

Module Outline

Professional Qualification:	Certified Fintech Professional (Specialist - Distributed Ledger Technology Stream) (CPFinT(S-DLT)) (QF Level 6)
Programme Title:	Postgraduate Certificate for ECF on Fintech (Specialist – Distributed Ledger Technology Stream) - Completion of M5 & M7
Module Title:	Distributed Ledger Technology (DLT) (M7)*
Credit:	30 (21 contact hours, 3 examination hours and about 276 self-study hours)
Teaching/Training Activities:	Training Class
Pre-requisite:	<ul style="list-style-type: none">• Professional Certificate for ECF on Fintech awarded by HKIB; OR• Grandfathered for ECF on Fintech (Core Level) by HKIB• Grandfathered for at least one stream or track under ECF on Fintech (Professional Level) by HKIB
Remarks:	* Pitched at QF Level 6

Professional Qualification Objective

The Professional Qualification of Specialist Track is developed to nurture a sustainable talent pool of more experienced and specialised expert level Fintech practitioners for the banking industry. Learners will achieve mastery within a specific Fintech domain on technology principles and applications in the banking industry to advise on Fintech use cases, solution architecture, and implementation management.

Professional Qualification Intended Outcomes (PQIOs) for Specialist Track (M5, M6, M7, M8, M11)

Upon completion of the Professional Qualification, candidates should be able to:

PQIO 1:	Drive practical Fintech adoption in a range of applicable business contexts.
PQIO 2:	Acquire in-depth knowledge and design rationale of Fintech solutions and applications in banks.
PQIO 3:	Evaluate new technologies and vendors in the market and supervise

	the application of technology concepts of relevant Fintech disciplines in solution design for addressing specific business scenarios and user pain points.
PQIO 4:	Formulate policies for the design, development, and implementation of Fintech solutions.
PQIO 5:	Formulate the implementation approach and guidelines in Fintech projects after reviewing the solution architecture
PQIO 6:	Establish and enforce policies and standards on Fintech software engineering across different coding practices, design patterns, production processes, and system operations.

Module Objective

The module aims to introduce distributed ledger technology, smart contracts, and their latest applications in financial institutions.

Module Intended Outcomes (MIOs) & Units of Competencies (UoCs)

Upon completion of the Module 7, candidates should be able to:

MIOs	Intended Outcome / Competence	Unit of Competencies (UoCs)
MIO 1:	Demonstrate proficiency in the advanced technical concepts, principles, and practical demonstrations of the emerging DLT domains to execute problem framing and strategy analytics in conducting Fintech solution development.	109358L6 109400L5 / 107432L5
MIO 2:	Interpret and leverage current and emerging Fintech use cases, project management techniques, and solution implementation, operation, and maintenance methodologies.	109376L6 109577L6 / 107590L6 109399L5

Assessment Activity

Type of Assessment Activity	PQIO/MIO	Weighting (%)
Examination	MIO 1 - 2	100%

Examination Format and Duration

Paper 1

Time allowed: 1.5 hours

Format: Multiple choice (closed-book; 50 questions - each 1 mark)

Paper 2

Time allowed: 1.5 hours

Format: Essay Type Questions (open-book; choose 2 out of 3 - each 25 marks)

Pass mark: 50% for combining both papers, failed candidate (<50% as a whole) needs to retake both papers in future attempt.

CPFint(S-DLT) Certification Requirement

- Completion of ECF on Fintech (Professional Level) Training and Pass examination in Module 5 and Module 7; and
- Having at least 3 year of relevant work experience in Fintech projects and / or any of the Professional Level functions in Fintech Solution Development, Fintech Product Design, Fintech Strategy and Management or Regtech; and
- Currently as a Relevant Practitioner

Syllabus

Chapter 1: Distributed Ledger Technology Overview and Trend	
1	- What is distributed ledger technology (DLT)? <ul style="list-style-type: none">• Definition of DLT• Features of DLT
2	- Comparison of DLT with other databases <ul style="list-style-type: none">• Important differences between DLT and other databases• Advantage of DLT
3	- History of DLT <ul style="list-style-type: none">• First application of DLT: Bitcoin• Differences between Bitcoin and other attempts of digital currency
4	- Current state of the field

