Blockchain & Distributed Ledger technologies

1. GENERAL

SCHOOL	ENGINEERING		
DEPARTMENT	DEPARTMENT OF INFORMATICS AND COMPUTER ENGINEERING		
LEVEL OF EDUCATION	GRADUATE		
COURSE CODE	CSCYB-105	**SEMESTER OF STUDIES**	**A'**
COURSE TITLE	**Blockchain & Distributed Ledger Technologies**		
INDEPENDENT TEACHING ACTIVITIES *in case the credits are awarded in separate parts of the course e.g. Lectures, Laboratory Exercises, etc. If the credits are awarded uniformly for the whole course, indicate the weekly teaching hours and the total number of credits.*		**WEEKLY HOURS OF TEACHING**	**ECTS CREDITS**
Lectures		3	
Practice -Exercises		2	
Add rows if needed. The teaching organization and teaching methods used are described in detail in 4.		**5**	**7.5**
COURSE TYPE *Background, General Knowledge, Scientific Area, Skills Development*	*Skills Development, Background*		
PREREQUISITE COURSES:	-NONE		
LANGUAGE OF TEACHING AND EXAMS :	ENGLISH		
ERASMUS STUDENTS	Yes (English)		
ONLINE COURSE (URL)	Cscyb.uniwa.gr and eclass (https://eclass.uniwa.gr/courses/CSCYB103/)		

2.LEARNING OUTCOMES

Learning outcomes

The learning outcomes of the course are described, the specific knowledge, skills and abilities of an appropriate level that students will acquire after the successful completion of the course.

Refer to Appendix A.

- *Description of the Level of Learning Outcomes for each course according to the Qualifications Framework of the European Higher Education Area*
- *Descriptive Indicators Levels 6, 7 & 8 of the European Qualifications Framework for Lifelong Learning and Annex B*
- *Summary Guide for writing Learning Outcomes*

In the Blockchain & Distributed Ledger Technologies course, students will get to know the characteristics of the Blockchain technology and its features without any pre-requisite. Upon completion of the course, students will be able to:

- argue about the use (or not) of a solution based on blockchain technology in a given use case.
- design a solution based on blockchain technology
- understand how the use of cryptography and digital signatures can improve data integrity and security
- create a wallet and use it for transactions
- connect and trade in the most popular Blockchain networks (Ethereum, Bitcoin).
- create and install a Smart Contract
- create an NFT

General Abilities

Taking into account the general skills that the graduate must have acquired (as they are listed in the Diploma Supplement and are listed below), which of them is intended for the course ?.	
Search, analysis and synthesis of data and information, using the necessary technologies *Adaptation to new situations* *Decision making* *Autonomous work* *Teamwork* *Working in an international environment* *Work in an interdisciplinary environment* *Production of new research ideas*	*Project design and management* *Respect for diversity and multiculturalism* *Respect for the natural environment* *Demonstration of social, professional and moral responsibility and sensitivity in gender issues* *Exercise criticism and self-criticism* *Promoting free, creative and inductive thinking*
Search, analysis and synthesis of data and information, using the necessary technologies *Adaptation to new situations* *Decision making* *Autonomous work* *Teamwork*	

3. COURSE CONTENT

Theoretical Part of the Course:

The course is divided into 8 sections:

Section 1: Introduction to Blockchain Technology

In this Section, the main features of blockchain technology are presented and its advantages and disadvantages are analyzed. In addition, the types of blockchains that exist are analyzed and it is studied how one can find if a blockchain solution is suitable for a use case and if so which type fits best.

Section 2: Popular Blockchain Platforms

This Section analyzes the two most popular blockchain networks, that of Bitcoin and Ethereum. Their main operating characteristics are examined and their similarities and differences are noted.

Section 3: Keys and Addresses

In this Section, there is a detailed presentation on the role of asymmetric cryptography for the creation of the private and public key pair. Also, it is analyzed how the user's address in the Bitcoin network and Ethereum is obtained from this pair of keys.

