Imperial College London

Module Specification (Curriculum Review)

Basic details

UID		Cohorts covered	Earliest cohort: 2024-25; Latest cohort:
Long title	Advanced Quantum Information		
New code	PHYS70059	New short title	
Brief description of module *(approx. 600 chars.)*	This module introduces students to the theory of quantum information and its algebraic foundations. The three main sections of the module are quantum algorithms, theory of entangled states and quantum error correction. (219 characters)		
Available as a standalone module/ short course?	N		

Statutory details

	ECTS	CATS	Non-credit	
Credit value	5	10	N	HECOS codes
FHEQ level	Level 7			

Allocation of study hours

	Hours	
Lectures	22	
Group teaching		*Incl. seminars, tutorials, problem classes.*
Lab/ practical		
Other scheduled		*Incl. project supervision, fieldwork, external visits.*
Independent study	103	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement		*Incl. work-based learning and study that occurs overseas.*
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed?	No

Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 2	Other	

Ownership

Primary department	Physics
Additional teaching departments	
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		Florian	Mintert

Learning and teaching

Module description

Learning outcomes	At the end of this module, students will be able to: - explain theory and applications of quantum information with rigorous mathematical footing. - understand the algebraic concepts of quantum information theory, including quantum algorithms, entanglement theory and quantum error correction. - distinguish and apply quantum algorithms including period finding, the hidden subgroup problem and quantum fourier sampling. - explain how entanglement theory includes notions of locality and causality, convex sets of quantum states and manipulation of quantum states by local operations. - apply quantum error correction including the stabilizer formalism and measurement-based quantum computation.
Module content	The modules contains advanced notions of quantum algorithms, entanglement theory and quantum error correction. Topics include single qubits and quantum gates, the dynamics of qubits, and error correction protocols.
Learning and Teaching Approach	This module will be delivered by lectures with problem sets for the students to solve.
Assessment Strategy	The assessment will be based on a two hour written examination and assessed problem sheets. The written examination contributes 70% and the problem sheets contribute 30%.
Feedback	Feedback will be provided by model answers to the problem sheets.
Reading list	

Quality assurance

Date of first approval	
Date of last revision	August 2023
Date of this approval	
Module leader	Florian Mintert

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

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