B28PO Photonics and Optics

**COURSE DETAILS**

**Course Code:** B28PO  
**Full Course Title:** Photonics and Optics  
**SCQF Level:** 8  
**SCAF Credits:** 15  
**Available as Elective:** No

**DELIVERY LEVEL**

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<th>Postgraduate Research:</th>
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**Additional Information:**

**COURSE AIMS**

To give a grounding in the technology of photonics and its applications

To provide an understanding of wave optics, including interference, coherence, diffraction

To provide an understanding of the physics behind the major photonics elements including polarisation, birefringence, and optical fibres

To provide an understanding of optics and simple optical systems.

**LEARNING OUTCOMES – SUBJECT MASTERY**

- Understanding of light as a wave and the relevance of this to optical effects such as interference and diffraction, and hence to lasers and optical fibres
- Students should be able to use mathematical methods to predict optical effects with e.g. light-matter interaction, interference, fibre optics, geometrical optics

**LEARNING OUTCOMES – PERSONAL ABILITIES**

- Students should develop abilities to:
  - critically evaluate a problem
  - plan and organise their work
  - review and evaluate academic materials
  - express and interpret physical data graphically
  - solve problems mathematically.

- Take an interest in current developments in, and applications of, physics; make critical and evaluative comment; understand that physics is a changing subject; think independently about the subject.

- Make effective use of online learning support materials; make effective use of the support of academic and tutorial support staff; organise their study time in a way that allows them to meet coursework submission
deadlines and prepare effectively for assessments

SYLLABUS

Photonics

- Waves: wave equation; spherical, plane waves; superposition
- Interference: double & multiple beam interference; interferometers (Michelson, Mach-Zehnder, Fabry-Perot); coherence
- Diffraction: Fraunhofer diffraction; diffraction gratings and resolving power
- Lasers: principles of operation (stimulated emission, resonators, population inversion and how to achieve it); properties of laser light
- Fibre optics: principles of optical waveguides (including fibre optics)- total internal reflection, modes; applications of fibre optics
- Applications of photonics: a number of applications will be explored, such as: optical data storage; laser ranging; laser processing of materials (welding, drilling, cutting, etc; optical telecommunications.
- Polarisation: Polarisers, waveplate, Birefringence

Optics

- Geometric optics:
  - Lenses and mirrors; thin lens equation; combinations of lenses; thick lenses and principal planes; aberrations.
  - Examples of imaging systems.

COURSE RELATIONSHIPS

N/A

LOCATION AND ASSESSMENT METHODS

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