Module Descriptor

Title	Advanced Drone Systems Integration and Design		
Session	2024/25	**Status**	Published
Code	COMP11136	**SCQF Level**	11
Credit Points	10	**ECTS (European Credit Transfer Scheme)**	5
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	J Riordan		

Summary of Module

In this module, students will work collaboratively to propose a new drone-based service, developing a comprehensive system specification for its implementation.

This module delves into the complexities of advanced drone systems, focusing on the integration and design of drone components and their interactions. Students will explore cutting-edge developments in drone technology, including motor and flight control systems, navigation aids, connectivity, sensing, and power management. Through hands-on laboratory sessions and project based system integration tasks using a drone development kit, students will gain practical experience in designing and optimising drone systems.

The group project will require students to apply their technical knowledge of drone systems to design an optimal drone platform tailored to specific real-world applications. Students will also critically evaluate emerging drone technologies and consider market, regulatory, and operational constraints in their designs. Through this process, students will develop key skills in teamwork, project management, and communication, with individual contributions assessed through a reflective report on their specific roles in the project.

The module emphasises the application of theoretical concepts to real-world scenarios, enabling students to critically evaluate emerging technologies and develop bespoke solutions for new and evolving use cases in the drone industry.

The module will cover:

- Overview of drone system components and integration
- Airspace management, deconfliction, Unmanned Traffic Management (UTM), and detect-and-avoid systems
- Motor control systems and flight dynamics integration
- Navigation and communication systems design
- Power management systems and optimisation for drone operations

Universal

Critical Thinker: Students will enhance their ability to critically evaluate emerging technologies, perform trade-off analyses, and make informed decisions regarding system design and optimisation.

Collaborative: Students will work closely with peers to solve complex integration challenges, improving their ability to contribute effectively to team-based projects.

Work-Ready

Problem-Solver: By engaging in practical tasks that involve troubleshooting, optimisation, and developing bespoke solutions, students will be well-prepared for real-world challenges in the drone industry.

Digitally Literate: Mastery of the tools and technologies necessary for drone system integration, including the use of a drone development kit, will ensure students are proficient in the digital skills required for modern engineering roles.

Successful

Autonomous: The module encourages students to take ownership of their learning through independent contributions to group projects, where they must manage and integrate various system components.

Innovative: Students will be challenged to think creatively and develop new solutions for emerging and evolving applications in the drone industry.

Module Delivery Method	**On-Campus**[1] ☒	**Hybrid**[2] ☒	**Online**[3] ☐	**Work -Based Learning**[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☒ Lanarkshire ☐ London ☐ Paisley	☒ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	☒	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Understand the principles and methodologies for integrating and designing advanced drone systems.

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

L2	Apply practical skills to design, develop, and optimise drone systems for specific applications.
L3	Critically evaluate emerging technologies and develop bespoke solutions for drone systems.
L4	Demonstrate proficiency in using a drone development kit for system integration projects.
L5	Document and present drone system integration processes and outcomes clearly and effectively, while leading and managing system integration projects with accountability.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	**During completion of this module, there will be an opportunity to achieve core skills in:**
Knowledge and Understanding (K and U)	**SCQF 11** Demonstrate advanced understanding of theoretical foundations and methodologies of artificial intelligence and computer vision, including image processing techniques, machine learning frameworks, and state-of-the-art deep learning models. Critically analyse and evaluate complex AI and machine techniques for drone perception and their application in enhancing drone capabilities for real-time perception and decision-making.
Practice: Applied Knowledge and Understanding	**SCQF 11** Apply advanced image processing and machine learning techniques, such as object detection, image segmentation, and scene understanding, to implement and integrate computer vision and AI into functional drone systems. Utilise standard machine learning frameworks and tools to design, train, and evaluate perception models and demonstrate proficiency in using contemporary ML frameworks (TensorFlow, Keras, PyTorch) to develop, benchmark, and optimise specific drone-related perception tasks. Plan and execute projects that involve addressing challenges such as trustworthy artificial intelligence.
Generic Cognitive skills	**SCQF 11** Critical evaluation and synthesis of current research and emerging technologies in AI and computer vision, contributing to innovative solutions for autonomous drone applications. Demonstrate originality and creativity in developing intelligent perception systems and solving complex problems in advanced drone technology.
Communication, ICT and Numeracy Skills	**SCQF 11** Communicate complex technical information effectively and present their project findings, technical analyses, and research in a clear and coherent manner, demonstrating their ability to convey complex ideas to both technical and non-technical audiences. Utilise advanced ICT tools for data analysis and model development by leveraging advanced toolchains and programming environments to perform in-depth data analysis, model development, and performance

