Module Descriptor

Title	Remote Sensing and Data Analysis		
Session	2024/25	**Status**	Published
Code	COMP11131	**SCQF Level**	11
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	J Riordan		

Summary of Module

This module provides a comprehensive introduction to remote sensing and data analysis using drones, with a focus on real-world applications in precision agriculture, environmental monitoring, construction, and infrastructure assessment. Students will learn the complete workflow of drone-based data acquisition, processing, and visualisation, equipping them with the skills needed to handle and analyse complex datasets.

The module emphasises practical, hands-on learning, utilising professional software tools and Python programming for data processing and analysis. Students will be guided through the basics of Python, making the module accessible even to those without prior programming experience. The course will also explore emerging technologies such as machine learning applications in remote sensing and data fusion techniques, preparing students to innovate and adapt to the rapidly evolving field of geospatial analysis.

The assessment comprises an individual project and a group project, where students develop tools for real-world data analysis problems.

The module will cover:

- Remote sensing principles and applications
- Drone sensors and data capture techniques
- Python programming for data analysis and processing
- Structure from Motion (SfM) and 3D reconstruction
- Photogrammetry and orthophoto-mosaic generation
- Machine learning for remote sensing and classification
- Object detection and segmentation using deep learning
- Data fusion and advanced visualisation techniques
- Real-world case studies

This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module:

Universal

- Critical Thinker: Students will develop the ability to critically evaluate and synthesize information from various sources, including sensor data and machine learning models, to solve complex problems in remote sensing and data analysis.

Work-Ready

- Digitally Literate: This module will equip students with advanced digital skills, particularly in Python programming, data processing, and the use of specialized remote sensing software. These skills are crucial for their future careers in fields like geospatial analysis, environmental monitoring, and engineering.

Successful

- Innovative: By engaging in project-based learning and tackling real-world problems, students will be encouraged to think creatively and develop innovative solutions in the field of remote sensing. The module promotes autonomy and accountability in managing projects, pushing students to be resilient and adaptable in their approach to new challenges.

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 and apply the fundamental principles of remote sensing, including the operation of various mapping and imaging sensors and the use of reconstruction techniques (e.g., Structure from Motion) to produce accurate georeferenced datasets.
L2	Develop and utilise Python programming skills to analyse, process, and visualise remote sensing data, including the integration of multiple datasets and the application of machine learning models for data classification and object detection.

[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

L3	Critically evaluate and solve complex remote sensing challenges by integrating theoretical knowledge with practical project management, culminating in the development, presentation, and peer review of a comprehensive remote sensing project.
L4	
L5	

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 an in-depth understanding of the core principles and technologies in remote sensing, including the physics of data acquisition via drones and the technical specifications that influence spatial resolution and accuracy. Critically analyse the integration of different sensor modalities and techniques in practical applications, evaluating their suitability and effectiveness in engineering contexts such as infrastructure monitoring, environmental assessment, and urban planning.
Practice: Applied Knowledge and Understanding	**SCQF 11** Utilize a comprehensive range of specialised software and engineering tools for processing and analysing complex drone-captured datasets and produce high-quality outputs that meet professional standards. Develop and implement innovative solutions to technical challenges in data processing, employing advanced programming skills and engineering methodologies to enhance the interpretation of drone-captured data.
Generic Cognitive skills	**SCQF 11** Critically evaluate complex engineering problems related to remote sensing data, including error analysis and data integrity issues, and propose scientifically and technically sound solutions. Demonstrate creativity and innovation in developing new methodologies or improving existing processes in remote sensing and data analysis, contributing to advancements in engineering practices and technologies.
Communication, ICT and Numeracy Skills	**SCQF 11** Communicate complex engineering concepts and analytical results clearly and effectively to both technical and non-technical audiences, using appropriate formats such as technical reports, presentations, and visualisations. Exhibit advanced proficiency in using ICT tools relevant to engineering and remote sensing, including specialised software for data processing and analysis, as well as programming skills for developing custom solutions.
Autonomy, Accountability and Working with Others	**SCQF 11** Demonstrate the ability to undertake and lead independent engineering research or project work, including the design, implementation, and

	evaluation of remote sensing systems, while adhering to ethical standards and professional practices

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	128
Please select	
Please select	
TOTAL	200

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. Learn Python 3 the Hard Way: A Very Simple Introduction to the Terrifyingly Beautiful World of Computers and Code (Zed Shaw's Hard Way Series). Publisher ： Addison-Wesley Professional; 4th edition (27 Jun. 2017) ISBN-10 ： 0134692888 ISBN-13 ： 978-0134692883 Online Resources and Tutorials: Pix4D Academy, Agisoft Metashape Documentation, Open3D Library Documentation
(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 & 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
Individual Project with Portfolio of Lab Reports (60%) Students will compile a series of lab reports documenting their work throughout the module. These reports will include tasks such as data capture, sensor integration, photogrammetry, Python programming, and basic machine learning applications. The individual project will integrate the lab-based tasks

throughout the term. Students will submit a comprehensive project report, showcasing their ability to collect, process, and analyse remote sensing data.

Learning Outcomes Assessed:

LO1: Understand and apply the fundamental principles of remote sensing, including the operation of various drone sensors and the use of photogrammetry techniques.

LO2: Develop and utilise Python programming skills to analyse, process, and visualise remote sensing data.

LO3: Critically evaluate and solve complex remote sensing challenges by integrating theoretical knowledge with practical project management, culminating in the development, presentation, and peer review of a comprehensive remote sensing project.

Assessment 2

Group Project - Data Integration and Analysis (40%) A group project that integrates and extends the individual projects leading to a final report and group presentation. Students will collaboratively produce a final report and presentation to demonstrate the tools or models they have developed.

Learning Outcomes Assessed:

LO1: Understand and apply the fundamental principles of remote sensing, including the operation of various drone sensors and the use of photogrammetry techniques.

LO2: Develop and utilise Python programming skills to analyse, process, and visualise remote sensing data.

LO3: Critically evaluate and solve complex remote sensing challenges by integrating theoretical knowledge with practical project management, culminating in the development, presentation, and peer review of a comprehensive remote sensing project.

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
Individual Project with Portfolio of Lab Reports	☒	☒	☒	☐	☐	60	2

Component 2

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
Data Integration and Analysis	☒	☒	☒	☐	☐	40	2

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	4 hours

Change Control

What	When	Who