

Photonics and Optoelectronic Devices

Programme Requirements:

Photonics and Optoelectronic Devices (collaborative) - MSc
PH5180 (20 credits) and PH5181 (15 credits) and PH5182 (10 credits) and PH5184 (15 credits) and PH5185 (15 credits) and PH5186 (15 credits) and PH5187 (15 credits) and 15 credits from Module List: PH5015 - PH5016, PH5025 and PH5177 (60 credits)

Compulsory modules:

PH5180 Laser Physics				
SCOTCAT Credits:	20	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	10.00 am Mon, Tue, Wed, Thu (TBC)			
This module presents a description of the main physical concepts upon which an understanding of laser materials, operations, and applications can be based. These concepts include a treatment of light-matter interaction, gain, absorption and refractive index, rate-equation theory of lasers, gain and its saturation, frequency selection and tuning in lasers, transient phenomena, resonator and beam optics, and the principles and techniques of ultrashort pulse generation and measurement.				
Learning and teaching methods of delivery:	Weekly contact: 4 lectures/tutorials each week.			
Assessment pattern:	2.5-hour open-notes Examination = 80%, Coursework = 20%			
Re-assessment pattern:	Oral Re-assessment, capped at grade 7			
Module teaching staff:	TBC			

PH5181 Photonics Laboratory 1				
SCOTCAT Credits:	15	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	2.00 pm - 5.30 pm Mon, Tue and Thu			
The photonics teaching laboratory gives training in the experimental photonics, and allows students the opportunity to explore photonics practically in a series of chosen open-ended investigations. Students use their knowledge and skills from the lecture modules, supplemented by additional reading, to investigate relevant photonic effects. Phase I involves work in small groups in introductory areas, then phase II allows primarily individual investigation of topics such as the second harmonic generation, optical parametric oscillation, erbium amplifiers, Nd lasers, optical tweezers, spectroscopy, remote sensing of speed, Bragg reflectors, and holography.				
Pre-requisite(s):	Admission to a taught postgraduate photonics programme in the school.			
Learning and teaching methods of delivery:	Weekly contact: 3 x 3.5-hour practicals.			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	"No Re-Assessment available, lab-based module"			
Module teaching staff:	TBC			

Physics and Astronomy - Photonic and Optoelectronic Devices - 2018/9 - June 2018

PH5182 Displays and Nonlinear Optics

SCOTCAT Credits:	10	SCQF Level 11	Semester	1
Academic year:	2018/9			
Planned timetable:	9.00 am Tue, Thu and 3.00 pm Fri (weeks 10 -12)TBC			
The physics of polymers and liquid crystals is covered, showing the way to the use of semi-conducting polymers as light emitters, and the use of liquid crystals in displays and spatial light modulators. The nonlinear optics section of this module describes the physical ideas and application of second and third order nonlinear optics, including phenomena such as harmonic generation, parametric gain, saturated absorption, nonlinear refraction, Raman scattering, and optical solitons. The final section looks at second order nonlinear effects being exploited in optical parametric amplifiers and oscillators in the optical and THz regions.				
Learning and teaching methods of delivery:	Weekly contact: 2 lectures and occasional tutorials.			
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%			
Re-assessment pattern:	"Oral Re-Assessment, capped at grade 7"			
Module teaching staff:	TBC			

PH5184 Photonics Experimental Laboratory 2 (B21HL)

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Available only to students on the Photonics and Optoelectronic Devices MSc programme			
Planned timetable:	To be arranged.			
This module is taught at Heriot-Watt University, and forms part of certain taught Master's degrees run collaboratively between St Andrews and Heriot-Watt Universities.				
Learning and teaching methods of delivery:	Weekly contact: At Heriot-Watt University			
Assessment pattern:	Coursework = 100%			
Re-assessment pattern:	"If any, will be under Heriot-Watt regulations"			
Module teaching staff:	TBC			

PH5185 Semiconductor Optoelectronic Devices (B21OD)

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Available only to students on the Photonics and Optoelectronic Devices MSc programme			
Planned timetable:	To be arranged.			
This module is taught at Heriot-Watt University, and may form part of certain taught Master's degrees run collaboratively between St Andrews and Heriot-Watt Universities.				
Learning and teaching methods of delivery:	Weekly contact: At Heriot-Watt University			
Assessment pattern:	3-hour Written Examination = 100%			
Re-assessment pattern:	Under Heriot-Watt regulations			
Module teaching staff:	TBC			

Physics and Astronomy - Photonic and Optoelectronic Devices - 2018/9 - June 2018

PH5186 Modern Optics (B21FM)

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Available only to students on the Photonics and Optoelectronic Devices MSc programme			
Planned timetable:	To be arranged.			
This module is taught at Heriot-Watt University, and may form part of certain taught Master's degrees run collaboratively between St Andrews and Heriot-Watt Universities.				
Learning and teaching methods of delivery:	Weekly contact: At Heriot-Watt University			
Assessment pattern:	3-hour Written Examination = 100%			
Re-assessment pattern:	Under Heriot-Watt regulations			
Module teaching staff:	TBC			

PH5187 Fibre Optic Communications (B21FC)

SCOTCAT Credits:	15	SCQF Level 11	Semester	2
Academic year:	2018/9			
Availability restrictions:	Available only to students on the Photonics and Optoelectronic Devices MSc programme			
Planned timetable:	To be arranged.			
This module is taught at Heriot-Watt University, and may form part of certain taught Master's degrees run collaboratively between St Andrews and Heriot-Watt Universities.				
Learning and teaching methods of delivery:	Weekly contact: At Heriot-Watt University			
Assessment pattern:	3-hour Written Examination = 100%			
Re-assessment pattern:	Under Heriot-Watt regulations			
Module teaching staff:	TBC			

