Imperial College London

Module Specification (Curriculum Review)

Basic details

UID		Cohorts covered	Earliest cohort: 2024-25; Latest cohort:
Long title	Fibre and Ultrafast Lasers		
New code	PHYS70033	New short title	
Brief description of module *(approx. 600 chars.)*	This module is an introduction to fibre lasers and ultrafast lasers. It will cover the fundamentals of optical fibres and how they can be used as laser gain media, the generation and characterisation of ultrafast optical pulses and relevant examples of ultrafast pulsed lasers. You will gain an understanding of how fibre and ultrafast lasers work and gain insight into why they are such useful tools in a wide variety of scientific and industrial applications.		
	461 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	15	
Group teaching	5	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	10	*Incl. project supervision, fieldwork, external visits.*
Independent study	95	*Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.*
Placement	0	*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		Timothy	Runcorn

Learning and teaching

Module description

Learning outcomes	On completing this module you will be able to: - determine, and calculate where appropriate, the transmission characteristics of different types of optical fibre - interpret the spectroscopic properties of the main rare-earth-doped fibre gain media and their associated optical pumping schemes for applications in optical amplifiers and/or fibre lasers - critically analyse the main state-of-the-art continuous-wave and pulsed fibre laser architectures and the key characteristics of the components used to build them - calculate the key characteristics of ultrafast laser pulses, and explain the fundamental physics behind their formation - determine the details of the unique properties of fibre and ultrafast lasers which are useful in applications such as materials processing and nonlinear optics.
Module content	-Waveguiding properties and transmission characteristics of single-mode and multimode optical fibres -Rare-earth-doping of optical fibres, the spectroscopic properties of key laser-active ions and optical pumping schemes -Continuous-wave and pulsed fibre laser architectures -The physics of ultrafast optical pulses and characterisation techniques -Exemplar fibre and solid-state ultrafast pulsed lasers -Example applications of fibre and ultrafast lasers: materials processing and nonlinear optics
Learning and Teaching Approach	Students will be taught through a combination of lectures, classworks (where a timetabled session is used for a group problem solving exercise) and office hours. Problem sheets will guide students' self-study.
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.
Reading list	-J. M. Senior, “Optical Fiber Communications,” 3rd ed. (Prentice Hall, 2009) -B. Saleh, and M. Teich, “Fundamentals of Photonics,” 2nd ed. (Wiley, 2007) -G. Agrawal, “Nonlinear Fiber Optics,” 5th ed. (Academic Press, 2013) -V. Ter-Mikirtychev, “Fundamentals of Fiber Lasers and Fiber Amplifiers,” (Springer, 2019) -U. Keller, “Ultrafast Lasers,” 1st ed. (Springer, 2021)

Quality assurance

Date of first approval	
Date of last revision	
Date of this approval	
Module leader	Timothy Runcorn

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Notes/ comments	

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