GLOBAL SUMMER PROGRAMME 2027

IS465S Quantum Computing in Financial Services

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COURSE DESCRIPTION

Quantum computing is now being realised at an ever-increasing pace. “Quantum advantage” has been demonstrated and the underlying technology continues to advance rapidly. While everyone talks about the speed of quantum computers, the power of this technology is not just in how fast calculations can be performed but also the size of data that can be processed. The overall objective of the course is to understand quantum computing, how it differs from classical computing and what the main applications are, now and in the future. Emphasis is placed on FinTech/Banking applications, e.g., risk, investments. Furthermore, you can experience interacting with real quantum computers and explore the quantum world.

LEARNING OBJECTIVES

Upon completion of the course, students will be able to:

- Explain the fundamentals of quantum computers
- Recognize the advantages and disadvantages of quantum computers in financial services
- Use real quantum computers
- Predict advancements in quantum computing
- Recommend quantum computers for the correct problem types

PRE-REQUISITES / REQUIREMENTS / MUTUALLY EXCLUSIVE COURSE(S)

None.

ASSESSMENT METHODS

Quizzes
Group Assignment

INSTRUCTIONAL METHODS AND EXPECTATIONS

- Lectures on the main topics
- Discussion and quizzes
- Demonstration of key elements and the use of quantum simulators
- Hands-on labs with simulators and real quantum computers

CONSULTATIONS

Ad-hoc as required

RECOMMENDED TEXT AND READINGS

- Book – Johnston, Eric R.. Programming Quantum Computers . O'Reilly Media. Kindle Edition.
- Qiskit tutorials - https://quantum-computing.ibm.com/docs/
- Blogs:
  - https://www.quantamagazine.org/tag/quantum-computing/
  - https://www.scottaaronson.com/blog/
  - http://www.quantumforquants.org/blog/
  - https://cloudblogs.microsoft.com/quantum/

Google quantum supremacy paper - https://authors.library.caltech.edu/99516/2/41586_2019_1666_MOESM1_ESM.pdf

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LESSON PLAN		
LESSONS	**TOPICS**	**REMARKS**
LESSON 1	*Introduction to quantum computing*	
LESSON 2	*Use cases for quantum computing*	
LESSON 3	*Quantum phenomena*	Using IBM Composer
LESSON 4	*Qubits, gates and circuits*	Guest speaker
LESSON 5	*Quantum algorithms I (QML)*	Using Classiq
LESSON 6	*Quantum algorithms II (Optimisation)*	Using IBM Composer
LESSON 7	*Quantum algorithms III (Modelling)*	Using Classiq
LESSON 8	*Site visit to Centre of Quantum Technologies*	
LESSON 9	*Quantum hardware*	Guest speaker
LESSON 10	*Future of quantum computing*	
LESSON 11	*Assignment presentations*	
LESSON 12	*Review*	Quiz 2