Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2023-24	
Long title	Concepts in Device Physics			
New code	PHYS70003	New short title		
Brief description of module *(approx. 600 chars.)*	This module builds on the solid-state physics learned in the Solid State Physics core module, developing an understanding of transport and light-matter interactions in nanoelectronic and magnetic devices. It shows how such devices are designed and gives an insight into some of the latest research developments in nanomaterials and device physics.			
	347 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	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	10	*Incl. project supervision, fieldwork, external visits.*
Independent study	151.5	*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	Other	
Delivery term		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	359060	Will	Branford
Topic Leader	1002541	Malcolm	Connolly

Learning and teaching

Module description

Learning outcomes	•A thorough understanding of the fundamental solid-state physics needed to understand modern quantum nanoelectronic devices. •An understanding of the building blocks of microelectronics, and materials and device concepts for future electronics. •An understanding of the devices that involve the creation or detection of light. •An understanding of the use of magnetic materials and nanostructuring in information storage, data retrieval and concepts associated with integrating storage and logic.
Module content	• Fundamentals: Electronic bandstructure and semiconductor physics. Quantum well structures and low-dimensional quantum devices. Carrier dynamics and light emission and absorption in heterostructures. Magnetic phenomena, quantum-mechanical interpretation of the magnetic (exchange) interaction; introducing magnetic order and magnetic anisotropy. • Electronic Devices: An understanding of the building blocks of quantum transport in nanoelectronic devices (metal-semiconductor contacts, MOS capacitors, transistors and gates), and materials and device concepts for future electronics. • Magnetic Devices: An understanding of the use of magnetic materials and nanostructuring in information storage, data retrieval and concepts associated with integrating storage and logic.
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% of summative assessment is based on a final exam: written exam of 2 hours that will evaluate competences in the following 3 topics: •Electronic devices •Photonic Devices •Magnetic Devices
Feedback	Four problem sheets are provided which include further work associated with the module material and questions which allow students to apply the material. Model solutions are provided for problem sheets. Office hours are provided each week to allow for direct interaction between students and the module lecturers.

Reading list	Lecture notes are provided to students. The notes are designed to be self-contained, and there is no designated textbook required for this module. There are however also some excellent textbooks, that are suggested as supplementary or complementary reading for those of you wishing to explore further some aspects of the module. All those textbooks are fully optional. The module mainly follows the following two core textbooks: •Solid state electronic devices / Ben G. Streetman and Sanjay Kumar Banerjee. •Physics of semiconductor devices / S.M. Sze and Kwok K. Ng. Other useful textbooks: •Magnetism and magnetic materials / Coey, J. M. D •Magnetism in condensed matter / Blundell, Stephen •Silicon nanoelectronics / S. Oda and D. K. Ferry. • Transport in Nanostructures / D. K. Ferry

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Will Branford

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

Template version 16/06/2017

Programme structure

Associated modules

UID	Legacy code	Module title	Requisite type

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	2 hour written examination.	100%	50%	N
		100%		