Imperial College London

Module Specification (Curriculum Review)

Basic details

			Earliest cohort	Latest cohort
UID		Cohorts covered	2024-25	
Long title	Lasers			
New code	PHYS70025	New short title		
Brief description of module *(approx. 600 chars.)*	Lasers underpin much of commercial and research optics and photonics. This module provides a basic introduction to the physics of lasers including 3 and 4-level lasers, the conditions required for gain and laser operation, control of the spectral properties of laser emission, Q-switching, modelocking and the different types of laser gain media, spatial laser modes, Gaussian beam propagation and includes an introduction to the topic of nonlinear optics.			

456 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	16	
Group teaching	8	*Incl. seminars, tutorials, problem classes.*
Lab/ practical		
Other scheduled	10	*Incl. project supervision, fieldwork, external visits.*
Independent study	91	*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 1	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		Chris	Dunsby
Lecturer		Mike	Damzen

Learning and teaching

Module description

Learning outcomes	On completion of this module students will be able to: - calculate the conditions for laser action using laser and material rate equations - describe the implementation of the techniques of q-switched and modelocked laser operation to create laser pulses - calculate the charactersitc parameters of a Gaussiand beam and its propagation - design laser reasonators to acheive a given spatial mode size, and describe the form of higher order spatial modes - solve key equations of nonlinear optics including second harmonic generation, phase matching and intensity-dependent refractive index
Module content	Overview of the key light-matter interactions involved in laser action Two, three and four level laser systems and the development of corresponding rate equations The operation of laser cavities and laser output power Methods used to control and adjust the spectral characteristics of the laser output Methods for q-switched and modelocked laser operation
Learning and Teaching Approach	Students will be taught through a combination of lectures and classworks (where a timetabled session is used for a group problem solving exercise) supported by problem sheets and office hours. Some of the material will be delivered by assigning the students pre-recorded content to study, with subsequent in-person sessions used to reinforce that material.
Assessment Strategy	A 2 hour written examination provides 100% summative assessment. Examination questions are designed to assess across all of the learning outcomes. Formative assessment is provided through the problem sheets and classworks.
Feedback	Problem sheets are provided and model solutions are provided. An office hour is provided each week during the module to allow for feedback and direct interaction between students and lecturers. Classworks provide an opportunity for group discussion and for students to receive feedback on the classwork exercises. For material that is delivered using pre-recorded content, the in-person sessions allow the students to discuss the module material with the lecturer in small groups
Reading list	Optics by E. Hecht Laser Physics by P. W. Milonni and J. H. Eberly The Principles of Lasers by O. Svelto Solid-state Laser Engineering by W. Koechner Lasers by A. Siegman

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Chris Dunsby

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments