Course Outline

Course   : The NUS BBA
Course Code : FIN4721
Course Title : AI, Blockchain and Quantum Computing
Class Date   : From 13/1/2025   To 18/4/2025
Semester   : Semester 2, Academic Year 2024/2025
Location   :
Faculty   : Prof David Lee Kuo Chuen (DL); Dr Lo Swee Won (LSW)
Department : Finance
Email   : DavidLee@nus.edu.sg; swlo@nus.edu.sg
Note   : Emphasis on AI, videos, hands-on experiences, group presentations and applications.
Linkedin Profiles: https://www.linkedin.com/in/david-lee-kuo-chuen-%E6%9D%8E%E5%9B%BD%E6%9D%83-07750baa/ and https://www.linkedin.com/in/swlo/

Overview

This course provides a comprehensive framework and analysis of the latest technological advancements in the financial and insurance sectors, including emerging technologies like AI, Blockchain, Cloud & Cyber Security, Data Analytics, Environmentally Friendly Technology, Financial Inclusion, 5G, and Quantum Computing (ABCDEFG-Q). It aims to enhance students' technology literacy and equip them with the tools to critically evaluate inclusive FinTech, Generative AI, and open metaverse projects in a trustless world. The class leverages technology to provide lectures through recorded videos, discussions, AI and quizzes.

Module Objectives

Upon completion of the course, students will be able to:
- Grasp the underlying design principles behind technology.
- Evaluate inclusive fintech projects with a critical eye.
- Appreciate the social and business implications of technology.
- Possess the technical skills necessary to address the needs of underserved communities.
- Apply learned techniques to real-world scenarios.

Rules and Expectations

1. Students are expected to have their computers (laptops preferred) with them during lectures and actively engage in in-class discussions.
2. Video presentations may be shown, and questions can be addressed in class.
3. This course fosters a peer-to-peer and decentralised learning environment, encouraging maximum student interaction and collaboration.
4. To benefit from the course, regular and active participation in online/F2F discussions is crucial.
5. The two-track lectures on AI and Blockchain may run alternatively, depending on the professors' schedules.

Assessment

Assessment Components	Weightage
Weekly Learning Log (5), Weekly Group PPT (5), End of Class Quiz, Chat Discussion and Verbal Participation (5)	15
Group Project	30
Mid-Term Quiz	30
Final Quiz	25

Schedule and Outline

Lesson/ Week	Session: DL (lesson summary or outline / learning objectives/preparation/cases & assignments/follow-up readings & resources) There may be guest speakers, hands-on and/or group discussions every lesson. The syllabus may be updated to the latest information in line with the market.	Session: LSW (lesson summary or outline / learning objectives/preparation/cases & assignments/follow-up readings & resources) There may be guest speakers, hands-on and/or group discussions every lesson. The syllabus may be updated to the latest information in line with the market.	References (If you are unfamiliar with the technical terms, reading these materials will help you bridge the gap. If you can read it before the class, it will help.)
1 13 Jan	DL: **AI 1: The Why of Tech in Finance - Overview**: Unbundling and bundling of services, LASIC Model, Web3 Pholpsophy (To Submit both Study Log and Group PPTs)		**IF: C1 Reading: 1 Case 1**
2 20 Jan	DL: **AI 2: The AI Landscape and FinTech Competition:** US versus China, AI & FinTech Giants **The AI Landscape I and Techniques** Data Structure, Data Storage and Singapore IMDA Plan (To Submit both Study Log and Group PPTs)		**AIQC: C1-4 AIDB: C1-2 FFP: C3-4 Case 2**
3 27 Jan	DL: **AI 3: The AI Landscape II and Business Applications** K-Mean, K Nearest Neighbours, Neural Network, Machine Learning, Deep Learning, CNN (To Submit both Study Log and Group PPTs)		**Lecture Notes ATF: C4-5 FFT: 5-7 Case 3**
4 1 Feb (Sat 9-3pm)	DL: **AI 4: The AI Landscape III and Generative AI** GAN, VAE, the importance of Data Privacy Protection, Inclusiveness and Ethics (To Submit both Study Log and Group PPTs)		**Lecture Notes AFT I: C4-5 Case 4**
5 3 Feb	DL: **AI 5: Latest Topics in AI** VAE, GAN, GAI, Agenic AI and ChatGPT (To Submit both Study Log and Group PPTs)		**Lecture Notes Case 5**
6 14 Feb (Sat) 10-11.30am		**Mid-Term** 30 Multiple Choice Questions Online Test, Open Book, Open Access in 90 minutes from AI 1-5	Instructional Word File on Preparation for blockchain lesson.

