



Course Syllabus

Course Code	Course Title	ECTS Credits
DFIN-524	Blockchain Technology and Applications	10
Prerequisites	Department	Semester
None	Management and MIS, School of Business	Fall/Spring/Summer
Type of Course	Field	Language of Instruction
Required	Technology Management	English
Level of Course	Lecturer(s)	Year of Study
2 nd Cycle	Dr. Klitos Christodoulou	2 nd
Mode of Delivery	Work Placement	Co-requisites
Distance Learning	N/A	N/A

Course Objectives:

This course aims to provide a conceptual understanding on the function of Blockchains as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable. It covers the technological underpinnings of blockchain operations as distributed data structures and decision making systems, their functionality, and different architecture types. It provides a critical evaluation of existing Smart Contract (SM) capabilities and platforms, and examines their future directions, opportunities, risks and challenges.

Learning Outcomes:

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

- understand the structure of a Blockchain and why/when it is better than a simple distributed database;
- analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities;
- evaluate the setting where a blockchain based structure may be applied, its potential and its limitations;
- understand what constitutes a “smart” contract, what are its legal implications and what it can and cannot do, now and in the near future;
- analyze to what extent smart and self-executing contracts can benefit automation, governance, transparency and the Internet of Things (IoT);

- attain awareness of the new challenges that exist in monetizing businesses around blockchains and smart contracts;
- describe and understand the differences between the most prominent blockchain structures and permissioned blockchain service providers, as well as, rising alliances and networks.

Course Content:

- An (Deeper) Overview of Bitcoin, Alternative coins and Networks
 - o Understand why Blockchain was first proposed and what problems it's called to solve
 - o Understand what can be replicated ad-hoc and what cannot
 - o Understand what differentiating features altcoins have
 - o Recognize the nascence of the ecosystem and blue ocean ahead Analyze the incentive structure in a blockchain based system and critically assess its functions, benefits and vulnerabilities
- Methods of Blockchain Security
 - o Strengthening Proof of Work (PoW - GHOST protocol in Ethereum, Bitcoin-NG, SPECTRE)
 - o Proof of Stake (PoS)
 - o Delegated Proof of Stake (dPoS) (e.g., Tezos, Bitshares)
 - o PoS proposals in Ethereum (Casper)
 - o Other PoW/PoS Hybrids
 - o Other interesting exotic proofs
- Public, Syndicated and Hybrid Blockchains
 - o The Hyperledger project, Digital Assets Holdings, and Blockchain as a Service (BaaS) (Microsoft Azure)
 - o Monax (Eris Industries) and other private blockchain initiatives
 - o Connecting public and private distributed ledgers, sidechains, connectors
 - o When a blockchain might not really be what you're looking for if you're a bank (R3CEV – Corda) Analyze to what extent smart and self-executing contracts can benefit automation, governance, transparency and the Internet of Things (IoT)
- Securing, Interconnecting Public and Private Blockchains
 - o Bitcoin blockchain incentive structures
 - o Nash Equilibriums, evolutionary stable strategies, and Pareto efficiency (Game theory)
 - o Weaknesses and news Points of Failure
 - o Mitigation Methods
 - o Redundancies and fallback methods
- Smart Contracts: Overview of Algorithmic Decision Making
 - o Smart contracts platform elements (Ethereum, Rootstock, etc.)
 - o Understand what makes a contract “smart” and what are their practical limitations
 - o Surface examination of the legality and potential of a binding nature for smart contracts today
 - o Overview of use-cases and industry applications for smart contracts
- Smart Contracts: Distributed Autonomous Organizations

- o Slock.it as the first attempt towards a DAO, issues of the legal structure and adjustments, failure and aftermath.
- o Potential of algorithmic governance in transparency, accountability, anonymity and personal liability
- o Bitnation and further governance initiatives and potential
- Smart Contracts: Connecting external data and physical resources (Oracles, and IoT)
- o Understand the low level challenges of reaching network wide consensus based on external data and/or APIs
- Machine driven and Socially driven Oracles, syndication and their respective issues
- Reality Keys, Truthcoin (Bitcoin Hivemind), Orisi, Town Crier, ChainLink, as oracles
- The rising importance of decentralized reputation mechanisms and sources of new “clout”
- Contract Autonomy, Transparency and Monetization
- o Technical and developmental limitations of smart contracts
- o Transparency and open-source ramifications to smart contract functions
- o Profiting out of smart contracts and decentralized Apps
- o Zero-knowledge proofs, contract independence and “black box” autonomous contracts
- Use Cases:
- Augur, Gnosis and reputation as a tradable commodity basis for a social oracle system
- Use Cases:
- o Blockchain-based IoT functionalities and challenges, use-cases: Slock.it and Oraclize
- Use Cases:
- o Open Bazaar and other platforms as decentralized information and reputation (super) marketplaces, reputation brokerages and smart darknet marketplaces (Daemon)
- o Additional functions of decentralized markets beyond mere products
- Use Cases:
- o Smart cities, Mycelium, JAAK, Provenance, Plutus and/or other upcoming and interesting project

Learning Activities and Teaching Methods:

Presentations, Lectures, Forum Discussions

Assessment Methods:

Quiz, Group Project, Final Examination

Group Project highlights: Teams: 2-5 students Choice of:

- A practical service offering including smart contracts for a real scenario
- Detailed examination of a particular topic, covered during the course
- Student suggestions / Instructors evaluation

Required Textbooks / Readings:

Provided in course