Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2023-24	

Long title: Quantum Information

New code: PHYS70009

New short title:

Brief description of module *(approx. 600 chars.)*:

Quantum information provides basic understanding of the current development of quantum computation, quantum algorithms, and quantum cryptography. We are witnessing that governments around the world, venture capitalists and IT giants are spending a significant amount of funds to develop a quantum computer. This is due to the potential that the quantum computer might be able solve some of the challenging problems the information industry is facing. There is thus a demand for physics graduates who understand the basic principles of the theory of quantum information. The course is an answer to this demand. It is also important to recognise that quantum information provides a new way to understand fundamental principles of quantum mechanics, using the language of information theory. In the course, students will learn various aspects of quantum information theory.

870 characters

Available as a standalone module/ short course? N

Statutory details

	ECTS	CATS	Non-credit
Credit value	7.5	15	N

HECOS codes:

FHEQ level: Level 7

Allocation of study hours

	Hours	
Lectures	26	
Group teaching	10	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	10	*Incl. project supervision, fieldwork, external visits.*
Independent study	141.5	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement	0	*Incl. work-based learning and study that occurs overseas.*
Total hours	187.5	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed? No

Module delivery

Delivery mode: Taught/ Campus

Delivery term:

Other:

Other: Term 1, exam in term 3

Ownership

Primary department	Physics
Additional teaching departments	None
Delivery campus	South Kensington

Collaborative delivery

Collaborative delivery?	N
External institution	N/A
External department	N/A
External campus	N/A

Associated staff

Role	CID	Given name	Surname
Module Leader		Myungshik	Kim

Learning and teaching

Module description

Learning outcomes	On completing the Quantum Information course, students will have acquired: • A new way to understand quantum mechanics • A good understanding of basic quantum algorithms • An understanding of how quantum mechanics is used for secure communications • A comprehensive knowledge in quantum circuits, quantum gate operations and their physical realisations
Module content	• Basic ingredients: Qubits and Quantum parallelism • Quantum computing: Universal gate operations, Deutsch-Josza algorithms, Search algorithm, Quantum Fourier transformation, Error correctionx, Physical realisations • Quantum communication, Quantum teleportations, Realisation of gate operations
Learning and Teaching Approach	Students will be taught over one term using a combination of lectures, office hours and directed exercises on theoretical work
Assessment Strategy	100% summative assessment based on final written exam.
Feedback	A set of problems are provided throughout the course (about 4-5 questions per week) with questions and examples students can get practice with. Students will be encouraged to submit their answers which will be marked with detailed feedback. There will be small surveys for the lecturer to get students' feedback to answer to students' needs when needed.
Reading list	•Nielsen and Chuang, Quantum computation and quantum information (Cambridge); •Devitt, Nemoto and Munro, Quantum error correction for beginners, Rep. Prog. Phys. 76, 076001 (2013);

•Barnett, Quantum information (Oxford).

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Myungshik Kim

Notes/ comments

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Template version 16/06/2017

Programme structure
Associated modules

UID	Legacy code	Module title	Requisite type
		Foundations of Quantum Mechanics	prerequisite

UID	Legacy code	Module title	Requisite type

Assessment details

		Pass mark
Grading method	Numeric	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
			50%	
Examination	Written examination	100%	50%	N
		100%		