MODULE SPECIFICATION

Module Code:	ENG772

Module Title:	UAS Technology and Applications

Level:	7	**Credit Value:**	20

Cost Centre(s):	GAME	JACS3 **code**:	H400

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

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:
With effect from: 01/09/2018
Date and details of revision: Version no:

Module Aims

To support the development of the student in the following areas:

- To apply advanced modelling and analysis to the solution of drone technology related problems.
- To be able to specify, select and assemble flight and payload components and sub-systems suitable to an advanced UAV application.
- Demonstrate a proficiency in the skills required to safely operate a UAS.

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 a comprehensive understanding of the technology and terminology relating to the component elements of an unmanned aircraft system.	KS1	KS3
		KS4	KS10
		KS6	
2	Critically analyse the airworthiness of a UAS, considering the role, limitations and purpose of the components that comprise a UAS.	KS1	KS3
		KS4	KS10
		KS5	
3	Analyse the flight stability, control, power and associated operational parameters required to conduct an advanced UAS mission.	KS3	KS3
		KS4	KS10
		KS10	
4	Demonstrate a systematic understanding of the knowledge and a critical awareness of the current problems associated with the successful and safe conduct of a drone mission.	KS1	KS2
		KS3	KS7
		KS1	KS3

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: The coursework shall comprise a series of tasks relating to the technology associated with component elements of UAS and a series of flight tests during which the student will demonstrate correct pre and post flight preparation (including mission planning documentation) and practical drone piloting skills with and without GNSS assisted flight modes.

Assessment 2: Report shall be based on computerised simulation and analysis of UAS flight stability and control or a critical investigation into UAS design for airworthiness using approved safety analyses techniques.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,4	Coursework	50		2500
2	2,3	Report	50		2500

Learning and Teaching Strategies:

The module will be taught with lectures, laboratory and workshop sessions, actual and simulated flight exercises including, team exercises, mock missions and mission planning using way-point flying techniques. Also the use of computer modelling software such as MATLAB, SIMULINK and ANSYS.

Syllabus outline:

UAV System Technology

The anatomy of a drone. Types of drones: fixed wing and multi-rotor designs. Aerodynamics. Power storage and Propulsion systems. Control technology: Transmitters and Receivers, Flight Controllers, auto-pilots. Operational and performance envelopes. GPS, Inertial Navigation Systems. Gyro stabilisation and gain selection. UAS flight stability and control theory.

UAS Design for Airworthiness

The meaning and importance of airworthiness, reliability and maintenance procedures to a UAS design. An overview of airworthiness legislation for manned flight and its relevance to UAS. Reliability analyses: Functional Hazard Assessments, Failure Mode Effect Analyses, Fault Tree and Markov Analyses, UAS Inspection, Safety Studies and the design for redundancy and dormant failure modes. UAS maintenance procedures and Failsafe provisions.

Payload Technology
Payload centre of gravity, freight conveyancing techniques, camera technology, video storage, Real-time video transmission systems. Photographic equipment capabilities and limitations.

Drone Operations
Mission planning and Risk Assessment for safe drone operation. UK Airspace operating principles. Airmanship and aviation safety. Navigation and charts. Waypoint flying and associated software systems. Practical flying exercises both simulated and real.

Indicative Bibliography:

Essential reading

Elliott, A. (2016) *Build Your Own Drone Manual. The Practical Guide to Safely Building, Operating and maintaining an Unmanned Aerial Vehicle (UAV)*. Haynes.

Other indicative reading

Garner,W.B (2009) *Model Airplane Propellers.* DCRC Club Newsletter, Vol 55, Issue 4/5.
Juniper, A. (2015) *The Complete Guide to Drones.* Octopus Publishing Group
Austin, R. (2010) *Unmanned Aircraft Systems: UAVs Design, Development and Deployment*. Wiley-Blackwell.
Marshall,D.M., Barnhart,R.K.,Shappee,E.,Most,M.T.(2016) *Introduction to Unmanned Aircraft Systems, Second Edition*. CRC Press.