IMPERIAL

Module Specification

Basic details

UID		Cohorts covered (Earliest cohort)	2025
Long title	Communications: Physical Layer		
New code	ELEC70134	New short title	

Brief description of module *(approx. 600 chars.)*

Communication links are a vital part of sensing systems and networks. Virtually all communications transmit data in digital form, and processing of digital signals is a major part of communication systems. In practice all these signals must take some physical form – normally fields within a transmission line (e.g., cable), free-space radio waves, or light in a fibre. This is called the physical layer, and greatly influences the properties and performance of the communication system, setting limits on range, data rate, multiplexing capabilities, security and other characteristics. This course will briefly introduce the sources and detectors used in optical communications, and the behaviour of their signals as they propagate in various media. You will gain an understanding of how to choose a physical method according to the needs and constraints of their application, and learn how to predict the performance of particular systems. Some related applications such as radiation-based scanners will also be introduced.

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	20	
Group teaching	0	*Incl. seminars, tutorials, problem classes.*
Lab/ practical	0	
Other scheduled	0	*Incl. project supervision, fieldwork, external visits.*
Independent study	105	*Incl. wider reading/ practice, follow-up work, completion of asses*
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 1	Other	

Ownership

Primary department	Electrical and Electronic Engineering
Additional teaching departments	0
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		Hakan	Merdan
Lecturer		Stepan	Lucyszyn

Learning and teaching

Module description

Learning outcomes	On successful completion of this module, you will be able to: -Characterise optical and radio-frequency links -Evaluate existing optical and radio-frequency subsystems, and predict the likely direction of future developments -Formulate power link budgets - Evaluate the main choices for components and materials that make an optical communications link and the criteria for selection for each of these components
Module content	Introduction: physical layer at optical wavelengths. **Part I:** Optical Guided waves Optical communication components Modulation techniques Multiplexing System architectures and applications **Part II:** Radio-frequency S-Parameters Antennas and propagation Power link budgets Stand-off detection body scanners
Pattern of learning and teaching activities	Two hours of lectures per week
Learning and Teaching Approach	Taught material will be introduced in traditional-style face-to-face lectures (20 hrs). These will be supported by reading assigned before the lectures and online quizzes run during the lectures. The latter will serve as formative assessment. Additional feedback will be provided during question-and-answer sessions regularly built into the lectures.
Assessment Strategy	This module is assessed by a 3-hour open book written exam. Problem sheets will be assigned for each section of material. These will not be marked for credit, but the GTAs will provide feedback on your worked solutions on an ad hoc basis.
Feedback	Informal feedback during lectures can be obtained by participating in lecture quizzes, and question-and-answer sessions.
Reading list	G. Keiser, Optical fiber communications, McGraw-Hill Education

	J. Gowar, Optical communication systems, Prentice-Hall, 1993 I. B. Djordjevic Advanced optical and wireless communications systems, Springer. D. M. Pozar, Microwave and RF wireless systems. New York ;: New York ; Chichester : Wiley, 2001. J. Sun, F. Hu and S. Lucyszyn, “Predicting atmospheric attenuation under pristine conditions between 0.1 and 100 THz”, IEEE Access, vol. 4, pp. 9377-9399, Nov. 2016.
Required equipment/ software	

Quality assurance

Date of first approval	
Date of last revision	September 2025
Date of this approval	

Office use only

QA Lead	
Department staff	
Date of collection	
Date exported	
Date imported	

Module leader	Hakan Merdan
Notes/ comments	

Template version

Assessment details

Grading method	Numeric	Pass mark	50%

Assessments

Assessment type	Assessment description	Weighting	Pass mark	Must pass?
Examination	3-hrs open book exam	100%	50%	N
		100%		