MODULE SPECIFICATION

Module Title:	**Physics of Light**	**Level**:	4	**Credit Value**:	20

Module code:	ENG478	**Is this a new module?**	YES	**Code of module being replaced**:	

Cost Centre:	GAME	JACS3 **code**:	H680

Trimester(s) in which to be offered:	1, 2	**With effect from:**	September 17

School:	Applied Science, Computing & Engineering	**Module Leader:**	Dr A Osanlou

Scheduled learning and teaching hours	60 hrs
Guided independent study	140 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered	Core	Option
BEng (Hons) Opto Electronics and Holography	✓	☐
BEng (Hons) Aerospace and Modern Optics	✓	☐

Pre-requisites
None

Office use only
Initial approval February 17
APSC approval of modification Version 1
Have any derogations received Academic Board approval? Yes ✓ No ☐

Module Aims
To ensure the student will develop a clear understanding of optics and electromagnetic waves within the context of applied photonics and the physics of light, and be able to apply them to real-world situations in imaging and control

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Use a professional logbook to document experimental results. Write technical reports, documenting design and developed.	KS1	
		KS4	
		KS5	
2	Analyse and compare the performance of typical optical imaging system. Understand the associated principles, limitations and methodologies through analysis and prediction	KS3	
		KS6	
3	Illustrate knowledge of waves, optics and the associated principles	KS3	
		KS10	
4	Demonstrate knowledge of imaging, typical optical imaging systems, opto -electromechanical and control systems	KS3	
		KS10	
5	Use computer based methodologies and practical experiments to verify and assess predictions.	KS1	
		KS3	

Assessment:

Assessments One and Two
Multiple choice questions – Two 1-hour tests in the form of multiple choice questions will review the students understanding of the subject area, coving outcomes 3 and 4. May be carried out online.

Assessment Three
This is by means of an optical imaging assignment of students' choosing, to be agreed with their module leader. It covers outcome 1, 2 and 5. Students to create a portfolio: Producing their individual evidence of activity including key concepts. This evidence should be gathered throughout the duration of the module. The student will submit a report and give a summary presentation followed by challenging questions.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	3	Multiple Choice Questions	30	1 hour	N/A
2	4	Multiple Choice Questions	30	1 hour	N/A
3	1,2,5	Portfolio	40	N/A	2000

Learning and Teaching Strategies:

The student will:
- be taught through lectures, practical sessions and computer based exercises, tutorials and regular meetings with the module leader,
- have access to industrial standard computing software
- extensively use computer based learning materials and the university's Virtual Learning Environment (VLE)

Syllabus outline:

Electromagnetic waves and imaging: an overview

- **Waves:** Travelling waves. Complex representation. Electromagnetic spectrum.Acoustic waves. Amplitude and intensity
- **Fundamental optics:** Electricity and magnetism; Geometric optics; Lenses; When geometric optics goes wrong.
- **Interference and Coherence:** Oscillators and interference. Coherence and incoherence. Physical relationships: Acoustic constructive interference and destructive, Young's slits
- **Diffractions:** Interference from an extended source. Diffraction in parallel-plane geometry. Approximate forms. Two-dimensional diffraction. Can a lens perform a transform. Speckle patterns

- **Optical systems:** Modelling. Effect of apertures. Diffraction limited telescopes and microscopes
- **The human eye and colour vision:** Principle of operation. The retina and the space of possible colours. The colour space. The Commission Internationale de l'Elcairage (CIE) chromaticity diagram. Reflection profiling of layered media
- **Lasers :** The resonant optical cavity. Light amplification. Energy levels. Stimulated emission and population inversion. Other types of laser. Limitations: cavity modes and frequency range
- **Holography** :In-line; off-axis. Developments.Holographic optical elements
- **Microscopy:** Optical; Holographic
- **Control Systems:** Opto-electromechanical configuration. Micro systems. Nano systems. Silicon photonics

Bibliography:

Essential reading

Hecht, E.G. (2014), Optics. 4th ed. Harlow: Pearson Education Limited

Other indicative reading

Boas, M.L. (1983), Mathematical methods in physical sciences. New York: John Wiley and Sons Ltd

Blackledge, J. M. (2006), Digital Signal Processing. 2nd ed. Chichester: Harwood Publishing Ltd

Additional Key Website Reading:
http://www.ieee.org/index.html (Online resources from the IEEE)
IEEE Xplore Digital Library http://ieeexplore.ieee.org/Xplore/guesthome.jsp
IEEE, Monthly Journal;

Glyndwr University Research Centre for Applied Science Computing and Engineering:
https://www.glyndwr.ac.uk/en/OurResearch/Researchcentres/UniversityResearchCentreforAppliedScienceComputingandEngineering/centre%20for%20ultra-realistic%20imaging/FurtherReading/

Online resources from the IET:
http://www.theiet.org/
IET, Monthly Journal.