for both SA1 and SA2		Discussions, Feedback and Self-Learning Metamask Wallet (Free Testnet Coin Preparation)	
7 17 Feb		**LSW: Blockchain 1: Bitcoin Design Thinking** Hash, PKI, Digital Signature, UTXO, PoW, Byzantine General Problem (To Submit both Study Log and Group PPTs)	**Lecture Notes** **BSC: C1-2** **FF: C15-18** **Case 6**
8 10 Mar		**LSW: Blockchain 2: Ethereum** PoS, Smart Contracts, EOA, Contract Account, MetaMask Wallet (To Submit both Study Log and Group PPTs)	**Lecture Notes** **BSC: C7** **Case 7 and 8**
9 17 Mar		**LSW: Blockchain 3: Blockchain design thinking and Consensus algorithms** (To Submit Study Log)	
10 24 Mar		**LSW: Blockchain 4: DeFi** DeFi Application, Cross Chains, DAO and Voting (To Submit both Study Log and Group PPTs)	**Lecture Notes** **Case 9**
11 29 Mar (Sat) 9-3pm		**LSW: Blockchain 5: Fungible and Non-Fungible Tokens** ERC20, ERC721, ERC1155, ERC3525 and other tokens (To Submit both Study Log and Group PPTs)	**Lecture Notes** **Case 10**
12 7 April		**LSW: Blockchain 6: Hands-On Fungible, Non-Fungible and Semi-Fungible Tokens and Use Cases Quantum Computing and Valuation of Fintech** Quantum Hardware, Software, Algorithms and Applications Valuation Methods for Fintech and Asset Allocation (To Submit both Study Log and Group PPTs)	**AIQC: C11** **AIDB: C3-4** **BSC: C4-5** **ATF I: C7**
18 Apr (Sat) 10-11.15am for both SA1 and SA2		Final Test of 25 Online MCQs, Open Book, Open Access in 75 minutes for Lectures from Blockchain 1-6.	

General Guide & Reading

Main Text and Reading

1. "Inclusive FinTech: Blockchain, Cryptocurrency and ICO", David Lee Kuo Chuen and Linda Low, World Scientific. Topics 1 to 6, 8 and 9. (**IF**)
2. "AI and Quantum Computing for Finance and Insurance", Paul Schulte and David Lee Kuo Chuen, World Scientific. Topics 10, 11, and 12. (**AIQC**)
3. "Artificial Intelligence, Data and Blockchain in a Digital Economy", David Lee Kuo Chuen, World Scientific. Topics 2, 7, 8, and 11. (**AIDB**)
4. "Blockchain and Smart Contracts". Lo Swee Won, Cheryl Wang and David Lee Kuo Chuen, World Scientific, Topics 1-7 (**BSC**)
5. "Foundations for Fintech" David Lee Kuo Chuen, Joseph Lim, Phoon Kok Fai, Wang Yu, Global Fintech Institute – World Scientific Series on Fintech (**FF**)
6. "Applications and Trends in Fintech I", David Leek Kuo Chuen, David Lee Kuo Chuen, Joseph Lim, Phoon Kok Fai, Wang Yu, Global Fintech Institute – World Scientific Series on Fintech (**ATF**)
7. "Fintech for Finance Professionals", David Leek Kuo Chuen, David Lee Kuo Chuen, Joseph Lim, Phoon Kok Fai, Wang Yu, Global Fintech Institute – World Scientific Series on Fintech (**FFP**)

Reading (To Supplement and as ideas for Group Presentations)

1. "Emergence of FinTech and the LASIC Principles", David Lee Kuo Chuen and Ernie Teo, Journal of Financial Perspectives, Vol. 3, No. 3, 2015 https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2668049
2. "Handbook of Blockchain, Digital Finance, and Inclusion: Cryptocurrency, FinTech, InsurTech, and Regulation", David Lee Kuo Chuen, RH Deng – 2018
3. "Handbook of Blockchain, Digital Finance, and Inclusion: ChinaTech, Mobile Security, and Distributed Ledger", David Lee Kuo Chuen, RH Deng – 2018 (**HB**)
4. "CRypto IndeX", 2015, by Wolfgang Hardle and Team and initiated by David Lee Kuo Chuen, https://thecrix.de/
5. Decentralisation and Distributed Innovation: Fintech, Bitcoin and ICO's, David Lee, 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3107659
6. The New Money: The Utility of Cryptocurrencies and the Need for a New Monetary Policy, David Lee and Ernie Teo, 2019, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3608752
7. Blockchain Use Cases for Inclusive FinTech: Scalability, Privacy, and Trust Distribution, David Lee and Caroline Lim, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3629135
8. Fintech Tsunami: Blockchain as the Driver of the Fourth Industrial Revolution, David Lee, 2017, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2998093
9. Libra: It is a fine balance, David Lee and Ernie Teo, 2018, https://jupiterchain.tech/facebook-libra/
10. Blockchain and Inclusion, David Lee, 2018, https://vinaj.com/spotlight-series/interview-with-david-lee-kuo-chuen-professor-of-fintech
11. Digital Economy and Blockchain, David Lee, 2020, http://tfageeks.com/2020/05/31/digital-economy-and-blockchain-professor-david-lee-kuo-chuen-professor-of-finance-programme-singapore-university-of-social-sciences/
12. Other articles and cases assigned

