Module Specification

Quantum Computing [TSI]

Version: 2023-24, v2.0, 09 Aug 2023

Contents

Part 1: Information

Module title: Quantum Computing [TSI]

Module code: UFCE5E-6-3

Level: Level 6

For implementation from: 2023-24

UWE credit rating: 6

ECTS credit rating: 3

College: College of Arts, Technology and Environment

School: CATE School of Computing and Creative Technologies

Partner institutions: None

Field:

Module type: Module

Pre-requisites: None

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Not applicable

Features: Not applicable

Educational aims: To introduce students to the mathematics of quantum computing through the fundamentals of quantum mechanics and models of quantum computing. To teach the basic principles of practical programming of quantum computing, as well as their use in cryptography and improving the reliability of computing.

Outline syllabus: •Introduction to quantum mechanics.
•Various physical realizations of quantum computing, such as transmon qubit (IBM Q), trapped ion (IonQ), and quantum annealing (D-Wave).
•Quantum states and qubits.
•Quantum gates including Hadamard, Pauli-XYZ, Toffoli, Fredkin, Qiskit.
•Quantum algorithms such as Grover, and Shor.
•Programming quantum computers using IBM qiskit and Microsoft Quantum.
•Quantum cryptography.
•Quantum fault tolerance.

Part 3: Teaching and learning methods

Teaching and learning methods: Learning and teaching will be provided to students in two forms: lectures, practical classes and labs. During lectures, theoretical aspects of the course will be provided to students by the teaching staff. Lectures will be supported by presentation published and available to the students on e.tsi.lv under the module section.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Demonstrate understanding through application the mathematics behind quantum algorithms, such as unitary operators and quantum gates.

MO2 Evaluate and compare major quantum computing algorithms, such as Grover and Shor.

MO3 Analyse quantum hardware platforms, such as: transmon qubit (IBM Q), trapped ion (IonQ), and quantum annealing (D-Wave).

MO4 Program the simple quantum operations.

Hours to be allocated: 60

Contact hours:

Independent study/self-guided study = 48 hours

Face-to-face learning = 32 hours

Total = 80

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/C06ED041-127F-CCF2-57EC-6F52C7815D81.html?lang=en&login=1

Part 4: Assessment

Assessment strategy: To assess the learning outcomes of this course, several types of activities are provided, which include:
1) performing practical / laboratory work (summary assessment)
2) examination (summative assessment).

Practical / laboratory work is carried out by students independently. The main task is the acquisition of practical skills and the application of theoretical knowledge gained during the classes. Based on the results of the implementation, a report is prepared,

In addition to the assessment, the student receives feedback on the work done. Automated tests are used as a formative type of knowledge assessment and are designed for continuous self-assessment of the knowledge acquired by the student. This will allow students to pay attention to material that they have not mastered enough.

The course ends with an exam, which is aimed at assessing the theoretical knowledge and practical skills acquired by the student in the process of studying the course.

Resits are like for like.

Assessment tasks:

Practical Skills Assessment (First Sit)
Description: A series of laboratory tasks, the implementation of data structures and algorithms for their processing, which should be completed by the students. An

application, its source code and report should be provided to the teaching staff by uploading to the e.tsi.lv system.
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO4

Examination (First Sit)
Description: 2 hour Examination
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO3

Practical Skills Assessment (Resit)
Description: A series of laboratory tasks, the implementation of data structures and algorithms for their processing, which should be completed by the students. An application, its source code and report should be provided to the teaching staff by uploading to the e.tsi.lv system.
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO4

Examination (Resit)
Description: 2 hour Examination
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO3

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Computer Science and Software Development {Double Degree} [Feb][FT][TSI][4yrs] BSc (Hons) 2020-21

Computer Science and Software Development {Double Degree} [Oct][FT][TSI][4yrs] BSc (Hons) 2020-21

Computer Science and Software Development {Double Degree} [Oct][PT][TSI][5yrs] BSc (Hons) 2020-21

Computer Science and Software Development {Double Degree} [Feb][PT][TSI][5yrs] BSc (Hons) 2020-21