Imperial College London

Module Outline

Optical Communications

Module Code	PHYS97055	FHEQ Level	Level 7
Pre-requisites	Light and Matter	Co-requisites	None
Primary Department	Physics		
Module Leader	Dr Rupert Oulton		
Additional Teaching Departments	None		
Teaching Staff	Dr Rupert Oulton + Course Associates		

Programmes on which the Module is delivered	Core/Elective
All UG Physics programmes (F300, F303, F309, F325, F390, F3W3)	Elective

Learning Outcomes	• Explain the operation principles and technology behind optical fibre networks • Explain the advantages of optics over other communication methods, in particular with regards to data capacity and energy efficiency • Explain the factors that limit light transmission and the information it carries over optical fibres and methods used to mitigate them. • Explain the operation of semiconductor lasers and photo-detectors used in optical data communications systems. • Explain the implementation of optical fibre communications systems and the factors that affect wavelengths of operation, information capacity and likely future developments. • Describe the factors that limit bit-rates in optical fibre communications
Description of Content	• Ray picture of light propagation in multimode optical fibres. • Guided mode solutions of a step-index cylindrical fibre from Maxwell's equations: optical fibre modes. • Light propagation in optical fibres: dispersion & attenuation. • Fibre Amplifiers (Erbium doped and Raman). • Dispersion mitigation and compensation in optical fibres. • Principles of semiconductor lasers for fibre data communications. • Laser modulation (direct and indirect): Laser ringing & chirp, Electro-Absorption (Franz-Keldysh, Quantum Confined Stark Effects, Electro-Refraction and Mach Zehnder Interferometers). • Photodiodes: efficiency, speed & noise. • Noise in optical communications, bit error rate and eye diagrams.

Assessment		Assessment Type	Weighting
Written Exam		Exam	100%
Learning & Teaching Hours	Independent Study Hours	Placement Hours	Total Hours
23.5	51.5	0	75
ECTS Credit	3	CATS Credit	6
Date of introduction	October 2016	Date of Last Revision	May 2020