	<ul style="list-style-type: none"> • Cryptocurrency use case • Cryptocurrency industry including mining • Difference between cryptocurrency and other currency
Chapter 2: Distributed Ledger Technology Fundamentals	
1	<ul style="list-style-type: none"> - Basics of cryptography in DLT <ul style="list-style-type: none"> • Overview of cryptography used in DLT • How cryptography ensure immutable data in DLT
2	<ul style="list-style-type: none"> - Hash function <ul style="list-style-type: none"> • Definition of hash function • Important features of hash function • Use of hash function in DLT and other scenario
3	<ul style="list-style-type: none"> - Public key encryption <ul style="list-style-type: none"> • Definition of public key encryption • Features of public key encryption • Use of public key encryption in DLT
4	<ul style="list-style-type: none"> - Decentralized digital identity <ul style="list-style-type: none"> • Definition of decentralized digital identity • How to use public key encryption to achieve decentralized digital identity
5	<ul style="list-style-type: none"> • Cryptocurrency storage and custodian - Transactions <ul style="list-style-type: none"> • Definition of transactions in DLT
6	<ul style="list-style-type: none"> • Example of cryptocurrency transactions - Block building and consensus mechanism <ul style="list-style-type: none"> • Block structure • Merkle tree • Block building process • Consensus mechanism : proof of work, proof of stake

	<ul style="list-style-type: none"> • Forks
Chapter 3: Smart Contracts	
1	<ul style="list-style-type: none"> - What is a smart contract? <ul style="list-style-type: none"> • Definition of smart contract • Smart contract features • History of smart contract
2	<ul style="list-style-type: none"> - Advantage of smart contracts <ul style="list-style-type: none"> • Important differences between smart contract and traditional contracts • Advantage and disadvantage of using smart contracts
3	<ul style="list-style-type: none"> - Applications of smart contracts <ul style="list-style-type: none"> • Application of smart contracts in DLT • Immaturity of the DLT technology
4	<ul style="list-style-type: none"> • Technical vulnerabilities related to security • Example of smart contracts - Smart contract examples: Lightning network <ul style="list-style-type: none"> • Multi-signature output; hashed secret and time-lock • Opening payment channels • Updating channel balance • Creating a network
Chapter 4: DLT Applications in Financial Institutions	
1	<ul style="list-style-type: none"> - Pros and Cons of using DLT <ul style="list-style-type: none"> • Distinguishing characteristics of DLT • Advantage and disadvantage of using DLT
2	<ul style="list-style-type: none"> - DLT applications in money transfer and payment <ul style="list-style-type: none"> • Background of intra-bank, inter-bank and international money transfer • Ripple as a money transfer service • Other DLT-based money transfer services

<p>3</p> <p>4</p>	<ul style="list-style-type: none"> • DLT in payment services - DLT applications in securities <ul style="list-style-type: none"> • Discussion of DLT application in securities industry • Project Ubin (securities settlement Dvp) • Australian Stock Exchange's DLT application (CHESS) • HKEX's Synapse - Other DLT applications in financial institutions <ul style="list-style-type: none"> • Application of DLT in derivative market • Application of DLT in insurance industry • Application of DLT in auditing
<p>Chapter 5: Token Offering</p>	
<p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p>	<ul style="list-style-type: none"> - What is an Initial Coin Offering? <ul style="list-style-type: none"> • Definition of ICO • Typical structure of ICO • Typical token sale disclosure • Determinants of token sale success - Advantage and Disadvantage of ICO <ul style="list-style-type: none"> • Advantage and disadvantage of ICO from issuer's perspective • ICO's role in start-up life-cycle and ways of working • Advantage and disadvantage of ICO from investors/users' perspective - Tokenomics <ul style="list-style-type: none"> • Discuss using tokens can support the development of new business models • How tokens can align incentives of users and project managers - Securities Token Offering – Regulated ICOs <ul style="list-style-type: none"> • Laws and regulations related to ICOs • Enforcement actions against ICOs - Example in Token Offering

