DO NOT TYPE IN THIS BOX

Bulletin # : 3

Academic Year : 2019-20

FLORIDA INTERNATIONAL UNIVERSITY
UNIVERSITY CURRICULUM COMMITTEE
Proposal for a New Course

1. **School/College** Engineering and Computing

   Div./Dept. in Which Taught School of Computing and Information Sciences

2. | CIS | 4 | XXX | | 3 |
   |---|---|---|---|---|
   | Alpha Prefix | 1st Digit | Last 3 Digits | "C"-lec-lab "L"-Lab | Cr. Hrs. |

   CIP Code *(Leave this blank):*

CIS 4731

3. **Grading Method (select one):** ☒ Graded ☐ Pass/Fail

4a. **Course Title** Fundamentals of Blockchain Technologies

b. **Abbreviated course Title** *(for computer class schedules, transcripts)* Fundamentals BlkChn Tec

LIMITED TO 25 Characters *(including spaces)*

5. **Statewide Course Numbering Subject Matter Area** Computer Information Systems

6. **Catalog Description/Major Topics** *(not to exceed 200 characters including spaces)*

College of Medicine and College of Law: Attach description not exceeding 1,000 characters including spaces.

Introduction to blockchain key concepts such as proof-of-work, mining, distributed consensus, and its applications including crypto-currencies, smart contracts, and supply chain monitoring.

7. **Attach detailed syllabus course outline and course justification on separate page(s).**
8. **Prerequisite(s):** COP-3530
9. **Corequisite(s):**
10. **Objective(s) of Course:**

Students will understand:
What the principles of blockchain technology are,
What limitations the Internet has for online transactions,
How blockchain can establish trust for business,

11. **Does this course duplicate/overlap other courses at FIU?** ☒ No ☐ Yes
    If yes, please explain:
12. **What other closely related department(s) have been consulted about this course?**
13. **Is this course used for the assessment of a program or a certificate (if yes, then send a notification to assessment@fiu.edu)?** No Yes

PROPOSAL REQUESTED BY:

Faculty Contact Kianoosh Boroojeni — 11 / 25 / 2019
(Type name) (Signature)
kgholami@fiu.edu — 305-348-9935
(Email address) (Phone number)

Chairperson (Dept./Div.) S.S. Iyengar — 11 / 25 / 2019
(Type name) (Signature)

Chairperson (Curr. Comm.) Wei-Chiang Lin — 12 / 10 / 2019
(Type name) (Signature)

College/School Dean John Volakis — 12 / 10 / 2019
(Type name) (Signature)

Submit one original form. Attach one copy of the course justification and course syllabus, course description, objectives, major topics and textbooks.

Fundamentals of Blockchain Technologies - Course Justification

The Internet is designed and implemented as a tool of communication with the purpose of transferring information between smart devices. In the second era of the Internet, humans need blockchain to trade values online and place secure online transactions to do business electronically.

Blockchain technology has a fast-growing list of real-world applications including money transfers and cryptocurrencies, supply chain monitoring, digital identification, data marketplaces for the purpose of sharing or selling data, digital identification tools for the purpose of authentication in social and mobile platforms, securing database systems by creating immutable data backups, tracking prescription drug abuse patterns in federal level as well as state levels, tax regulation and compliance, medical recordkeeping, tracking weapons, etc.

Considering the aforementioned applications, there is a critical need to a course that describes the principles of blockchain technologies, distributed consensus protocols, cryptocurrency technologies, smart contracts and other applications that require robust trust establishment between parties. This undergraduate-level course will thoroughly equip students with the tools and ideas required to understand a large variety of blockchain technologies crucial for the development of next-generation of computing and information systems.

There are many industrial, and academic positions available in high-tech companies, national labs, and universities requiring people with CS-related degrees who have solid understanding of blockchain technologies. This course can pave the way for the students who seek such positions.