Cases
1. Ant Financial: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3052318
Robinhood and FTX
2. Trusted Third Party: https://nakamotoinstitute.org/trusted-third-parties/
3. Social Scalability:
http://unenumerated.blogspot.com/2017/02/money-blockchains-and-social-scalability.html

4. AI Ethics and Principles:
https://www.mas.gov.sg/~/media/MAS/News%20and%20Publications/Monographs%20and%20Information%20Papers/FEAT%20Principles%20Final.pdf
5. ChatGPT Research: DL5.1 and Agenic AI
6. Crypto and Asset Allocation: ATF I, C7
7. Satoshi Nakamoto White Paper (2008): https://bitcoin.org/bitcoin.pdf
8. Smart Contract: https://nakamotoinstitute.org/the-idea-of-smart-contracts/
9. DAO Governance and Voting: Digital Currency 2nd Edition
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4442470
10. Central Bank Digital Currency: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3608752
https://www.adb.org/sites/default/files/publication/906241/central-bank-digital-currency-developments-asia-implications.pdf

Weekly Learning Log and Participation
Submit a 2-page summary in the given format, or complete a weekly group project or quiz (unless there's a short quiz/assignment at the end of class). If you miss a practice quiz for an official reason, submit a learning log to show your views on the lessons.

Each lesson will typically include a case study, and your participation and conclusions are important. Submit the summary/study log by the next lecture using the provided template. This must be done for all 11 lectures (unless the professor decides otherwise for the week) and indicate any absences in the top right corner.

Group Project
Each group will consist of x (class size divided by 10) students with a maximum of 10 groups, formed on **CANVAS** by students by the second lesson. The presentation will involve a 10-minute PowerPoint video presentation of not more than 15 slides (excluding the intro and ending page).

The students will choose a research or discussion topic on AI, Blockchain, and Quantum Computing, either from the course material or beyond, and must apply the concepts taught in the course. All references must be acknowledged on the slides, including figures, diagrams, pictures, and quotes.

Grading will be based on content and presentation flow (20%), analysis and technical expertise (20%), original charts, diagrams, infographics, and figures (50% and most important), and conclusion (10%). Those who create viral-potential infographics can score a full 50 marks.

The video presentation must be submitted online to the professor. If unsure of the topic, a 100-word proposal can be submitted to the professor by the 8th lesson. Each student will present in the video. Each Group is to ask at least one question for each video. These questions should be given to the video group and the group should answer all the questions with a maximum of 100 words for each and submit the answers online.

(Submission: 10-minute video, PPT on the 11th April noon. Once the videos are posted, the group should have one day to ask the question by 12th April noon, and the answers to the other groups by 13th April noon. There will be 5 quiz questions based on the videos.)

Mid Term Quiz
There will be an open-book and open-access mid-term test.

Final Test
An open-book and open-access final will be at the end of the term.

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ACADEMIC HONESTY & PLAGIARISM

Academic integrity and honesty is essential for the pursuit and acquisition of knowledge. The University and School expect every student to uphold academic integrity & honesty at all times. Academic dishonesty is any misrepresentation with the intent to deceive, or failure to acknowledge the source, or falsification of information, or inaccuracy of statements, or cheating at examinations/tests, or inappropriate use of resources.

Plagiarism is 'the practice of taking someone else's work or ideas and passing them off as one's own' (The New Oxford Dictionary of English). The University and School will not condone plagiarism. Students should adopt this rule - You have the obligation to make clear to the assessor which is your own work, and which is the work of others. Otherwise, your assessor is entitled to assume that everything being presented for assessment is being presented as entirely your own work. This is a minimum standard. **In case of any doubts, you should consult your instructor.** You are encouraged to use Generative and Agenic AI for your work, but whatever you use has to be declared.

Additional guidance is available at:
http://www.nus.edu.sg/registrar/adminpolicy/acceptance.html#NUSCodeofStudentConduct

Online Module on Plagiarism:
http://emodule.nus.edu.sg/ac/