	<ul style="list-style-type: none"> • Examples of ICOs • ICO and VC-based Blockchain startups • Filecoin ICO case
Chapter 6: DLT Project Management	
1	<ul style="list-style-type: none"> - Project objectives and planning <ul style="list-style-type: none"> • Determine the right project for DLT • Define project objectives • Deutsche Bank: Pursuing Blockchain Opportunity (A) case • Project Genesis: Advantage of tokenized securities
2	<ul style="list-style-type: none"> - Vendor selection management <ul style="list-style-type: none"> • Popular DLT structures including DLT consortiums • Comparison of different DLT consortiums, their underlying technologies and key focus areas: Hyperledger, R3 Corda, Ethereum
3	<ul style="list-style-type: none"> • DLT selection in Project Genesis • Stablecoin
4	<ul style="list-style-type: none"> - Milestone monitoring and reporting <ul style="list-style-type: none"> • Reporting of SWIFT DLT proof-of-concept • Reporting of Project Genesis - Operation and maintenance <ul style="list-style-type: none"> • Operational issues to consider in DLT projects • Regulatory challenges • Workflows and payment rail • Stablecoins • DLT project design: Information sharing, decentralized nature, and governance

Recommended Readings

Essential Readings:

1. Bitcoin: A Peer-to-Peer Electronic Cash System (Satoshi Nakamoto, 2009).
<https://bitcoin.org/bitcoin.pdf>
2. Some Simple Economics of the Blockchain, by Christian Catalini and Joshua Gans.
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2874598
3. Bitcoin and Cryptocurrency Technologies, by Narayanan, Bonneau, Felten, Miller, Goldfeder – Perface, and Chapters 1-3 and 5.
https://d28rh4a8wq0iu5.cloudfront.net/bitcointech/readings/princeton_bitcoin_book.pdf
4. Blockchain Technology: Beyond Bitcoin, Applied Innovation Review 2016.
<https://j2-capital.com/wp-content/uploads/2017/11/AIR-2016-Blockchain.pdf>
5. Cryptocurrencies: Investment, Money, or Gamble? (A) (Required Case)
<https://hbsp.harvard.edu/product/W91C19-PDF-ENG>
6. The idea of smart contracts (Nick Szabo).
<https://nakamotoinstitute.org/the-idea-of-smart-contracts/>
7. The Bitcoin Lightning Network summary.
<https://lightning.network/lightning-network-summary.pdf>
8. The Bitcoin Lightning Network white paper.
<https://lightning.network/lightning-network-paper.pdf>
9. An Introduction to Smart Contracts and Their Potential and Inherent Limitations by Stuart Levin on Harvard Law School Forum on Corporate Governance.
<https://corpgov.law.harvard.edu/2018/05/26/an-introduction-to-smart-contracts-and-their-potential-and-inherent-limitations/>
10. Project Ubin Phase 3: Delivery versus Payment on DLT.
<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin-DvP-on-Distributed-Ledger-Technologies.pdf?la=en&hash=2ADD9093B64A819FCC78D94E68FA008A6CD724FF>
11. Corporate Governance and Blockchains by David Yermack, Review of Finance, Vol. 21 Issue 1, 2017.
<https://academic.oup.com/rof/article/21/1/7/2888422>

12. Toward Blockchain-Based Accounting and Assurance by Jun Dai and Miklos Vasarhelyi, Journal of Information System, Vol. 31 Issue 3, 2017.
<https://meridian.allenpress.com/jis/article-abstract/31/3/5/75785/Toward-Blockchain-Based-Accounting-and-Assurance>
13. Whitepaper on Distributed Ledger Technology by ASTRI.
[https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper On Distributed Ledger Technology.pdf](https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Whitepaper%20On%20Distributed%20Ledger%20Technology.pdf)
14. Whitepaper 2.0 on Distributed Ledger Technology by HKMA.
<https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/infrastructure/20171025e1.pdf>
15. Filecoin's Initial Coin Offering: Using Blockchain to Decentralise Storage (Required Case).
<https://hbsp.harvard.edu/product/NTU182-PDF-ENG>
16. Basic Attention Token White Paper.
<https://basicattentiontoken.org/static-assets/documents/BasicAttentionTokenWhitePaper-4.pdf>
17. Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales by Sabrina T Howell, Marina Niessner, David Yermack, Review of Financial Studies, Vol. 33 Issue 9, 2020.
<https://academic.oup.com/rfs/article/33/9/3925/5610546>
18. Statement on Initial Coin Offerings by SFC HK.
<https://www.sfc.hk/en/News-and-announcements/Policy-statements-and-announcements/Statement-on-initial-coin-offerings>
19. Statement on Security Token Offerings by SFC HK.
<https://www.sfc.hk/en/News-and-announcements/Policy-statements-and-announcements/Statement-on-Security-Token-Offerings>
20. Understanding initial coin offering: A new means of raising funds based on Blockchain by European Parliament.
[https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/696167/EPRS BRI\(2021\)696167 EN.pdf](https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/696167/EPRS_BRI(2021)696167_EN.pdf)
21. Deutsche Bank: Pursuing Blockchain Opportunities (A) (Required Case)
<https://hbsp.harvard.edu/product/817100-PDF-ENG>
22. Project Genesis, Report 1, BIS/HKMA.
https://www.bis.org/publ/othp43_report1.pdf

