Module Template for New and Revised Modules[1]

Module Code	EEP55C25
Module Name	Algorithms for Quantum Computing
ECTS Weighting[2]	5 ECTS
Semester taught	Semester 1
Module Coordinator/s	Biswajit Basu
Module Learning Outcomes with reference to the Graduate Attributes and how they are developed in discipline	On successful completion of this module, students should be able to: LO1. Describe the basic elements and advantages/disadvantages of a Quantum circuit. LO2. Transform classical calculations into quantum operations. LO3. Use Dirac notation to perform calculations with quantum algebra. LO4. Apply period finding algorithms for solving related problems. LO5. Design and apply algorithms for Quantum Wavelet and Fourier Transforms. LO6. Solve problems and perform stochastic simulations using Quantum random walk. LO7. Solve optimization problems using quantum computing algorithms. LO8. Solve problems in Quantum Information Processing. LO9. Solve problems in Quantum Machine Learning. **Graduate Attributes: levels of attainment** To act responsibly - Introduced To think independently - Attained To develop continuously - Attained To communicate effectively - Attained
Module Content	Quantum control algorithms is an emerging area in response to the development of quantum computers which have been made feasible due to the recent breakthrough in hardware technologies. This would revolutionize applications related to simulation, optimization, security, medical application and drug design to name a few. The module considers theoretical development and application - oriented problem solving in the areas of: estimation, stochastic simulation, optimization, control and machine learning.

[1] An Introduction to Module Design from AISHE provides a great deal of information on designing and re-designing modules.
[2] TEP Glossary

	The course will emphasize the interplay between theory and application with practical coding.
Teaching and Learning Methods	The module contains a mixture of tutorials and conventional lab sessions where students will be able to seek assistance on their assignments.

Assessment Details[3]
Please include the following:

- **Assessment Component**
- **Assessment description**
- **Learning Outcome(s) addressed**
- **% of total**
- **Assessment due date**

Assessment Component	Assessment Description	LO Addressed	% of total	Week due
Coursework	Continuous Assessment (algorithm design assignments and in-class tests)	CA1 MLO 1-3 CA2 MLO 4-6 Computer Project MLO 1-9 CA3 MLO 7-9	10% 15% 25% 10% Total = 60%	CA1 W4 (Sem1) CA2, W6 (Sem1) Computer project, W10 (Sem1) CA3, W11 (Sem1)
Written Exam (2 hours)	Final Exam	MLO 1-9	40%	Trinity Term Exam period

[3] TEP Guidelines on Workload and Assessment

Reassessment Requirements	Based on a 100% repeat exam.
Contact Hours and Indicative Student Workload[3]	**Contact hours:** Scheduled hybrid lectures (synchronous online and in-situ f/f) **22 hours**, Tutorials and labs, Discussion/advice computer project (f/f in-situ as appropriate) **11 hours** **Independent Study (preparation for course and review of materials):** Independent student reading/Reflection using asynchronous materials in VLE **40 hours**. **Independent Study (preparation for assessment, incl. completion of assessment):** Computer project **15 hours**, CA 1-3 **21 hours**, Summative assessment **16 hours**
Recommended Reading List	1. An introduction to quantum computing (2010) by Kaye, Laflamme and Mosca. OUP 2. Quantum computation and quantum information (2010) by Nielsen and Cheung, CUP.
Module Pre-requisite	Mathematics modules in the Freshman years, Coding in Python
Module Co-requisite	None
Module Website	Via Blackboard
Are other Schools/Departments involved in the delivery of this module? If yes, please provide details.	No
Module Approval Date	
Approved by	Prof. Naomi Harte
Academic Start Year	September 2026
Academic Year of Date	2026-27