Prifysgol Wrecsam
Wrexham University

Module specification

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Module Code	ENG5C6
Module Title	Applied Thermofluids and Propulsion
Level	5
Credit value	20
Faculty	FACE
HECoS Code	100115
Cost Code	GAME
Pre-requisite module	N/A

Programmes in which module to be offered

Programme title	Core/Optional/Standalone
BEng (Hons) Aerospace Engineering	Core

Breakdown of module hours

Learning and teaching hours	24 hrs
Placement tutor support hours	0 hrs
Supervised learning hours e.g. practical classes, workshops	24 hrs
Project supervision hours	0 hrs
Active learning and teaching hours total	**48 hrs**
Placement hours	0 hrs
Guided independent study hours	152 hrs
Module duration (Total hours)	**200 hrs**

Module aims

This module develops applied understanding through a balance of theory and practice. Learners undertake both classroom study and supervised practical activity to explore design, implementation, and evaluation processes. Collaborative work and enquiry-based learning foster communication, teamwork, and the confidence to apply problem-solving techniques in varied contexts.

This module aims to develop students' understanding of thermofluidic principles and their application within aerospace propulsion systems. Students will analyse and evaluate the thermodynamics, fluid mechanics, and heat transfer processes that govern the performance, efficiency, and operational behaviour of gas turbine and rocket propulsion systems in an aerospace engineering context.

Module Learning Outcomes

At the end of this module, students will be able to:

1	Apply principles of thermodynamics, fluid mechanics, and heat transfer to analyse aerospace propulsion systems, evaluating engine performance and efficiency under a range of operating conditions.
2	Analyse and interpret thermofluidic behaviour within propulsion system components, using appropriate analytical methods and assumptions to assess losses, limitations, and performance trade-offs.
3	Apply an integrated systems approach to the evaluation of aerospace propulsion systems, considering the interaction between thermodynamic cycles, fluid flow, and component performance to support evidence-based engineering judgement.

Assessment

Indicative Assessment Tasks:

This section outlines the type of assessment task the student will be expected to complete as part of the module. More details will be made available in the relevant academic year module handbook.

Assessment 1: Portfolio

Students undertake a comprehensive analysis of an aerospace propulsion system, applying thermofluidic principles within an integrated systems framework.

Through a portfolio, students are provided with defined design criteria and operating parameters and are required to apply their analytical knowledge of thermodynamics, fluid mechanics, and propulsion to design and evaluate a core component of a gas turbine system, such as an intake duct, compressor stage, combustor, turbine, or nozzle.

Assessment number	Learning Outcomes to be met	Type of assessment	Duration/Word Count	Weighting (%)	Alternative assessment, if applicable
1	1-3	Portfolio	3000	100	N/A

Derogations

Credits shall be awarded by an Assessment Board for those modules in which a pass mark 40% has been achieved, with a minimum mark of 30% in each assessment element.

Learning and Teaching Strategies

Learning integrates conceptual study with practical investigation to deepen understanding and enhance problem-solving ability. Students participate in lectures, laboratory work, and team-based projects that encourage collaboration and communication. Online materials, recordings, and discussion forums support blended engagement. Tutorials promote reflective learning and increasing autonomy in preparation for advanced study.

Welsh Elements

This module will be delivered through the medium of English; however, students have the option to submit their assessments in the medium of Welsh. While this module is not currently offered fully through Welsh, Welsh language support and guidance are available, and some learning materials or tutorial discussions may incorporate Welsh elements where appropriate. To further promote bilingual learning, all students have the opportunity to take the 20-credit *Welsh for STEM* short course, designed to develop confidence and subject-specific language skills in both English and Welsh.

Indicative Syllabus Outline

Thermodynamic Cycles for Aerospace Propulsion Systems:
Analysis of thermodynamic cycles used in aerospace propulsion, including turbojet, turboprop, turbofan, and rocket engines, with application to real operating conditions.

Propulsion System Performance Parameters:
Evaluation of key propulsion performance measures such as thrust, specific fuel consumption, and propulsive efficiency to assess system performance and efficiency across a range of operating conditions.

Compressible Flow in Propulsion Components:
Analysis of compressible flow behaviour within propulsion system components, including nozzles, intakes, compressors, and turbines, using appropriate analytical methods and assumptions.

Loss Mechanisms and Efficiency Modelling:
Evaluation of loss mechanisms and component efficiency modelling to understand performance limitations and thermofluidic trade-offs within propulsion components.

Component Matching and System Integration:
Application of component matching techniques to integrate propulsion system components within gas turbine engines, considering interactions between thermodynamic cycles, fluid flow, and component performance.

System-Level Performance Analysis:
Assessment of overall propulsion system performance under varying operational and environmental conditions, supporting informed and evidence-based engineering judgement.

Indicative Bibliography

Please note the essential reads and other indicative reading are subject to annual review and update.

Essential Reads:

D. Zhao, S. L. Dixon, and C. Hall, *Fluid Mechanics and Thermodynamics of Turbomachinery*, 8th ed. Amsterdam, The Netherlands: Elsevier, 2025.

Other indicative reading:

Y. Fu, W. Liu, H. Qi, Q. Chen, J. Wen, and G. Xu, *Heat transfer area optimization of intermediate heat-exchange cycle system,"* International Journal of Heat and Mass Transfer*, vol. 220, pp. 1–14, 2024.

N. Neumann and D. Peitsch, *Holistic performance evaluation of a turbofan featuring pressure gain combustion for a short-range mission,* CEAS Aeronautical Journal*, vol. 14, pp. 983–995, 2023.

Administrative Information

For office use only	
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