University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Introduction to Thermo-Fluids			
Code: ENGG08021	**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 introduce the students to the topics of fluid flow, engineering thermodynamics and heat transfer.
Fluid Mechanics introduces the basic properties of fluids as well as the classification of fluids. The module discusses fluid statics and fluid dynamics.
Introduction to the concepts of conservation of mass, conservation of momentum and the conservation of energy will lead to the introduction of the Bernoulli, Navier-Stokes and Euler equations.
Flow in pipes and channels and flow between reservoirs will be explained with appropriate examples.
Shear stress – Shear rate relations will be used to introduce the students to Non-Newtonian fluids and their importance in both engineering and physiological systems.
Compressible flow and multiphase flow will be introduced.
Fluid movers such as pumps, blowers and compressors will be discussed as well as common flow measurement techniques.
The engineering thermodynamics part of the module builds on the basic definitions of work, heat, enthalpy, internal energy, temperature scales and p-v diagrams. The 1st Law of Thermodynamics is applied to both non-flow and flow systems and the energy balance equations for several equipment (e.g. boilers, condensers, compressors, nozzles, etc.) are derived. The main stages of common power cycles are developed and the ability to carry out numerical analysis of such cycles is undertaken.
The module aims to develop appreciation of the importance of safety in thermal systems, preservation of energy and the importance of sustainability, and also the ability to apply systematic methods for identifying process hazards (e.g. HAZOP), and for assessing the range of consequences (e.g. impact on people, environmental reputation, financial, security).
The module is illustrated by appropriate laboratory sessions.
Fluid statics discusses the concepts of pressure and head. Fluid dynamics starts with the introduction of the concept of shear stresses and their relation with friction and pressure drop in flow systems. Losses due to pipe fittings will be addressed. The principles of similarity will be used to introduce the dimensionless groups of importance such as the Reynolds number and the distinction between turbulent and streamline flows will be stressed.

The module introduces the concepts of entropy, reversibility, efficiency and T-S diagrams when discussing the 2nd law of thermodynamics. Compressibility is discussed as part of the introduction of the ideal gas law and other models that describe real gases.

Conduction introduces the Fourier law then applies the equation to steady state problems. Convection covers the mechanisms of natural and forced convection and introduces the

empirical techniques used to estimate heat transfer coefficients as well as the concept of effective average driving force such as LMTD. Fundamentals of heat transfer by radiation will be discussed and basic concepts such as reflection, absorption, transmission and emission will be explored.

I am UWS (https://www.uws.ac.uk/current-students/your-graduate-attributes/): Upon completing this module the students will be equipped with tools that will help them in their journey to be work-ready, successful and universal. The module develops critical thinking and analytical skills that enhance the students' ability to deal with complicated issues and make them problem solvers. It encourages them to become motivated, innovative, autonomous, inquisitive, creative and imaginative. The module and the teaching approach encourage collaborative working, effective communications, resilience and perseverance, and development of research and inquiry skills. The aim is to produce graduates who are knowledgeable with excellent digital skills fit for the 21st century and aware of the global context in which they operate and the challenges that face humanity in the 21st century in the areas of water, food, energy, environment and well-being, who strive to lead, influence and dare to make transformational changes while being ethically-minded, socially responsible, critically aware of the environmental and social impacts of their decisions and actions, and culturally sensitive.

This module has been reviewed and updated, taking cognisance of the University's Curriculum Framework principles. Examples of this are found within the module such as active and engaging laboratory and tutorial activity, module assessment which reflects real-life (industry) problems/activities, development of problem-solving skills, recorded lecture content supporting students to organise their own study time and the use of integrated group activities supporting learning communities.

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

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

(Provided viable student numbers permit).

Term 1	☐	Term 2	☒	Term 3	☐

Learning Outcomes: (maximum of 5 statements) At the end of this module the student will be able to:	
L1	Develop a comprehensive knowledge of the fundamentals of fluid flow, heat transfer and engineering thermodynamics and the role they play in the design and analysis engineering systems and the environment.
L2	Understand the concepts of conservation of mass, momentum and energy when applied to thermofluids and the solution of engineering problems to reach a substantiated conclusion.
L3	Identify and analyse fluid flow, heat transfer and engineering thermodynamics problems using experimental, tabulated, literature and other numerical data.
L4	Demonstrate ability to obtain and critically evaluate experimental thermofluids data, alongside with understanding the principles of risk assessment and of safety management, and be able to apply techniques for the assessment and abatement of process and product hazards. Be able to work in group to perform the experimental tasks

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 Level **8** Demonstrating a broad and integrated knowledge and understanding of the main areas of fluid flow, heat transfer and engineering thermodynamics Demonstrating a critical understanding of a selection of their principal theories, principles, concepts and terminology
Practice: Applied Knowledge and Understanding	SCQF Level **8** Use a selection of the principal skills, techniques, practices and/or materials associated with engineering and industrial tasks Practice routine searches for thermo-physical data of fluids
Generic Cognitive skills	SCQF Level **8** Be able to compare suggested solutions with expected values
Communication, ICT and Numeracy Skills	SCQF Level **8** The ability to report in writing and orally on experimental findings Use a range of IT applications to facilitate calculations and provision of report and presentations 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** Take some responsibility for use of appropriate data resources Practice in ways which take account of own role and responsibilities Work under guidance with qualified practitioners Recognise the importance of working effectively with others and have acquired a range of experience in achieving this	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: ENGG07002	**Module Title:** Applied Engineering Science
	Other:	Any other suitable engineering background.
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching	
The learning and teaching activity for this module include lectures, tutorials and problem based learning.	
Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	18
Tutorial/Synchronous Support Activity	18
Laboratory	4
Independent Study	160
	Hours Total 200
****Indicative Resources: (eg. Core text, journals, internet access)**	
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: Access to appropriate laboratories.	

Course notes and presentations will be provided. Texts: Essential: Cengel, Y. A, J M Combala and R H Turner, Fundamentals of Thermal-Fluid Science, McGraw-Hill, 6th Edition, 2022 Cengel Y and J M Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill, 4th Ed., 2014 Douglas, J F, Fluid Mechanics, 6th edition, Prentice Hall, 2011
(**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.

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.
(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	Engineering and Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Engineering
Moderator	Bassam Rakhshani
External Examiner	E Tingas
Accreditation Details	This module is part of the IMechE accredited programmes BEng/MEng (Hons) Mechanical Engineering
Changes/Version Number	2.19 (was 2.18) Module Coordinator changed to Dr Noorfazreena Kamaruddin from TBC

	Module summary updated to include power cycles. Delivery Changed to Face-To-Face from Hybrid C. Assessment text changed to reflect a consistency within the programmme. Assessment weightings changed to reflect a more consistent programme assessment weightings. Moderator changed to Bassam Rakhshani from Stephanie Docherty.

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment for the module includes both formative and summative assessment. Formative assessment is provided during lectures in the form of class quizzes and exercise problems, during tutorial sessions, during laboratory sessions and as part of the preparation for written submissions. Component 1 – Unseen Closed Book Class Test - 60% of the final mark.
Component 2 – Laboratory (40%)
(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.)

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**
Laboratory/ Clinical/ Field notebook	✓	✓		✓	40	4
Combined Total for All Components					**100%**	**6 hours**