Section 4: Digital Signatures and Wallets

This Section presents how digital signatures are created using encryption and explains the role they play in a Blockchain network. In addition, the role that wallets play in a blockchain network is analyzed and the different types of wallets that exist are studied.

Section 5: Transactions

This Section explains how transactions are done on the Bitcoin and Ethereum networks. Their main difference is explained and examples are presented for understanding.

Unit 6: Smart Contracts and Non-Fungible Tokens (NFTs)

In this Section there will be a presentation of Smart Contracts on the Ethereum network. The way they are compiled and the role of gas in their execution will be explained. Also, a Smart Contract will be drawn up and installed on a real test network. In addition, the ERC standards on which NFTs and tokens are based will be presented and examples of how NFTs based on the ERC721 standard can be created.

Unit 7: Decentralized Applications and Introduction to Web 3.0

In this Section, a presentation of Web3.0 will be made and its differences with Web 2.0 will be explained. Then, it will be explained how a Decentralized Application can be created (DApp) and how it is connected to a blockchain network and the necessary Smart Contracts.

Section 8: Use Cases

This Section presents many use cases where the use of blockchain technology can have very good results and improve the performance of modern solutions. In addition, it analyzes both why blockchain technology can help and what kind of solution is proposed

to be used in each case.
Laboratory Part of the Course
The laboratory part of the course follows the theoretical part. It uses tools like *ETH.Build* which is recommended by the Ethereum Foundation to educate the world on Blockchain technology. This tool gives exercises related to:

- Cryptography
- Digital Signatures
- Transactions

In addition, *Remix* tool is used to write the Smart Contracts and install them on a real Ethereum Test Network. For this reason, an account will be made in a wallet (e.g., *Metamask*). The wallet will also be used to transfer NFTs between the students.

4. TEACHING AND LEARNING METHODS - EVALUATION

METHOD OF DELIVERY *Face to face, Distance education etc.*	In class face to face
USE OF INFORMATION AND COMMUNICATION TECHNOLOGIES *Use of ICT in Teaching, in Laboratory Education, in Communication with students*	Use of ICT in Teaching, Laboratory Education and Communication with Students
TEACHING ORGANIZATION *The way and methods of teaching are described in detail. Lectures, Seminars, Laboratory Exercise, Field Exercise, Bibliography study & analysis, Tutoring, Internship (Placement), Clinical Exercise, Art Workshop, Interactive teaching , Study visits, Study work, artwork, creation. λπ. The student study hours for each learning activity are indicated as well as the non-guided study hours so that the total workload at the semester level corresponds to the ECTS standards .*	Projection system and presentation capability with the application of the Power Point program, - Internet connection, - Use of bibliography search engines HEAL-LINK, PUBMED, SCOPUS, GOOGLE SCHOLAR - Use of e-mail and the Department's website to communicate with students and keep them informed - Use of the course eclass
STUDENT EVALUATION *Description of the evaluation process* *Assessment Language, Assessment Methods, Formative or Concluding, Multiple Choice Test, Short Answer Questions, Essay Development Questions, Problem Solving, Written Assignment, Report / Report, Oral Examination, Public Presentation, Public Presentation, Others* *Explicitly defined assessment criteria are stated and if and where they are accessible to students.*	A final project will be assigned and the grade will depend on: - On the submitted written report (40%) - In the oral presentation of the work (60%) Each exercise/problem of the project has a different score which is indicated in the project.

5. RECOMMENDED-BIBLIOGRAPHY

- Suggested Bibliography:
English

3. *A. Antonopoulos, "Mastering Bitcoin", O'Reilly, 2nd edition, 2017.*
4. *A. Antonopoulods, G. Wood, "Mastering Ethereum: Building Smart Contracts and DApps", O'Relly, 1st Edition, 2018.*

Greek

9. Patrikakis, C., Leligkou, H., & Kogias, D. (2023). *Blockchain* [Postgraduate textbook]. Kallipos, Open Academic Editions. https://dx.doi.org/10.57713/kallipos-171

Links
https://bitcoin.org/bitcoin.pdf