Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	
Semester/Trimester/Others (specify approx. Start/End date)	
Course Author * Faculty proposing/revising the course	Deng Xin
Course Author Email	xin.deng@ntu.edu.sg
Course Title	Blockchain and AI in Finance
Course Code	BF3223
Academic Units	0
Contact Hours	39
Research Experience Components	

Course Requisites (if applicable)

Pre-requisites	AB1202 Statistics & Analysis
Co-requisites	
Pre-requisite to	
Mutually exclusive to	
Replacement course to	
Remarks (if any)	

Course Aims

This course provides the foundation for developing new financial business models and trading strategies using blockchain and artificial intelligence (AI) technologies. It is designed for students who are interested in the applications of blockchain and AI in finance. Experience with linear algebra, basic probability theory and basic calculus is necessary to complete assignments in this course. You will learn the basics of blockchain and AI technologies and related practical topics,
such as CBDC, crypto economics, digital asset management. You will also learn how to use open-source Python packages to design, test, and implement algorithms in finance. With relevant knowledge and skills, you will be ready for more advanced courses such as smart contract for finance, computational law in token economy, reinforcement learning in finance.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Describe recent developments of blockchain and AI technologies and analyze their impact on the financial services
ILO 2	Explain the technologies underlying cryptocurrencies and blockchains, and the concepts of AI, machine learning, supervised learning, unsupervised learning, deep learning, and reinforcement learning
ILO 3	Design smart contracts and decentralized applications
ILO 4	Valuate blockchain project and other ventures
ILO 5	Compare stable coins, CBDC, Libra and other digital currencies
ILO 6	Apply data mining and AI techniques in FinTech and develop applications

Course Content

1. Blockchain technology – characteristics of public, private, consensus algorithms, blockchain cryptography for distribution of trust and protection of privacy 2. Create smart contract on Ethereum network 3. Token Economics, digital asset management and valuation analysis of the drivers of returns 4. CBDC, stable coins 5. Data Structure and data mining 6. Supervised learning - Logistic model, boosting, random forest, and support vector machines 7. Unsupervised learning: risk control and anti-fraud 8. Graph theory and networks: valuation of venture firms* 9. Reinforcement learning: trading strategy* *advanced topics that depend on students' progress.

Reading and References (if applicable)

We will depend heavily on class slides. The following textbooks are recommended as reading materials and references. 1. A.Geron, Hands-On Machine Learning with Scikit-Learn and TensorFlow 2. C. Bishop, Pattern Recognition and Machine Learning 3. A. Antonopoulos, Mastering Bitcoin 4. T. Mitchell, Machine Learning 5. A. Narayanan et al., Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction 6. H. Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations 7. A. Bahga and V. Madisetti, Blockchain Applications: A Hands-on Approach 8. G. James, et al., An Introduction to Statistical Learning: with Applications in R

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Overview of the application of Blockchain and AI in Finance	ILO1	"Mastering Bitcoin", Ch7&9 "Hands-On Machine Learning"	In-person	
2	Blockchain technology: characteristics of public, private, consensus algorithms, blockchain cryptography for distribution of trust and protection of privacy	ILO2	"Mastering Bitcoin", Ch6-8	In-person	
3	Smart contract: creating smart contract on Ethereum network	ILO1 ,ILO 3	"Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations"	In-person	
4	Token Economics and valuation analysis: crypto-token fundraising methods and analysis of the drivers of returns.	ILO2 , ILO4	"Mastering Bitcoin", Ch9&10 http://tfageeks.com/2020 /05/31/digital-economyand┐blockchainprofessor-david-lee┐kuochuen-professor-offinance┐programmesingapore-university┐ofsocial-sciences/	In-person	
5	Digital asset management: alternative investment	ILO1 ,ILO 2	"Blockchain Applications: A Hands-on Approach"	In-person	

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
6	CBDC and stable coins	ILO2 ,ILO 5	ttps://jupiterchain.tech/ facebook┐libra/ https://libra.org/enUS/white┐paper/ 9 https://papers.ssrn.com/s ol3/papers.cfm?abstract_ id=3608752	In-person	
7	AI: Data Structure, Neutral Network, Machine Learning, Deep Learning, web crawling	ILO1 ,ILO 2	"Hands-On ML" Ch1	In-person	
8	Supervised learning - Logistic model, boosting, random forest, and support vector machines	ILO2 ,ILO 6	"Hands-On ML", Ch 9 Ch 4	In-person	
9	Application in credit risk modeling	ILO2 ,ILO 6	"Hands-On ML", Ch 9 Ch 4	In-person	
10	Unsupervised learning		"Hands-On ML"Ch5-7 "An Introduction to Statistical Learning" Ch8- 9	In-person	
11	Application in risk control and anti-fraud	ILO2 ,ILO 6	"Hands-On ML"Ch5-7 "An Introduction to Statistical Learning" Ch8- 9	In-person	
12	Graph theory and networks: valuation of venture firms	ILO2 ,ILO 6	"Hands-On ML"Ch9 "An Introduction to Statistical Learning" Ch10	In-person	
13	Presentations by Students (15- 20 mins per group)			In-person	

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Seminars	The interactive seminar session where there are ample opportunities for open discussion on the conceptual questions raised in the class allows you to think critical and share their ideas and concept with the class. This also allows me to get the concepts clearly through the entire class by involving you and ensure that the targeted learning outcomes are being achieved
Individual assignment(s)	The assignments require you to generate, analyze and deliver humorous materials in a guided manner.
In-Class activities	Some learning outcomes for this course are skills which are practical in nature and cannot be achieved by reading and writing. The achievement of such learning outcomes requires hands-on experience, in-class activities provide such opportunities.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Quizzes)	ILO1, ILO2, ILO4, ILO5	Acquisition of knowledge, Problem Solving	40	Individual		
2	Continuous Assessment (CA): Project(written report and in-class presentation)	ILO3, ILO4, ILO5, ILO6	Critical Thinking, Creative Thinking, Oral Communication, Teamwork & Interpersonal Skills	30	Team		
3	Continuous Assessment (CA): Assignment(Homework assignments)	ILO1, ILO2, ILO4, ILO6	Acquisition of knowledge, Decision Making	20	Individual		
4	Continuous Assessment (CA): Class Participation()	ILO1-ILO6	Oral Communication	10	Individual		

Description of Assessment Components (if applicable)

Formative Feedback

You will receive formative feedback through written responses to your reports and assignments.
You will receive summative group feedback on the presentation following the conclusion of the module.

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level

Course Policy

Policy (Academic Integrity)

Policy (General)

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities.

Policy (Absenteeism)

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies.
If you miss a lecture, you must inform the course instructor via email prior to the start of the class.

Policy (Others, if applicable)

Last Updated Date: 17-04-2024 03:16:11

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