PH5177 Research Project (POED MSc)

SCOTCAT Credits:	60	SCQF Level 11	Semester	Full Year
Academic year:	2018/9			
Availability restrictions:	This project module is organised and assessed with Heriot Watt as the lead institution in 2017/8 and alternate years thereafter, St Andrews in 2018/9 and alternate years after that. It is available only to those in the Photonics and Optoelectronic Devices MSc programme.			
Planned timetable:	Placement, full time.			
All POED MSc students carry out a 3-month research project, in most cases carried out at a U.K. company. Part-time students who are industry employees may carry out the project at their own company. Students may have completed a literature survey prior to the project, and will write a dissertation on the project which is assessed in September.				
Learning and teaching methods of delivery:	Weekly contact: About 40 hours a week working on the project, with appropriate levels of supervision			
Assessment pattern:	Dissertation and Oral Examination = 100%			
Re-assessment pattern:	"No Re-Assessment possible, project module"			
Module teaching staff:	TBC			
Additional information from Schools:	Please see detailed information in the School's MSc programme handbook and in the School's Project Placement Handbook for the MSc in Photonics and Optoelectronic Devices.			

Physics and Astronomy - Photonic and Optoelectronic Devices - 2018/9 - June 2018

Optional modules:

PH5015 Applications of Quantum Physics			
SCOTCAT Credits:	15	SCQF Level 11	Semester 1
Academic year:	2018/9		
Availability restrictions:	Normally only taken in the final year of an MPhys or MSci programme involving the School, or a postgraduate photonics programme.		
Planned timetable:	12.00 noon Mon, Tue, Thu (TBC)		
Quantum physics is one of the most powerful theories in physics yet is at odds with our understanding of reality. In this module we show how laboratories around the world can prepare single atomic particles, ensembles of atoms, light and solid state systems in appropriate quantum states and observe their behaviour. The module includes studies of laser cooling, Bose-Einstein condensation, quantum dots and quantum computing. An emphasis throughout will be on how such quantum systems may actually turn into practical devices in the future. The module will include assessment based on tutorial work and a short presentation on a research topic.			
Learning and teaching methods of delivery:	Weekly contact: 3 lectures/tutorials, 1 x 3-hour research lab visit, 3 hours student presentations during the semester.		
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%		
Re-assessment pattern:	Oral Re-assessment, capped at grade 7		
Module teaching staff:	TBC		

PH5016 Biophotonics			
SCOTCAT Credits:	15	SCQF Level 11	Semester 1
Academic year:	2018/9		
Availability restrictions:	Normally only taken in the final year of an MPhys or MSci programme involving the School, or a postgraduate photonics programme.		
Planned timetable:	9.00 am Mon, Wed, Fri (TBC)		
The module will expose students to the exciting opportunities offered by applying photonics methods and technology to biomedical sensing and detection. A rudimentary biological background will be provided where needed. Topics include fluorescence microscopy and assays including time-resolved applications, optical tweezers for cell sorting and DNA manipulation, photodynamic therapy, optogenetics, lab-on-a-chip concepts and bio-MEMS. Two thirds of the module will be taught as lectures, including guest lectures by specialists, with the remaining third consisting of problem-solving exercises, such as writing a specific news piece on a research paper, assessed tutorial sheets and a presentation. A visit to a biomedical research laboratory using various photonics methods will also be arranged.			
Pre-requisite(s):	Pre-requisites are compulsory unless you are on a taught postgraduate programme. . Before taking this module you must (pass 1 module from {PH3081, PH3082} or pass 2 modules from {MT2506, MT2507}) and pass 1 module from {PH4034, PH4035}		
Learning and teaching methods of delivery:	Weekly contact: 3 lectures/tutorials.		
Assessment pattern:	2-hour Written Examination = 80%, Coursework (including presentation)= 20%		
Re-assessment pattern:	Oral Re-assessment, capped at grade 7		
Module teaching staff:	TBC		

PH5025 Nanophotonics			
SCOTCAT Credits:	15	SCQF Level 11	Semester 1
Academic year:	2018/9		
Availability restrictions:	Available only to students in the second year of Honours Programme or a taught postgraduate programme.		
Planned timetable:	To be arranged.		
<p>Nanophotonics deals with structured materials on the nanoscale for the manipulation of light. Photonic crystals and plasmonic metamaterials are hot topics in contemporary photonics, and form part of the School's research programme. The properties of these materials can be designed to a significant extent via their structure. Many of the properties of these nanostructured materials can be understood from their dispersion diagram or optical band-structure, which is a core tool that will be explored in the module. Familiar concepts such as optical waveguides and cavities, multilayer mirrors and interference effects will be used to explain more complex features such as slow light propagation and high Q cavities in photonic crystal waveguides and supercontinuum generation in photonic crystal fibres. Propagating and localized plasmons will be explained and will include the novel effects of super-lensing and advanced phase control in metamaterials.</p>			
Pre-requisite(s):	Before taking this module you must take PH3061 and (take PH3081 or take PH3082) and (take PH4027 or take PH4034 or take PH4035)		
Anti-requisite(s)	You cannot take this module if you take PH5183		
Learning and teaching methods of delivery:	Weekly contact: 3 lectures/tutorials (x 10 weeks)		
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%		
Re-assessment pattern:	Oral Re-assessment, capped at grade 7		
Module teaching staff:	TBC		