23. Project Genesis, Report 2, BIS/HKMA/Liberty Consortium.
https://www.bis.org/publ/othp43_report2.pdf
24. Project Genesis, Report 3, BIS/HKMA/Digital Assets.
https://www.bis.org/publ/othp43_report3.pdf
25. SWIFT gpi real-time Nostro Proof of Concept.
<https://www.swift.com/swift-resource/167181/download>

Supplementary Readings

1. Mastering Bitcoin by Andreas M. Antonopoulos (Chapter 1-2, 4-6, 9-10 and 12).
<https://github.com/bitcoinbook/bitcoinbook>
2. Bitcoin: Economics, Technology, and Governance by Böhme, Rainer, Nicolas Christin, Benjamin Edelman, and Tyler Moore, Journal of Economic Perspectives 29, no. 2, 2015.
<https://www.aeaweb.org/articles?id=10.1257/jep.29.2.213>
3. Bitcoin and Cryptocurrency Technologies (Chapters 4, 6-10).
https://d28rh4a8wq0iu5.cloudfront.net/bitcointech/readings/princeton_bitcoin_book.pdf
4. Risks and Returns of Cryptocurrency, by Yukun Liu and Aleh Tsyvinski, Review of Financial Studies, Vol. 34 Issue 6, 2021.
<https://academic.oup.com/rfs/article/34/6/2689/5912024>
5. Project Ubin Phase 3: Delivery versus Payment on DLT.
<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin-DvP-on-Distributed-Ledger-Technologies.pdf?la=en&hash=2ADD9093B64A819FCC78D94E68FA008A6CD724FF>
6. Whitepaper 2.0 on Distributed Ledger Technology (Annex) by HKMA.
<https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/infrastructure/20171025e1a1.pdf>
7. Distributed Ledger Technology: Implications of Blockchain for the Securities Industry by FINRA.
https://www.finra.org/sites/default/files/FINRA_Blockchain_Report.pdf
8. The Role of Disclosure and Information Intermediaries in an Unregulated Capital Market: Evidence from Initial Coin Offerings by Bourveau, De George, Ellahie and Macciocchi, Journal of Accounting Research forthcoming.
<https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-679X.12404>
9. Securities and Exchange Commission Release No. 81207.
<https://www.sec.gov/litigation/investreport/34-81207.pdf>
10. ASX's Replacement for CHES for Equity Post-Trade Services: Business Requirement.
<https://www.asx.com.au/documents/public-consultations/ASX-Consultation-Paper-CHES-Replacement-19-September-2016.pdf>

11. CHESSE Replacement: New Scope and Implementation Plan.
<https://www.asx.com.au/documents/public-consultations/chess-replacement-new-scope-and-implementation-plan.pdf>
12. Distributed Ledger Technology in Experiments in Payments and Settlements, by IMF.
<https://www.imf.org/en/Publications/fintech-notes/Issues/2020/06/25/Distributed-Ledger-Technology-Experiments-in-Payments-and-Settlements-49251>
13. The Dai Stablecoin System Whitepaper.
<https://makerdao.com/whitepaper/Dai-Whitepaper-Dec17-en.pdf>