School of Computing and Information Sciences

Course Title: Fundamentals of Blockchain Technologies **Date:** 11/18/2019

Course Number: CIS-4XXX

Number of Credits: 3

Subject Area: Computer Information Systems	**Subject Area Coordinator:** Jason Liu **email:** liux@cis.fiu.edu
Catalog Description: Introduction to blockchain key concepts such as proof-of-work, mining, distributed consensus, and its applications including crypto-currencies, smart contracts, and supply chain monitoring.	
Textbook: Imran Bashir, Mastering Blockchain: Distributed ledger technology, decentralization, and smart contracts explained, 2nd Edition (ISBN-13: 978-1788839044) Arvind Narayanan, et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016. ISBN: 978-0-691-17169-2	
References: Stanford CS251 Bitcoin and Cryptocurrencies	
Prerequisites Courses: COP-3530	
Co-requisite Courses:	

Type: CS-Elective (Systems group)

Prerequisites Topics:

1. Functions
2. Hashing
3. Basic number theory
4. Graphs
5. Tree data structures

Course Outcomes:

1. Understand the principles of blockchain technologies and distributed consensus
2. Be familiar with crypto-currency technologies
3. Understand proof-of-work and mining strategies
4. Understand proof-of-stake
5. Understand smart contracts and how blockchains establish trust for economic activities
6. Be exposed to how blockchain can enhance security and privacy of computer systems.

Relationship between Course Outcomes and Program Outcomes

BS in CS: Program Outcomes	Course Outcomes
a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms	2,3
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	1, 2, 3, 4, 5, 6
c) Demonstrate proficiency in problem solving and application of software engineering techniques	
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.	
f) Demonstrate the ability to work cooperatively in teams.	
g) Demonstrate effective communication skills.	

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: http://www.cis.fiu.edu/programs/undergrad/cs/assessment/

Outline

Topic	Number of Lecture Hours	Outcome
1. Introduction to Blockchain 1.1. Peer to peer networks 1.2. Cryptography 1.3. Digital Signature 1.4. Nodes 1.5. Hashing	10	1, 2
2. Overview of Consensus protocols 2.1. Byzantine fault and Byzantine Generals Problem 2.2. Practical Byzantine fault tolerance 2.3. Nakamoto Consensus	10	1, 5
3. Proof of Work and Mining Strategies 3.1. Analysis of the Blockchain protocol in Asynchronous networks 3.2. Scalable BlockDAG protocols	2.5	3
4. Proof of Stake 4.1. Algorand Byzantine Agreement	2.5	1, 4
5. Blockchain in Business 5.1. Blockchain in Marketing 5.2. Blockchain in Supply Chain 5.3. Smart Contracts and Accounting	7.5	5, 6
6. Cryptocurrency Technology 6.1. Trading cryptocurrencies 6.2. Mining attacks and security issues 6.3. Value evaluation of cryptocurrencies	7.5	2, 6

Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
Programming Assignment addressing consensus algorithms	3
Programming Assignment addressing trade using bitcoins	3
Programming Assignment addressing smart contracts	3
Homework addressing Hashing and Cryptography	2
Homework addressing Proof of work and Proof of stake	2
Homework addressing blockchain protocols for e-commerce	2

Oral and Written Communications

Written Reports		Oral Presentations	
Number Required	Approx. Number of pages	Number Required	Approx. Time for each
3	2	0	0

Approximate Number of Credit Hours Devoted to Fundamental CS Topics[1]

Fundamental CS Area	Core Hours	Advanced Hours
CN – Computational Science	0	1
DS – Discrete Structures	0	1
IS – Intelligent Systems	0	0.5

Theoretical Contents

Topic	Class time
Algorithm Analysis	5
Probability Theory	2

Problem Analysis Experiences

Blockchain applications and performance analysis of consensus algorithms

Solution Design Experiences

None

[1] See Appendix A in *Computer Science Curricula 2013.* Final Report of the IEEE and ACM Joint Task Force, available at: https://www.acm.org/binaries/content/assets/education/cs2013_web_final.pdf