**MODULE SPECIFICATION**

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| **Module Code:** | ENG764 |

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| **Module Title:** | UAS Sensor Technology |

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| **Level:** | 7 | **Credit Value:** | 20 |

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| **Cost Centre(s):** | GAME | JACS3 **code**: | H430 |

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

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| Scheduled learning and teaching hours | 40 hrs |
| Guided independent study | 160 hrs |
| Placement | 0 hrs |
| **Module duration (total hours)** | 200 hrs |

| **Programme(s) in which to be offered (not including exit awards)** | Core | Option |
|---|---|---|
| MSc Unmanned Aircraft System Technology | ✓ | ☐ |
| | ☐ | ☐ |
| | ☐ | ☐ |

| **Pre-requisites** |
|---|
| N/A |

**Office use only**
Initial approval: 19/06/2018 Version no:2
With effect from: 01/09/2018
Date and details of revision: Version no:

**Module Aims**

- 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

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|---|---|
| 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 a conceptual understanding of flight control and payload / mission sensor technology and be able to critically evaluate current research and advanced scholarship in this area. | KS1 | KS3 |
| | | KS5 | KS10 |
| | | KS6 | |
| 2 | Deal with the complex issues associated with the specification and selection of suitable sensor technologies and sub-system components for a particular UAV mission application. | KS1 | KS3 |
| | | KS4 | KS10 |
| | | KS5 | |
| 3 | Demonstrate a comprehensive understanding of the techniques required to make calculations relating to coherence, Lasers, IR and UV sensors and ultra-sonic transducer technologies. | KS1 | KS4 |
| | | KS3 | KS8 |
| | | KS10 | |
| 4 | Evaluate the methodologies and develop critiques relating to digital images. Time-of-Flight imaging and stereo vision systems for depth perception and 3D imaging. | KS3 | KS4 |
| | | KS6 | KS8 |
| | | KS9 | KS10 |

**Transferable skills and other attributes**

1. Communication
2. ICT Technologies
3. Time management and organisation
4. Interpersonal skills
5. Problem solving
6. Information handling including numeracy

**Derogations**

Credits shall be awarded by an assessment board for those Level 7 modules in which an overall mark of at least 50% has been achieved with a minimum mark of 40% in each assessment element.

**Assessment:**

Indicative Assessment Tasks:

Assessment 1: An examination covering learning outcomes 1, 2 and 3.

Assessment 2: An essay critically evaluating methodologies relating to digital images. Time-of-Flight imaging, stereo vision systems for depth perception and 3D imaging.

| Assessment number | Learning Outcomes to be met | Type of assessment | Weighting (%) | Duration (if exam) | Word count (or equivalent if appropriate) |
|---|---|---|---|---|---|
| 1 | 1,2,3 | Examination | 50 | 2 Hours | |
| 2 | 4 | Essay | 50 | | 2,500 |

**Learning and Teaching Strategies:**

The module will be delivered through lectures, tutorials and student-driven investigative work assisted by the use of computer based design and simulation software such as MATLAB and SIMULINK. Relevant video material and practical demonstrations will be used to strengthen topics from within the module.

**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 applications of commercially available 3D imaging software.

**Indicative 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.<br><br>De Silva,W.D. (2016) *Sensor Systems: Fundamentals and Applications*. CRC Press.<br><br>Vepa, R. (2016) *Nonlinear Control of Robots and Unmanned Aerial Vehicles: An Integrated Approach*.CRC Press |