

Course Code BLOC-529DL	Course Title Decentralized Finance (DeFi)	ECTS Credits 10
Prerequisites None	Department Digital Innovation, School of Business	Semester Fall/Spring
Type of Course Elective	Field Digital Currencies	Language of Instruction English
Level of Course 2 nd Cycle	Lecturers Prof. George Giaglis	Year of Study 1 st
Mode of Delivery Distance Learning	Work Placement N/A	Co-requisites BLOC-511DL

Course Objectives

Decentralized Finance provides an introductory, yet thorough, coverage of the field of decentralized finance (DeFi) and its main components, including decentralized exchanges (DEXs), automated market making (AMM), liquidity mining, yield farming, stablecoins, blockchain derivatives, DeFi protocol governance and others. The course will:

- Delineate the principles by which decentralised finance operates.
- Conceptualise the innovation/novelty and risks of DeFi by drawing parallels to its traditional financial (TradFi) applications.
- Survey the range of existing DeFi applications and protocols.
- Explain how DeFi may disrupt existing financial system architectures.
- Discuss related emerging developments related to DeFi, such as Non-Fungible Tokens (NFTs).

The course runs over six weeks, each covering two themes:

1. **DeFi fundamentals (weeks 1-2):** The first theme covers the fundamentals of DeFi and provides a background necessary to understand it in greater depth. This includes introducing Ethereum (and other Layer 1 blockchains) as well as smart contracts, fungible and non-fungible tokens,
2. **DeFi applications (weeks 3-6):** The second theme deep dives into the components of the DeFi application stack such as decentralized exchanges, lending and borrowing, liquidity mining, decentralised insurance, blockchain derivatives, oracles, stablecoins, algorithmic governance, and more.

Learning Outcomes

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

- Define DeFi and describe how it will interact with, supplement, or replace conventional finance.
- Summarize the primary components of the DeFi stack and provide examples of how decentralized exchanges, lending/borrowing, blockchain derivatives, and other aspects of the application stack work.
- Outline the essential risks associated with DeFi, including smart contract vulnerabilities, impermanent losses, regulatory considerations and more; plus propose measures for mitigating them.
- Interact with major types of DeFi protocols
- Analyze and explain advanced or supplemental applications of DeFi such as NFTs and CBDCs.

Course Contents

Week 1:

Thematic Session 1: Decentralized finance (DeFi) Fundamentals

- From centralized to decentralized finance
- Introduction to Decentralized Finance

We set the scene by introducing students to fundamental concepts from traditional finance and explaining how decentralized blockchain technology and self-executing smart contracts offer a radical departure from existing systems. This section showcases how DeFi has the potential to transform existing financial products into permissionless, trustless and transparent protocols that can run without the need of third parties mediating financial transactions. Additionally, students will be introduced to the size and growth of the DeFi landscape.

Thematic Session 2: The DeFi Ecosystem & Application stack

- The DeFi landscape and use cases
- DeFi ecosystem pillars
- DeFi application stack
- Composability and “Money Legos”

We will cover the different components of the decentralized finance ecosystem, including its pillars and parts. We will provide a broad overview of the major DeFi applications and projects, along with their features and innovative concepts. Additionally, we will examine the DeFi technology stack, which includes infrastructure layers, protocols, application settlement layers and aggregation layers. We will explain the significance of each layer and how they work together to form a modular architecture often referred to as 'money legos'.

Week 2:

Thematic Session 3: DeFi infrastructure, Part 1: Ethereum

- Introduction to Ethereum as the main Layer 1 protocol for DeFi applications
- Smart Contracts and token standards

We introduce the core blockchain technology that underlies DeFi applications, namely Ethereum. We also examine smart contracts and illustrate how they form the basis of DeFi applications through their self-executing and self-enforcing code.

Thematic Session 4: DeFi infrastructure, Part 2: Other L1/L2 Protocols

- Other notable Layer 1 protocols for DeFi (Binance Smart Chain, Avalanche, etc)
- The blockchain trilemma
- Layer 2 solutions and applications

We introduce other blockchains on which DeFi applications are being built beyond Ethereum and explain the emerging space of alt-L1 DeFi applications. Additionally, we present the blockchain trilemma along with successful and innovative solutions. This section will also cover a variety of layer 2 solutions in the DeFi and blockchain ecosystem.

Week 3:

Thematic Session 5: DeFi Applications I: Stablecoins and CBDCs

- Stablecoins
- Central Bank Digital Currencies (CBDCs)

We introduce stablecoins as a key component of the DeFi ecosystem. Students will gain an understanding of different types of stablecoin implementations, their advantages and drawbacks, and features. We will also delve into Central Bank Digital Currencies (CBDCs) and how decentralised and private stablecoins have impacted their design and functionality. Even though CBDCs are not part of the DeFi ecosystem per se, it is vital to consider how they could potentially interact with blockchain-based digital currencies, stablecoins, and DeFi applications when considering the future of the financial services industry.

