## University of the West of Scotland

## Module Descriptor

**Session: 2024/25**

| **Title of Module: Aerothermodynamics & Aircraft Propulsion** | | | |
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| **Code: ENGG08029** | **SCQF Level: 8 (Scottish Credit and Qualifications Framework)** | **Credit Points: 20** | **ECTS: 10 (European Credit Transfer Scheme)** |
| **School:** | School of Computing Engineering and Physical Sciences | | |
| **Module Co-ordinator:** | Dr Noorfazreena Kamaruddin | | |

**Summary of Module**

This module is designed to provide students with an understanding in the topics of thermodynamics, propulsion, and heat transfer within the context of aircraft systems. The module aims to show the importance of thermodynamics and heat transfer in the design/analysis of aircraft systems, with focus placed on aircraft propulsion systems.

Outcome 1 is intended to develop the student's understanding of key concepts in thermodynamics, including the first and second laws of thermodynamics, and the use of steam tables. Students will apply their understanding to analyse thermodynamic systems relevant to aircraft propulsion, such as compressors, turbines, and nozzles.

Outcome 2 is intended to provide the student with an understanding of the thermodynamics of gas turbine aircraft propulsion. The Brayton cycle will be analysed in detail.

Outcome 3 is intended to provide the student with an understanding of jet engine performance. The performance of turbojet, turbofan and turboprop engines will be examined, including estimation of key performance characteristics such as thrust.

Outcome 4 is intended to provide the student with an understanding of key concepts in heat transfer. Students will apply their understanding to analyse heat conduction and convection problems relevant to aircraft systems.

By undertaking this module, students will have the opportunity to develop their UWS Graduate Attributes (https://www.uws.ac.uk/current-students/your-graduate- attributes/ ), including critical thinking, problem solving, effective communication, autonomy and creativity.

**Module Delivery Method**

| **Face-To-Face** | **Blended** | **Fully Online** | **HybridC** | **Hybrid 0** | **Work-Based Learning** |
|---|---|---|---|---|---|
| ☒ | ☐ | ☐ | ☐ | ☐ | ☐ |

**See Guidance Note for details.**

| **Campus(es) for Module Delivery** | | | | | | |
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| The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate) | | | | | | |
| Paisley: | Ayr: | Dumfries: | Lanarkshire: | London: | Distance/Online Learning: | Other: |
| ☒ | ☐ | ☐ | ☐ | ☐ | ☐ | |

| **Term(s) for Module Delivery** | | | | | |
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| (Provided viable student numbers permit). | | | | | |
| Term 1 | ☐ | Term 2 | ☒ | Term 3 | ☐ |

| **Learning Outcomes: (maximum of 5 statements)**<br>At the end of this module the student will be able to: | |
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| L1 | Analyse thermodynamics problems relevant to mechanical and aircraft systems, including the use of tabulated data. |
| L2 | Solve problems in gas turbine thermodynamics. |
| L3 | Analyse and predict jet engine performance, and the role this plays in aircraft performance and design. |
| L4 | Analyse heat transfer problems relevant to mechanical and aircraft systems. |

| **Employability Skills and Personal Development Planning (PDP) Skills** | |
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| **SCQF Headings** | During completion of this module, there will be an opportunity to achieve core skills in: |
| Knowledge and Understanding (K and U) | SCQF Level **8**<br>Demonstrating a broad and integrated knowledge and understanding of the main areas of thermodynamics and heat transfer, and their importance for aircraft systems.<br><br>Demonstrating a critical understanding of a selection of principal theories, principles, concepts and terminology. |
| Practice: Applied Knowledge and Understanding | SCQF Level **8**<br>Use a selection of the principal skills, techniques, practices and/or materials associated with engineering and industrial tasks. |

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| | Practice routine searches for thermophysical data of fluids. | |
| Generic Cognitive skills | SCQF Level **8**<br><br>Be able to compare suggested solutions with expected values. | |
| Communication, ICT and Numeracy Skills | SCQF Level **8**<br><br>The ability to report in writing and orally on experimental findings.<br><br>Use a range of IT applications to facilitate calculations and provision of report and presentations.<br>Interpret and evaluate numerical and graphical data and use it to design and analyse equipment and systems. | |
| Autonomy, Accountability and Working with others | SCQF Level **8**<br><br>Take some responsibility for use of appropriate data resources.<br><br>Practice in ways which take account of own role and responsibilities.<br><br>Work under guidance with qualified practitioners. | |
| **Pre-requisites:** | Before undertaking this module the student should have undertaken the following: | |
| | **Module Code:**<br>ENGG07002 | **Module Title:**<br>Applied Engineering Science |
| | **Other:** | |
| **Co-requisites** | **Module Code:** | **Module Title:** |

