Module title: Blockchain, Cryptocurrencies and Applications

Please note this module description is preliminary and is subject to change.

Module code: Providing School/Department: ICMA Centre
Level: 7
Number of credits: 20
Term(s) in which taught: Spring
Number of ECTS credits: 10
Module convenor: Dr Andrew Urquhart

Summary module description:
Blockchain technology is rapidly changing the financial industry and beyond. Countless applications are being explored in payments, insurance, lending, fund raising, settlement of securities transactions and contract execution. In this course we will explore what a blockchain is and how you can create one with simple Python codes. Cryptocurrencies, one of the most popular uses of blockchain, are explored in detail. The module will present technical concepts at a high level suitable for students whose main interest is finance and the financial applications of blockchain.

Aims:
The module focuses on (1) blockchain applications in industry and financial services (2) the concept of an open distributed ledger, its advantages and disadvantages (3) public and private, permissioned and permission-less ledgers (4) an introduction to the cryptographic concept of a hash function and its use in forming a blockchain (5) the concept of mining and decentralised cryptocurrencies (6) bitcoin and other cryptocurrencies (7) Ethereum and the concept of smart contracts and their applications in finance (8) Python examples. (9) regulatory environment and challenges.

Intended learning outcomes:
Assessable learning outcomes:
By the end of the module it is expected that students will:
Understand how blockchain is changing the financial industry and the countless opportunities it offers
Understand the concept of an open distributed ledger and its advantages and disadvantages over a centralised database;
Understand at a high level the cryptographic concept of a hash function and how it is used form a blockchain;
Understand the concept of a cryptocurrency and the process of mining to form a blockchain;
Be familiar with technology underlying Bitcoin and other cryptocurrencies;
Understand the concept of a smart contract and be familiar with the application of such contracts to asset trading, cross border payments and insurance contracts;
Become familiar with how blockchains can be coded in Python.
Be aware of regulatory environment for blockchains and crypto-assets

**Additional outcomes:**
The module will use a number of in-class case studies showing the actual use of blockchain and the advantages it has offered. These case studies will develop a high level appreciation of the state of the art of the application of blockchain technology. The module will use the industry standard Python programming language and will build on the programming skills developed in Part 1.

**Outline content**

1. What is Blockchain and how it is changing the financial sector.
2. The concept of an open distributed ledger and its advantages over a centralised database.
   Governance issues related to decentralised ledger. Permissioned vs permission-less ledgers.
3. Public vs Private Blockchains
4. Basic cryptography, the hash function and mining.
5. Crypto-assets:
   a. Cryptocurrencies (Bitcoin and Ether)
   b. Tokens (e.g. ICOs and cryptocurrency funds)
   c. Trading and custody
6. Create a cryptocurrency with Python
7. Smart contracts and Ethereum
8. Create a smart contract with Python
9. Blockchain applications: Financial markets (settlements of securities transactions and post-trade services); payments (uses in emerging markets, business opportunities from PSD2), trade finance, anti-money laundering, P2P lending.

**Global context (where appropriate):**
The module covers industry standard techniques. The concepts are applied in investment banks, central banks, hedge funds and asset management firms worldwide.

**Brief description of teaching and learning methods:**
The core theory and concepts will be presented during lectures. Problem sets will be solved in workshops.

**Contact hours:**

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<th>Autumn</th>
<th>Spring</th>
<th>Summer</th>
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<tbody>
<tr>
<td>Lectures</td>
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<td>Seminars</td>
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<td>Work-based learning</td>
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<td>Guided independent study</td>
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<td>Placement</td>
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<td>Year abroad</td>
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<td>Total hours by term</td>
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<td>Module total hours (10 credit module = 100 hours)</td>
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Summative Assessment Methods (%) - work which contributes towards the overall module mark:

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<th>Method</th>
<th>Percentage</th>
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<td>Written assignment, including essay</td>
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<td>Dissertation</td>
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<td>Set exercise</td>
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<td>Portfolio</td>
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<td>Project output (other than dissertation)</td>
<td>40 (group project + presentation)</td>
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<td>Oral assessment and presentation</td>
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<td>Practical skills assessment</td>
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<td>Report</td>
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<td>In-class test administered by School</td>
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<td>Written examination</td>
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Summative assessment - Examinations:
One written final exam (closed book) of length 2 hours.

Summative assessment - Coursework and in-class tests:
Students will be asked to complete a group project (40%) to be submitted in week 1 of the summer term.

Formative assessment methods:
Seminar questions are assigned for each class. The seminar leader will facilitate discussion and offer feedback.

Penalties for late submission:
Penalties for late submission on this module are in accordance with the University policy. Please refer to page 5 of the Postgraduate Guide to Assessment for further information:
http://www.reading.ac.uk/internal/exams/student/exa-guidePG.aspx

Assessment requirements for a pass:
50% weighted average mark

Reassessment arrangements:
By written examination only, to be taken in August/September, as part of the overall examination arrangements for the MSc programme

THE INFORMATION CONTAINED IN THIS MODULE DESCRIPTION DOES NOT FORM ANY PART OF A STUDENT'S CONTRACT.