

Basic details

UID		Cohorts covered	Earliest cohort 2024-25	Latest cohort	
Long title	Optical Communications Physics				
New code	PHYS70007	New short title			
Brief description of module <i>(approx. 600 chars.)</i>	This module builds on the Oscillations and Waves, E&M and Solid State Physics core modules, and develops understanding of how modern optical communications technologies operate. The module considers optical fibres and the surrounding optoelectronic and photonic technology, classical information theory and data encoding, and network infrastructure. 349 characters				
Available as a standalone module/ short course?	N				

Statutory details

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

Allocation of study hours

	Hours	
Lectures	13	
Group teaching	1	<i>Incl. seminars, tutorials, problem classes.</i>
Lab/ practical	0	
Other scheduled	6	<i>Incl. project supervision, fieldwork, external visits.</i>
Independent study	105	<i>Incl. wider reading/ practice, follow-up work, completion of assessments, revisions.</i>
Placement	0	<i>Incl. work-based learning and study that occurs overseas.</i>
Total hours	125	
ECTS ratio	25.00	

Project/placement activity

Is placement activity allowed?	No
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Module delivery

Delivery mode	Taught/ Campus	Other	
Delivery term	Term 1	Other	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		Chris	Dunsby

Learning and teaching

Module description

Learning outcomes	On completion of this module, students will be able to: 1. Explain the operation principles and technology of optical fibre networks 2. Discuss the factors that limit the transmission of information over optical fibres and the methods commonly used to mitigate them 3. Analyse the operation of semiconductor light sources and detectors used in optical communications systems 4. Describe how information is encoded in optical communications systems, information capacity and future developments in intergrated photonics 5. Describe the effect of noise and other factors that limit bit-rates in optical fibre communications 6. Apply their theoretical understanding to design numerical simulations to study fibre modes and their dispersion
Module content	• Ray picture of light propagation in optical fibres: Fresnel's Equations/Total Internal Reflection • Guided-mode solutions of cylinder from Maxwell's equation: optical fibre modes • Light propagation in optical fibres: dispersion, attenuation • Fibre Amplifiers (Erbium doped and Raman) • Dispersion compensation in optical fibres • Revision of semiconductor physics • Revision of light emission from semiconductor materials (LEDs) • Principles of laser action and introduction to semiconductor lasers and strategies for single mode operation • Photodiodes: efficiency, speed and noise • Noise in optical communications systems, bit error rates and eye diagrams • Laser and LED modulation (direct and indirect): Electro-Absorption, Electro-Refraction and Mach Zehnder Interferometers • Data-encoding strategies to maximize data capacity over optical link stations. • Considerations on future developments in nanophotonics, photonic intergrated circuits and waveguides, wavelength division multiplexing
Learning and Teaching Approach	Students will be taught over one term using a combination of lectures, office hours, problem sheets and online quizzes. Examinable coursework consists of a group project. Some lecture time will be allocated to support students with both their group project, quizzes and problem-solving.

Assessment Strategy	Summative assessment is based on a final exam and coursework. The coursework will consist of a group project (30% of final mark). The written exam will last 1h and will evaluate ILOs 1-5 (70% of final mark). ILO 6 will be tested by a group project and will not be included in the final exam.
Feedback	Problem sheets are provided with questions and examples students can practise with. Online quizzes will also provide feedback. Summative assessment of the coursework (project) will be accompanied by feedback and comments.
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. □

Quality assurance

Date of first approval

Date of last revision

Date of this approval

Module leader

Notes/ comments

Office use only

QA Lead

Department staff

Date of collection

Date exported

Date imported

Associated modules

[illegible]

UID	Legacy code	Module title	Requisite type

Assessment details

Grading method	Numeric
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Pass mark

50%

Assessments

[illegible]

100%