II.2420 Blockchain

General Information

Module : Blockchain
Person in charge : Nour El Madhoun
Module code : II.2420
ECTS : 4
Workload : 120 hours including 42 hours face to face
Teamwork : Yes
Keywords : Blockchain, smart-contrats, PoW, PoS, Solidity

Presentation

Blockchain is reshaping the digital landscape by introducing new models of trust, transparency and decentralization. Beyond cryptocurrencies, it now powers secure and transparent systems across finance, supply chain, healthcare and digital identity. This course introduces the core principles of blockchain, including distributed systems and consensus mechanisms. Students will explore how information is securely stored and shared without intermediaries.

The course also covers smart contracts, teaching students how to design, program and deploy them on blockchain platforms. By the end, students will understand how blockchain works and will gain the essential skills to build and analyze decentralized applications and systems.

Academic Goals

Specialised competences

- Understand the fundamental principles of blockchain and distributed systems.
- Explain consensus mechanisms.
- Design and program smart contracts.
- Analyze and evaluate blockchain use cases.
- Identify the limitations and technical challenges of decentralized solutions.

Transversal competencies

- Work collaboratively on technical projects.
- Communicate effectively on scientific and technical topics.
- Demonstrate critical thinking and professional rigor.
- Adopt an ethical and responsible approach to technology use.
- Develop skills to adapt to the rapid evolution of the blockchain field.

Prerequisite

Knowledge of cryptography and a good or intermediate level in programming.

Content/program

This course enables students to explore and understand the following concepts:

- Structure and functioning of blockchain networks.
- Distributed consensus and transaction validation mechanisms.
- Smart contracts development and deployment.
- Comparison of major blockchain platforms and their applications.
- Security, privacy, and sustainability challenges in decentralized systems.
- Emerging trends and real-world use cases of blockchain technologies.

Pedagogical methods

Learning methods

This course is delivered through a combination of lectures and practical works.

Evaluation methods

The evaluation of this course is based on a group project (25%), a graded practical work (25%), and a final exam (50%).

Language

Lectures, practical works, and communication between teachers and students are conducted in English.

BIBLIOGRAPHY, WEBOGRAPHY, OTHER SOURCES

- https://www.sciencedirect.com/science/article/pii/S1084804524001097?casa_token=jO4jc1tXZUwAAAAA:13Gj1CdsV6XpaUmEhgUAQOE0TjpD_n92sPNrnF_-sfqbNHFxR6-v4NQ0VHgSHyJSVthkRli_SQ
- https://ietresearch.onlinelibrary.wiley.com/doi/pdfdirect/10.1049/blc2.12067
- https://www.sciencedirect.com/science/article/pii/S209672092400006X
- https://www.sciencedirect.com/science/article/pii/S2452414X24001195?casa_token=kFpgx2veSAYAAAAA:ZEQQgG-MVoL0j_8DYHrnACq1pJw_IXdWfGBTiOc8k4j65ZlDVt0-c-Af7ht_nD6_tPV53uA2VA
- https://ink.library.smu.edu.sg/cgi/viewcontent.cgi?article=5499&context=sis_research