ABDULLAH GÜL UNIVERSITY
GRADUATE SCHOOL OF ENGINEERING & SCIENCE
ELECTRICAL AND COMPUTER ENGINEERING PROGRAM
COURSE DESCRIPTION AND SYLLABUS

Course Title	Code	Semester	T+L Hours	Credit	ECTS
BLOCKCHAIN AND CRYPTOCURRENCIES	ECE503	FALL-SPRING	3 + 0	3	7,5

Prerequisite Courses	

Type	Elective
Language	English
Coordinator	
Instructor	Dr. Ahmet SORAN
Adjunct	none
Aim	The Blockchain, mostly used in cryptocurrency applications, is a newly developed model to create a trusted peer-to-peer network with untrusted parts. The technology has a revolutionary role in cyber-security innovation since omitting trusted authority within the parts of the contributors. The class aims to learn and understand the details of the blockchain, and to be able to apply this model to proper problems.
Learning Outcomes	To give an opportunity to students for • learning the fundamentals of blockchain technologies • understanding the concept of cryptocurrency • understanding/describing how blockchain works • learning the technology behind the blockchain(transactions, consensus building, etc.) • learning how does blockchain provide a trusted network on the decentralized environment • understanding the benefits and pitfalls of the blockchain • learning how blockchain works without a trusted authority • implementing applications other than cryptocurrencies • deciding if Blockchain is (really) needed or not • discussing the possible applications for blockchain • discussing the future of blockchain technologies
Course Content	• Introduction to Cryptography • History of Cryptocurrency • Overview of Blockchain Technology • Types of Blockchain – Enterprises • Transactions • Blocks and a chain of blocks • Consensus Building • Details of Mining • Security of Blockchain • Problems with Blockchain • Smart Contracts • Blockchain applications • Second layer of Blockchain – Lightening Network • Directed Acyclic Graphs • Future of Blockchain

WEEKLY TOPICS AND PRELIMINARY STUDY

Week	Topic	Preliminary Study
1	Introduction to Cryptography • Cryptographic Hash Functions • The Merkle Tree • Digital Signatures • Public-Private Keys	The relevant lecture notes
2	History of Cryptocurrency • Cypherpunks • Previous alternatives of Bitcoin • How Bitcoin started • Milestones of Blockchain/Bitcoin	The relevant lecture notes
3	Overview of Blockchain 1.0 • What is Bitcoin - Blockchain • Transactions-Blocks-Hashes • Consensus • Verification of Blocks • Types of Blockchain	The relevant lecture notes

4	Blockchain Mechaniccs • Peer-to-peer network and Ledgers • Permissioned/permissionless Ledgers • Recording Transactions • Mempools • Blocks - Chains • Hash pointers	The relevant lecture notes
5	Consensus Building / Protocols • Proof of Work • Segwit and Forks • Anonymity, Pseudonymity	The relevant lecture notes
6	Details of Mining • Proof of Work • Mining Analysis • Coinbase • Game Theory behind the mining • Mining Pools • CPU/GPU performance	The relevant lecture notes
7	Blockchain 2.0 • Smart Contracts • Ethereum – Blockchain Platform • Casper • Proof of Stack	The relevant lecture notes
8	Midterm	
9	Problems with Blockchain • Security of Blockchain • Game Theory and network attacks • Scalability problems • Hacks on exchanges	The relevant lecture notes
10	Blockchain applications (Blockchain 3.0) • Tokens vs Coins • Do we need a blockchain? • Alternative coins • Examples of new applications	The relevant lecture notes
11	Distributed Systems and Alternative Consensus • Lightening Network • Proof of State • Bitcoin-NG • Scaling Blockchain	The relevant lecture notes
12	Blockchain Alternatives • Directed Acyclic Graph • Cryptoeconomics • Future of Blockchain	The relevant lecture notes
13	Review Summary of the course, questions and answers	The relevant lecture notes
14	Demonstrations	

SOURCES	
Lecture Notes	Lecture notes and slides
Other Sources	**Course Textbook:** Bitcoin and Cryptocurrency Technologies by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder Princeton University Press (July 19, 2016) **Additional Materials:** 1. Andreas M. Antonopoulos. Mastering Bitcoin: Programming the Open Blockchain. O'Reilly Media; 2 edition (July 1, 2017)

COURSE MATERIALS SHARING	
Documents	Lecture notes, slides and papers
Homework	Students will be given 6 homework
Exams	1 Midterm and 1 Project/Paper

EVALUATION SYSTEM		
SEMESTER STUDY	**NUMBER**	**CONTRIBUTION**
Midterm	1	20

Homework	6	30
SUB-TOTAL		50
Contribution of Semester Study		50
Contribution of Final Exam as a Project/Paper	1	50
TOTAL		100

Course Category	
Sciences and Mathematics	70%
Engineering	15%
Finance	15%

RELATIONSHIPS BETWEEN LEARNING OUTCOMES AND PROGRAM QUALIFICATIONS

No	Program Qualifications	Contribution Level				
		1	2	3	4	5
1	The skills of using mathematics, science and engineering information in advanced research,					**x**
2	The skills of analyzing, designing and/or implementing an original system that will be able to solve an engineering problem,					**x**
3	The skills of using the required software, hardware and modern measurement equipment in their field of research,					**x**
4	The skills of planning independent research and implementing in detail,					**x**
5	The skills of following literature, listening to and making technical presentation, writing a paper in academic level,				**x**	
6	The skills of innovative and interrogative thinking and finding original solutions				**x**	

*Increasing from 1 to 5.

ECTS / WORK LOAD TABLE

Activities	Number	Duration (Hours)	Total Work Load
Course Length (includes exam weeks: 16x total course hours)	14	3	42
Out-of-class Study Time (Pre-study, practice)	14	4	56
Internet search, library work, literature search	14	5	70
Presentation	1	5	5
Homework	14	5	70
Midterm	1	27	27
Final Exam	1	30	30
Total Work Load			300
Total Work Load / 30			300/30
Course ECTS Credit			7,5