencies on the other hand, share characteristics of currency, property, commodities and money transmission networks. This creates challenges in neatly matching them to pre-existing categories, while the regulatory environment is still uncertain on a global basis, as many countries have not yet

given detailed guidance across the board about how cryptocurrencies, ICOs and blockchain startups should be treated. Week 9 approaches the likely areas of regulation that might impact Bitcoin and other decentralized currencies and develops an initial framework for evaluating different policy choices by nation-states in these areas. We also develop an appreciation for likely regulatory areas of concern when starting or working at a Blockchain-based business (taxation, money service businesses and securities legislation etc).

Week 10: Industrial applications of blockchain

In week 10, we turn our attention away from finance and look into other areas of the economy where blockchain & digital currencies may have a disruptive impact. We will address the benefits and limitations of blockchain-enabled decentralization, understand the different types of blockchains and their applications, explore the world of tokens and the applications of tokenization and focus on answering questions like: Why are blockchains considered so revolutionary? What are the different types of tokens and their applications? What are the main use cases of tokenization?

Week 11: Our decentralized future

In week 11, we will adopt a wider lens to explore the digital currency phenomenon in the context of a wider societal and technological trend toward decentralization. We will revisit the history of digital transformation and its possible future directions, explain how blockchain may unleash a new wave of decentralization, understand the limits of decentralization and the process of creative destruction and explore scenarios and applications of a decentralized future (self-sovereign identities, machine commerce, decentralized organizations, etc). Some of the questions addressed during this week include: why do most companies become technology companies? what are the implications of the coming singularity? why is it important to view blockchain in the context of other transformative technologies? Is the future of blockchain really decentralized? What types of new intermediaries will emerge in the blockchain economy?

Week 12: Blockchain converging with other technologies

Finally, week 12 views the adoption and applications of digital currencies and blockchain, when they are viewed in convergence with other technologies, notably artificial intelligence (AI) and the internet of things (IoT). We will discuss how blockchain is not alone in leading tomorrow's digital transformation and explore how real disruption will occur due to convergence with IoT (sensors allowing us to cost-effectively gather zillions of data points and connectivity allowing us to transmit/broadcast these data), decentralized AI (creating mini-brains at the edges of networks) and DLT (unleashing a wave of decentralized governance, programmable money and, ultimately, a machine economy).

Teaching Methods

Teaching material includes:
- Presentations with extended descriptions and explanations
- Asynchronous video presentations
- Additional readings (journal articles and e-books)

- Access to additional videos and commercials related to the course
- Synchronous meetings (WebEx)
- Forums, chats, quizzes, case studies and other formative and summative assessments

Assessment methods

Weekly Quizzes

In total 12 weekly quizzes exist (one each week). At the end of each week, an online quiz will be provided, containing 20 multiple-choice questions related to the week's course material. These tests do not have a time limit to complete and will be automatically graded upon submission. A student can retake this test multiple times and the higher score will be recorded; however, these scores will not count towards the final grade and the successful completion of the course.

Final Examination

The final exam format is different for students only enrolled in the MOOC and for students enrolled in the full MSc in Blockchain & Digital Currency. MOOC-only students will be assessed by means of a multiple-choice question test. MSc students will be assessed by an additional essay-based exam paper.

The final exam is timed (two-hours for MOOC-only students; three hours for MSc students). A minimum score of 60% both in the multiple-choice and the essay-based tests is required to successfully complete the course.

Details and guidelines on how to take the final exam are provided in Moodle and the main course page, while the test results are also uploaded to the Moodle main course page.