*Indicates that module descriptor is not published.

| **Learning and Teaching** | |
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| The learning and teaching activity for this module include lectures, tutorials and problem based learning. | |
| **Learning Activities**<br>During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | **Student Learning Hours**<br>(Normally totalling 200 hours):<br>(Note: Learning hours |

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| | include both contact hours and hours spent on other learning activities) |
| Lecture/Core Content Delivery | 18 |
| Tutorial/Synchronous Support Activity | 18 |
| Laboratory | 3 |
| Independent Study | 161 |
| | Hours Total 200 |

| ****Indicative Resources: (eg. Core text, journals, internet access)** |
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| The following materials form essential underpinning for the module content and ultimately for the learning outcomes:<br><br>Access to appropriate laboratories.<br><br>Course notes and presentations will be provided. Texts:<br><br>Cengel, Y. A, J M Combala and R H Turner, Fundamentals of Thermal-Fluid Science, McGraw-Hill, 4th Edition, 2012<br><br>Dunn, D J, Fundamental Engineering Thermodynamics, Longman, 2001<br><br>Cengel, Y A and M A Boles, Thermodynamics: An Engineering Approach, McGraw-Hill, 7th Edition, 2010<br><br>Moran, M J et al, Principles of Engineering thermodynamics, John Wiley & Sons, 7th Edition, 2011<br><br>Eastop T D and McConkey A, Applied Thermodynamics for Engineering Technologies. 5th edition, Prentice Hall. 1993<br><br>Flack R D, Fundamentals of Jet Propulsion with Applications, 1st edition, Cambridge University Press, 2005<br><br>Rogers G F C and Mayhew Y R, 1992, Engineering Thermodynamics, Work and Heat Transfer, 4th edition, Longman, 1992<br><br>Frank P, Introduction to Heat Transfer, John Wiley, 5th edition, 2007 |
| (**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** |

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| 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. |

| **Equality and Diversity** |
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| The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. |
| (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

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| **Divisional Programme Board** | Engineering and Physical Sciences |
| **Assessment Results (Pass/Fail)** | Yes ☐No ☒ |
| **School Assessment Board** | Engineering |
| **Moderator** | Tony Leslie |
| **External Examiner** | E Tingas |
| **Accreditation Details** | This module is part of the IMechE accredited programmes BEng/Meng (Hons) Aircraft Engineering |
| **Changes/Version Number** | Module name changed to " Aerothermodynamics & Aircraft Propulsion " to modernise the title and reflect industry descriptions of this content.<br><br>Module Coordinator changed to Dr Noorfazreena Kamaruddin from Stephanie Docherty.<br>Module<br><br>Delivery Changed to Face-To-Face from Hybrid C.<br><br>Assessment text changed to reflect a consistency within the programmme.<br><br>Assessment weightings changed to reflect a more consistent programme assessment weightings. |

| **Assessment: (also refer to Assessment Outcomes Grids below)** |
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| Formative assessment will be provided in the form of class quizzes and |

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| example problems during tutorial sessions and as part of preparation for written submissions.<br><br>Summative assessment will be in the form of one end of term an Unseen Closed Book Class Test; one case study; and a thermodynamics laboratory. A minimum overall 40% is required to achieve a pass in this module.<br><br>Summative Assessment Category 1:<br><br>Component 1 – Unseen Closed Book Class Test - 60% of the final mark. |
| Component 2 – Laboratory (15%) & Case Study (25%) |
| (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.<br>(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.) |

**Assessment Outcome Grids (See Guidance Note)**

| **Component 1** | | | | | | |
|---|---|---|---|---|---|---|
| **Assessment Type (Footnote B.)** | **Learning Outcome (1)** | **Learning Outcome (2)** | **Learning Outcome (3)** | **Learning Outcome (4)** | **Weighting (%) of Assessment Element** | **Timetabled Contact Hours** |
| Unseen Closed Book Class test (written) | ✓ | ✓ | ✓ | ✓ | 60 | 2 |

| **Component 2** | | | | | | |
|---|---|---|---|---|---|---|
| **Assessment Type (Footnote B.)** | **Learning Outcome (1)** | **Learning Outcome (2)** | **Learning Outcome (3)** | **Learning Outcome (4)** | **Weighting (%) of Assessment Element** | **Timetabled Contact Hours** |
| Case Study | | | ✓ | | 25 | |
| Laboratory/ Clinical/ | | ✓ | | | 15 | 2 |

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|---|---|---|---|---|---|---|
| Field notebook | | | | | | |
| **Combined Total for All Components** | | | | | **100%** | **4 hours** |