Thematic Session 6: DeFi Applications II: Decentralized Lending and Borrowing

- Lending and Borrowing

We provide an overview of the distinctive features of blockchain lending and borrowing. We will also look into developments that are exclusive to blockchain-enabled protocols, such as flash loans. Furthermore, we will examine the lending and borrowing protocol landscape in Ethereum and beyond.

Week 4

Thematic Session 7: DeFi Applications III: Exchanges

- Decentralized exchanges (DEXes)
- Automated market making (AMM)
- DeFi protocol risks
- Liquidity mining
- Yield farming
- Decentralised insurance
- Bringing the real world to the blockchain through oracles

This section provides an overview of decentralized exchanges (DEXs) and money markets (AMM) in DeFi. Students will be introduced to the differences between these and their traditional counterparts, as well as representative examples of DEXs and AMM applications and protocols. The potential risks associated with them will also be explored. We explain how decentralization has made new forms of yield-earning activities possible, such as liquidity mining; where users contribute liquidity to a decentralized protocol, and yield farming; a strategy for maximizing returns on investment. Examples of protocols that enable these applications will be presented and analyzed. We then cover financial derivatives in the traditional financial markets before introducing synthetic assets on DeFi. We demonstrate how oracles can replicate real-world assets on chain using synthetic assets, before discussing how some novel risks and challenges in the DeFi space can be mitigated through decentralised insurance.

Thematic Session 8: DeFi Applications IV: Blockchain Derivatives, Oracles, Insurance

- Blockchain Derivatives
- Bringing the real world to the blockchain through oracles
- Decentralised insurance

We offer an overview of the use and purpose of financial derivatives in conventional finance markets, before introducing blockchain derivatives. We illustrate how synthetic assets can be utilized to replicate real-world assets on chain through a concept known as oracles. Lastly, we discuss how some of the novel risks and issues associated with DeFi can be addressed with decentralized insurance.

Week 5

Thematic Session 9: DeFi Governance and DAOs

- Programmatic management of DeFi applications
- Decentralized Autonomous Organizations (DAOs)

We introduce the fundamentals of blockchain governance and decentralized autonomous organizations (DAOs) as they relate to DeFi and decentralization in general. We analyze the governance structures employed by major DeFi protocols. Students will gain an understanding of how decentralized governance has the potential to revolutionize how organizations operate, removing communication barriers, decreasing management overhead costs, enabling new forms of direct participation and coordination while also providing transparency and accountability.

Thematic Session 10: DeFi Tokenomics & Real-World Asset Tokenization

- Tokenomics in DeFi protocols
- Tokenization in real assets

We offer an overview of how different DeFi projects handle token economics (tokenomics), including token issuance and distribution, staking, protocol governance, etc. We will also explore the potential for this space to develop beyond token governance. Additionally, we will look at how tokenization is disrupting existing markets (e.g., real estate) or creating entirely new ones (e.g., markets for future income streams), as well as how prediction markets leverage decentralization and the collective wisdom of many people.

Week 6

Thematic Session 11: Beyond DeFi, Non-fungible Tokens (NFTs) & Metaverse

- Non-fungible tokens (NFTs)

We provide an overview of emerging applications beyond DeFi. We start by exploring how Non-Fungible Tokens (NFTs) are disrupting the arts and collectibles market by creating unique, on-chain representations of objects. We will review the history of NFTs - from their first implementations in 2017-18 to their current status - and explain how various ecosystems and marketplaces function, as well as what they offer for the future. Building on NFTs, we introduce the concept of a Metaverse and explain how blockchains may serve as its open and interoperable infrastructure.

Thematic Session 12: End of Course Details

Teaching Method

This course is delivered entirely online, with weekly live interactive sessions featuring instructors and leading figures from the DeFi industry. Every week, material such as presentations, case studies and discussion papers are posted on Moodle for student review. Discussion forums provide an opportunity for students to interact both with each other and the course instructors. Additionally, a weekly Zoom session allows students to submit questions to the instructor(s) and invited guests.

Assessment method

Quizzes

Students will be given two quizzes with multiple-choice questions. Each quiz can only be attempted once, and must be taken within the designated time frame. The results of these two quizzes will account for 40% of a student's final grade.

Final Exam

The final exam counts for 60% of the student's final grade, and is an essay-based test paper to be completed in a three-hour period. Only one attempt is permitted.