Doctor of Engineering in Photonics

http://www.idcphotonics.hw.ac.uk/

The DEng degree in Photonics is a 4-year course involving a blend of specialist postgraduate training in all aspects of photonics, tailored to the needs of the photonics industrial sector, and a significant, challenging and original research project undertaken as a partnership between industry and academia. Each research project provides experience in project management (including financial management) and teamwork as well as the opportunity to gain greater understanding of photonics and the business context in which the research is conducted. A significant proportion of the student's time (typically around 70%) is spent within the sponsoring company.

Graduates from the programme will have gained an in-depth understanding of the fundamental properties of photonic materials and practical experience of the technology and operation of a wide range of photonic devices. They will additionally have had extensive experience of research in an industrial environment and have received training in the transferable skills required in such an environment.

The course is organised jointly by Heriot-Watt, Glasgow, St Andrews, and Strathclyde universities. St Andrews will normally be the location for the start of the course and will provide full time teaching in photonics during the first semester of the first year of the course. Students then have a semester of electronic engineering theory and practice at Glasgow and Strathclyde Universities as additional preparation before embarking on their research. Details at:

http://www.idcphotonics.hw.ac.uk/sites/www.idcphotonics.hw.ac.uk/files/news/CDT%20Applied%20Photonics%20leaflet.pdf

PH5181 Photonics Laboratory is a compulsory module, and students then normally choose 45 credits from PH5015, PH5016, PH5180, PH5182. Students also take later in their programme modules amongst those taught by Heriot-Watt, Strathclyde, and Glasgow Universities, and PH5209 and PH5208 which are distance learning courses that may be taken from St Andrews.

Compulsory modules - Semester 1:

PH5181 Photonics Laboratory 1

SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	1
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. A formal lab report is included.				
Programme module type:	Compulsory for Photonics and Optoelectronic Devices Postgraduate Programmes and EngD Programme.			
Pre-requisite(s):	Admission to a Taught Postgraduate programme within the School.			
Learning and teaching methods and delivery:	**Weekly contact**: 3 x 2.5-hour practicals.			
Assessment pattern:	Coursework = 100%			
Module Co-ordinator:	Dr B D Sinclair			
Lecturer(s)/Tutor(s):	Dr B D Sinclair and others			

Optional modules - Semester 1:

PH5015 Applications of Quantum Physics				
SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	1
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.				
Programme module type:	Optional for Postgraduate programmes in the School			
Pre-requisite(s):	Relevant physics and mathematics			
Learning and teaching methods and delivery:	**Weekly contact**: 2 lectures (x 11 weeks) and a further 2 x 1-hour tutorials, 1 x 3-hour research lab visit, 3 hours student presentations during the semester.			
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%			
Module Co-ordinator:	Dr D Cassettari (TBC)			
Lecturer(s)/Tutor(s):	Dr D Cassettari, Dr M Mazilu (TBC)			

PH5016 Biophotonics				
SCOTCAT Credits:	15	SCQF Level 11	**Semester:**	1
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, 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.				
Programme module type:	Optional for Postgraduate programmes in the School. Optional for EngD Photonics Programm			
Pre-requisite(s):	Relevant physics and mathematics			
Learning and teaching methods and delivery:	**Weekly contact**: 3 lectures/tutorials.			
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%			
Module Co-ordinator:	Dr T Brown (TBC)			
Lecturer(s)/Tutor(s):	Dr T Brown, Prof M C Gather, Dr C Penedo-Esteiro (TBC)			

PH5180 Laser Physics

SCOTCAT Credits:	20	SCQF Level 11	**Semester:**	1
Planned timetable:	10.00 am Mon, Tue, Wed, Thu			
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.				
Programme module type:	Compulsory for Photonics and Optoelectronic Devices Postgraduate Programmes.			
Pre-requisite(s):	Admission to a Taught Postgraduate programme within the School.			
Learning and teaching methods and delivery:	**Weekly contact**: 4 lectures/tutorials each week.			
Assessment pattern:	2.5-hour open-notes Examination = 80%, Coursework = 20%			
Module Co-ordinator:	Dr B D Sinclair			
Lecturer(s)/Tutor(s):	Dr B D Sinclair, Dr C T A Brown, Dr L O'Faholain (TBC)			

PH5182 Displays and Nonlinear Optics

SCOTCAT Credits:	10	SCQF Level 11	**Semester:**	1
Planned timetable:	To be arranged.			
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.				
Programme module type:	Compulsory for Photonics and Optoelectronic Devices MSc Programmes.			
Pre-requisite(s):	Admission to a Taught Postgraduate programme within the School.			
Learning and teaching methods and delivery:	**Weekly contact**: 2 lectures and occasional tutorials.			
Assessment pattern:	2-hour Written Examination = 80%, Coursework = 20%			
Module Co-ordinator:	Prof I D W Samuel (TBC)			
Lecturer(s)/Tutor(s):	Prof I D W Samuel, Prof M H Dunn, Dr M Mazilu, Dr C F Rae (TBC)			

Optional modules - Distance Learning:

PH5208 Semiconductor Physics and Devices - Distance Learning				
SCOTCAT Credits:	10	SCQF Level 11	**Semester:**	1
Availability restrictions:	Distance Learning			
Planned timetable:	To be arranged.			
This is a distance-learning module covering the basic properties of semiconductor physics including their optical and electronic properties, and the low dimensional structures which may be constructed from them; and semiconductor devices ranging from pn junctions, solar cells, and LEDs to lasers, waveguides, optical amplifiers, optical modulators, and detectors.				
Programme module type:	Optional for Engineering Doctorate in Photonics Postgraduate Taught Programme. Postgraduate level module available on-line			
Pre-requisite(s):	Admission to a Postgraduate Programme involving the School			
Learning and teaching methods and delivery:	**Weekly contact**: Material, tutorial support, and continuous assessment delivered at a distance by means of Moodle. Students are responsible for ensuring they have internet access. The course covers material equivalent to that covered in 30 conventional lectures.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module Co-ordinator:	Prof G A Turnbull			
Lecturer(s)/Tutor(s):	Prof G A Turnbull			

PH5209 Polymers and Liquid Crystals for Displays - Distance Learning				
SCOTCAT Credits:	5	SCQF Level 11	**Semester:**	1
Availability restrictions:	Distance Learning			
Planned timetable:	To be arranged.			
This is a distance learning module covering the concepts of optoelectronic display devices, including semiconducting polymers, and the properties of liquid crystals.				
Programme module type:	Optional for Engineering Doctorate in Photonics Postgraduate Programme. Postgraduate level module available online			
Pre-requisite(s):	Admission to a Postgraduate Programme involving the School.			
Learning and teaching methods and delivery:	**Weekly contact**: Material, tutorial support, and Coursework delivered at a distance by means of the VLE. Students are responsible for ensuring they have internet access. The module covers material equivalent to that covered in 12 conventional lectures.			
Assessment pattern:	2-hour Written Examination = 60%, Coursework = 40%			
Module Co-ordinator:	Prof G A Turnbull			
Lecturer(s)/Tutor(s):	Prof G A Turnbull			