	evaluation, ensuring the effective application of theoretical knowledge in practical scenarios.
Autonomy, Accountability and Working with Others	**SCQF 11** Manage and lead independent research projects with professional accountability demonstrating responsibility and professional accountability in delivering high-quality technical and literature reviews. Collaborate effectively in team-based laboratory and field environments, contributing to collective problem-solving and decision-making processes while demonstrating effective teamwork and communication skills.

Prerequisites	**Module Code**	**Module Title**
	Other	
Co-requisites	**Module Code**	**Module Title**

Learning and Teaching	
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Laboratory / Practical Demonstration / Workshop	24
Asynchronous Class Activity	24
Independent Study	28
Please select	
Please select	
TOTAL	100

Indicative Resources
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: Study materials will be provided on AULA.
(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time. **For the purposes of this module, academic engagement equates to the following:** Attending all timetabled synchronous classes and engagement with asynchronous learning activities and resources.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. Aligned with the overall commitment to equality and diversity stated in the Programme Specifications, the module supports equality of opportunity for students from all backgrounds and with different learning needs. Using our VLE, learning materials will be presented electronically in formats that allow flexible access and manipulation of content (part-time and distant learning students should check with their programme leader for any queries). The module complies with University regulations and guidance on inclusive learning and teaching practice. Specialist assistive equipment, support provision and adjustments to assessment practice will be made in accordance with UWS policy and regulations.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	**Computing**
Overall Assessment Results	☐ **Pass / Fail** ☒ **Graded**
Module Eligible for Compensation	☐ **Yes** ☐ **No** **If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.**
School Assessment Board	Business and Applied Computing
Moderator	tbc
External Examiner	tbc
Accreditation Details	
Module Appears in CPD catalogue	☐ **Yes** ☐ **No**
Changes / Version Number	1.0

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Group Project Drone Service Proposal and Specification (100%)

The group will collaboratively propose a new commercial or public service that leverages drone technology. This assessment will include both a group component and individual contributions, ensuring that both teamwork and individual expertise are demonstrated.

Group Component (70%):

Service Proposal: A detailed description of the proposed drone service, including target market, use cases, operational considerations, and benefits.

Drone Specification: A comprehensive technical specification for the drone system required to deliver the service, addressing:

- Drone design (size, weight, endurance, payload).
- Required sensors and onboard systems (e.g., LiDAR, cameras, AI-based systems).
- Power systems, communication, and navigation systems.
- Operational constraints (flight range, environmental conditions).

Feasibility Analysis: A justification of the drone design, explaining how the proposed system meets operational, technical, and market requirements.

Presentation: The group will present the service proposal and drone specification, with each member responsible for explaining their contribution.

Individual Contribution (30%):

Each student will contribute to a specific aspect of the drone specification (e.g., sensor integration, power systems, flight control) and document their individual role in both the report and the presentation.

Assessment 2

Assessment 3

(N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.

(ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Component 1

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
Group Project	☒	☒	☒	☒	☒	100	2

Component 2

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
	☐	☐	☐	☐	☐		

Component 3

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
	☐	☐	☐	☐	☐		
Combined total for all components						100%	2 hours

Change Control

What	When	Who