MODULE SPECIFICATION

Module Title:	**UAV Sensor Technology**	**Level**:	6	**Credit Value**:	20

Module code:	ENG689	**Is this a new module?**	YES	**Code of module being replaced**:	

Cost Centre:	GAME	**JACS3 code**:	H430

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

School:	Applied Science, Computing & Engineering	**Module Leader:**	R.Bolam

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) Drone Technology and Operations	✓	☐
BEng (Hons) Optoelectronics & 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 support the development of the student in the following areas: • To gain a knowledge of flight control and payload / mission sensor technology at a conceptual and working level. • To be able to specify and select a suitable sensor technology and sub-system components suitable to a particular UAV mission application. • To gain a knowledge of optical metrology, photogrammetry and 3D imaging techniques in the context of UAV operations.

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	Demonstrate an in-depth knowledge of flight control and payload / mission sensor technology at a conceptual and working level	KS1	KS5
		KS6	
2	Specify and select a suitable sensor technology and sub-system components suitable to a particular UAV mission application	KS1	KS4
		KS5	
3	Explain the concepts and do calculations relating to coherence, Lasers, IR and UV sensors and ultra-sonic transducer technologies	KS1	KS3
		KS10	
4	Explain the concepts and do calculations relating to digital images. Time-of-Flight imaging and stereo vision systems for depth perception and 3D imaging	KS3	KS6
		KS9	KS10

Derogations

A derogation from regulations has been approved for this programme which means that whilst the pass mark is 40% overall, each element of assessment (where there is more than one assessment) requires a minimum mark of 30%.

Assessment:

Assessment 1: A 2 hour formal examination including calculations, covering learning outcomes 1, 3, 4.
Assessment 2: An essay based on sensor technology and sub-system components suitable to a particular UAV mission application, covering learning outcome 2.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,3,4	Examination	60	2 Hours	
2	2	Essay	40		2,000

Learning and Teaching Strategies:

This module will be delivered as a series of lectures, and laboratory demonstrations. The student will also be required to undertake significant reading of metrology and sensor technology materials.

Syllabus outline:

Flight Control Sensors
The measurement of altitude, airspeed and ground speed using pitot-static sensors, radio transmissions and GPS. Inertial Measurement Units (IMU), magnetometers and Micro-Electro-Mechanical Systems (MEMS) technology. Limitations and comparisons of GPS and locally sensed positional data. Controlling positional path accuracy in waypoint flying. FPV flying, The concept of digital images. Time-of-Flight imaging and stereo vision systems for depth perception and 3D imaging. Use of telemetry for UAV systems and the integration of control and payload / mission data systems.

Payload / Mission Sensors
Data capture, logging and transmission systems. The electromagnetic spectrum, the concept of coherence, Lasers, IR and UV sensors and ultra-sonic transducer technologies. Optical measurement techniques: photography, holography, TV holography, Interferometry, LIDAR systems, LASER triangulation and commercially available 3D imaging software.

Bibliography:
Essential reading
Zhang,S. (2013) *Handbook of 3D Machine Vision: Optical Metrology and Imaging (Series in Optics and Optoelectronics).*CRC Press.
Other indicative reading
Gonzalez,R.C. Woods, R.E.(2008) *Digital Image processing,3rd Edition.* Pearson.