MODULE SPECIFICATION

Module Code:	ENG763

Module Title:	UAV Construction

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:2
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 gain an advanced knowledge of drone technology at a conceptual and working level.
- To be able to specify, select and assemble flight and payload components and sub-systems suitable to a particular UAV application.
- To acquire the skills required to safely operate a drone.

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 techniques required to build a fully functional bespoke UAV or from a commercially available kit. Also demonstrate the ability to continue to advance their knowledge and understanding and develop new skills in drone construction to a high level.	KS1 KS2 KS3	KS4
2	Critically evaluate current research and advanced scholarship and produce formal technical records or logs which could be used as a basis for a maintenance manual or similar document for UAS management.	KS1 KS4 KS5	KS3
3	Demonstrate self-direction and originality in tackling and solving drone application, design and construction related problems such as UAV airframe or systems design, stability and control, controller programming, sensor installation or other operational applications of payload technologies. And be able to prepare and test all sub-systems in a safe and effective manner.	KS4 KS6 KS9	 KS10
4	Prepare and execute a safe and successful test flight of a UAV system. Deal with complex UAS operational issues and communicate conclusions clearly to specialist and non-specialist audiences.	KS2 KS5 KS1	 KS7 KS4

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: Journals of the UAV construction project should be submitted by the student on a weekly basis. These will be regularly assessed and graded with feedback informing the student on any areas that may be improved.

Assessment 2: A Practical assessment involving a pre-planned and documented functional check and Test Flight of the students own aspect of a UAS design and build.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1,2,3	Learning logs/journals	50		2500
2	4	Practical	50	I hour.	1000

Learning and Teaching Strategies:

The module will be taught with lectures, laboratory and some workshop demonstration sessions. However, the majority of the module will be delivered by supervised hands-on drone construction sessions in the Mechatronics Laboratory. There will also be some practical flight test exercises conducted prior to the inaugural flight testing.

Syllabus outline:

The module shall be centred on the supervised design and construction of a bespoke drone or alternatively the assembly and commissioning of a commercially available UAV kit. An example of a group UAV system design and build would be the manufacture of a bespoke drone, during which individual students would be allocated a particular aspect of the drone airframe or systems to design and build. However, the commercial UAV kit build may be more suitable for those students wishing to concentrate on implicational aspects of drone

technology for example, UAV stability and control, controller programming, sensor installation or other operational applications of payload technologies.

Lectures shall cover drone aerodynamics, airframe design theory, propeller performance and lift generating surfaces of fixed wing drones. Additionally there shall be lectures on airframe materials such as: aluminium alloys; titanium, composites and plastics and their forming, joining, finishing, inspection and repair techniques.

Instruction shall be given to the students so that they acquire the essential skills required during the construction process. Such as: soldering power systems, assembling the airframe, installing the power system components (Electronic Speed Controllers and motors etc.) installing the Receiver, Flight Control systems, Compass and GPS Navigation equipment. Use of rapid prototyping and laser cutting equipment.

At a suitable point during the construction programme a lecture shall be given on programing of the UAV's systems and Failsafe features. The student shall also be taught current practice with regard to firmware updating policies.

On completion of the UAV component build the student shall program the basic systems such as: the flight controller (including) PID gain settings; calibration of the ESCs; the control transmitter (including receiver binding), and the GPS system using industry standard software including any firmware updates.

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

Juniper, A. (2015) *The Complete Guide to Drones.* Octopus Publishing Group

Austin, R. (2010) *Unmanned Aircraft Systems: UAVs Design, Development and Deployment*. Wiley-Blackwell.

Marques,P. and Da ronch, A. (2017) *Advanced UAV Aerodynamics, Flight Stability and Control*. Wiley-Blackwell