Further Readings

1. Is Bitcoin Really Untethered? By John M. Griffin and Amin Shams, Journal of Finance Vol. 75 Issue 4, 2020.
<https://onlinelibrary.wiley.com/doi/full/10.1111/jofi.12903>
2. Getting off the Ground: The Case of Bitcoin by William Luther, Journal of Institutional Economics, 2019.
https://www.cambridge.org/core/services/aop-cambridge-core/content/view/08F266520BB3C5FDB1C346681550FF1C/S1744137418000243a.pdf/getting_off_the_ground_the_case_of_bitcoin.pdf
3. Banking on Stone Money Ancient Antecedents to Bitcoin by Fitzpatrick and McKeon, Economic Anthropology 2020.
<https://anthrosource.onlinelibrary.wiley.com/doi/full/10.1002/sea2.12154>
4. Hashcash – A Denial of Service Counter-Measure, Adam Back, 2002.
<https://nakamotoinstitute.org/static/docs/hashcash.pdf>
5. Blockchain without Waste: Proof-of-Stake, by Fahad Saleh, Review of Financial Studies, Vol. 34 Issue 3, 2021.
<https://academic.oup.com/rfs/article/34/3/1156/5868423>
6. Bitcoin and Cryptocurrency Technologies (Chapters 10 and 11).
https://d28rh4a8wq0iu5.cloudfront.net/bitcointech/readings/princeton_bitcoin_book.pdf
7. Mastering Bitcoin (Chapter 7).
<https://github.com/bitcoinbook/bitcoinbook>
8. Blockchain Technology Overview by NIST.
<https://nvlpubs.nist.gov/nistpubs/ir/2018/NIST.IR.8202.pdf>
9. Blockchain Disruption and Smart Contracts, by Lin William Cong and Zhiguo He, Review

of Financial Studies, Vol. 32 Issue 5, 2019.

<https://academic.oup.com/rfs/article/32/5/1754/5427778>

10. Smart Contract and the Cost of Inflexibility by Jeremy Sklaroff, University of Pennsylvania Law Review, 2017.

https://scholarship.law.upenn.edu/penn_law_review/vol166/iss1/5/

11. TradeIX: Blockchain-Enabled Trade Finance in Global Supply Chains.

<https://hbsp.harvard.edu/product/W20650-PDF-ENG>

12. Inthanon-LionRock Leveraging Distributed Ledger Technology to Increase Efficiency in Cross-Border Payments.

https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/Report_on_Project_Inthanon-LionRock.pdf

13. Distributed Ledger Technology in Payment Clearing and Settlement by BIS.

<https://www.bis.org/cpmi/publ/d157.htm>

14. On the Future of Securities Settlement by BIS.

https://www.bis.org/publ/qtrpdf/r_qt2003i.pdf

15. Position paper Regulation of virtual asset trading platforms by SFC HK.

<https://www.sfc.hk/-/media/EN/files/ER/PDF/20191106-Position-Paper-and-Appendix-1-to-Position-Paper-Eng.pdf>

16. Initial Coin Offerings, Speculation, and Asset Tokenization, by Jingxing Gan, Gerry Tsoukalas and Serguei Netessine, Management Science, Vol. 67 Issue 2, 2021.

<https://pubsonline.informs.org/doi/abs/10.1287/mnsc.2020.3796>

17. Digital Tulips? Returns to Investors in Initial Coin Offerings, by Hugo Benedetti and Leonard Kostovetsky, Journal of Corporate Finance, Vol. 66, 2021.

<https://www.sciencedirect.com/science/article/pii/S0929119920302303>

18. Project Ubin: SGD on Distributed Ledger.

<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin--SGD-on-Distributed-Ledger.pdf>

19. Project Ubin Phase 2 Report: Re-imagining Real-time Gross Settlement System Using Distributed Ledger Technologies.

<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin-Phase-2-Reimagining-RTGS.pdf?la=en&hash=02722F923D88DE83C35AF4D1346FDC2D42298AE0>

20. Jasper-Ubin Design Paper: Enabling Cross-Border High Value Transfer using DLT.

<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Jasper-Ubin-Design-Paper.pdf?la=en&hash=437222C94FD39314FB4C685EA31FC3AAA5CA5DA1>

21. Project Ubin Phase 5: Enabling Broad Ecosystem Opportunities.

<https://www.mas.gov.sg/-/media/MAS/ProjectUbin/Project-Ubin-Phase-5-Enabling-Broad-Ecosystem-Opportunities.pdf>

22. Investigating the Impact of Global Stablecoins, by BIS.

<https://www.bis.org/cpmi/publ/d187.htm>