

## **COURSE: Blockchain Technology and Applications**

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### **COURSE DESCRIPTION**

The course provides an introduction to blockchain technologies, with specific focus on industrial application scenarios. The course includes hands-on labs on permissioned blockchain platforms and simple application development examples.

### **LEARNING OUTCOMES**

- ✓ Understand what a blockchain is, which different “types” of blockchain are available, and which one(s) best fit different application scenarios.
- ✓ Get introduced to the technological aspects which lay at the foundation of any blockchain (distributed ledger architectures, consensus mechanisms, smart contract scripting languages and cryptographic tools)
- ✓ Gain practical experience with a permissioned blockchain platforms (Multichain).

### **METHODOLOGY**

Theoretical lessons and practice using Multichain.

### **ASSESSMENT**

Written exam; weighting: 80%

Project; weighting: 20%

### **OUTLINE**

- Blockchains’ overview: definition, history, taxonomy; rules to understand when blockchains are needed and when they are pointless; examples of blockchains (including the bitcoin’s ledger) vs examples of blockchain-like structure which are not blockchain (including Google’s certificate transparency)
- Background: (lightweight) review of basic crypto tools exploited in a blockchain (hash functions, digital signature, elliptic curve crypto, public-key-based identities, multi signatures, etc)
- Distributed ledger technologies and architectures (hash pointers, merkle trees, data organization)
- Consensus mechanisms for permissioned blockchains (RAFT, Paxos, Byzantine Fault Tolerant variants, DPOS, etc); consensus in permissionless blockchains (proof of work, proof of stake, etc)
- Scripting languages and smart contract: non-turning-complete scripting (bitcoin, multichain, etc), turing complete languages (Ethereum, Hyperledger, etc), pros and cons; example multisignature contracts; micropayment contracts and layer 2 off-chain contracts (e.g. Lightning network);

- Application examples, and hands-on practice using a permissioned blockchain platform (multichain).

### **TEXTBOOKS**

Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction Hardcover – July 19, 2016, by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder.

### **ADDITIONAL SUGGESTED READING**

References on specific topics will be provided during the class.