

Quantum Information

Module Code	PHYS97080	FHEQ Level	Level 7
Pre-requisites	Foundations of Quantum Mechanics	Co-requisites	None
Primary Department	Physics		
Module Leader	Professor Myungshik Kim		
Additional Teaching Departments	None		
Teaching Staff	Professor Myungshik Kim + Course Associate		
Programmes on which the Module is delivered			Core/Elective
All UG Physics programmes (F300, F303, F309, F325, F390, F3W3)			Elective
Learning Outcomes	<p>On completing the Quantum Information course, students will:</p> <p>Dynamics of qubits</p> <ul style="list-style-type: none"> • Construct the dynamics of a single or two qubits, as induced by a Hamiltonian. • Understand the effect of a projective measurement on a single or two qubits. • Understand the no-cloning theorem. <p>Single qubits and quantum gates</p> <ul style="list-style-type: none"> • Represent the state of qubits and their dynamics on the Bloch sphere. • Understand the dynamics of single qubits by quantum gates <p>Errors and error correction</p> <ul style="list-style-type: none"> • Understand qualitatively the source of errors. • Describe the dynamics of one or more qubits in terms of quantum channels. • Construct error correction codes for given errors. <p>Protocols</p> <ul style="list-style-type: none"> • Understand the teleportation protocol. • Understand the Deutsch Jozsa algorithm. • Understand the Grover algorithm and Quantum Fourier Transform. • Understand universal gates, controlled-unitary gates and quantum circuits <p>Entangled states</p> <ul style="list-style-type: none"> • Understand the Bell measurements. • Understand the concept of entangled states. • Determine if a state of two qubits is entangled or not. • Understand QKD, superdense coding and other protocols using entangled states. 		
Description of Content	This course aims to introduce you to the fundamental principles and applications of quantum information and their realisation.		
Assessment		Assessment Type	Weighting
Written Exam		Exam	100%

Learning & Teaching Hours	Independent Study Hours	Placement Hours	Total Hours
57	93	0	150
ECTS Credit	6	CATS Credit	12
Date of introduction	October 2019	Date of Last Revision	May 2020