University of the West of Scotland

Module Descriptor

Session: 2023/24

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Status: Proposal

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:	TBC		

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 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	HybridO	Work-based Learning
			✓		

Face-To-Face
Term used to describe the traditional classroom environment where the students and the lecturer meet synchronously in the same room for the whole provision.

Blended
A mode of delivery of a module or a programme that involves online and face-to-face delivery of learning, teaching and assessment activities, student support and feedback. A programme may be considered “blended” if it includes a combination of face-to-face, online and blended modules. If an online programme has any compulsory face-to-face and campus elements it must be described as blended with clearly articulated delivery information to manage student expectations

Fully Online
Instruction that is solely delivered by web-based or internet-based technologies. This term is used to describe the previously used terms distance learning and e learning.

HybridC
Online with mandatory face-to-face learning on Campus

HybridO
Online with optional face-to-face learning on Campus

Work-based Learning
Learning activities where the main location for the learning experience is in the workplace.

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)

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)

On successful completion 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

This module covers a wide variety of theoretical, conceptual and practical areas, which require a range of knowledge and skills to be displayed and exercised. Delivery of its syllabus content involves a diversity of teaching and assessment methods to achieve the learning outcomes of the module. These include formal lectures, structured tutorials (work closely integrated with the lecture material), laboratory exercises to develop practical skills and familiarisation with equipment, experimental techniques, understand the principles of safety and loss prevention, and their application to inherently safe design, completion and submission of written coursework making use of appropriate forms of IT and VLE, and independent study.

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/Practical Demonstration/Workshop	4
Independent Study	160
	200 Hours Total

****Indicative Resources: (eg. Core text, journals, internet access)**

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

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)

Engagement Requirements

In line with the Academic Engagement Procedure, Students are defined as academically engaged if they are regularly engaged with timetabled teaching sessions, course-related learning resources including those in the Library and on

the relevant learning platform, and complete assessments and submit these on time. Please refer to the Academic Engagement Procedure at the following link: Academic engagement procedure

Supplemental Information

Programme Board	Engineering
Assessment Results (Pass/Fail)	No
Subject Panel	Engineering
Moderator	Stephanie Docherty
External Examiner	R Ocone
Accreditation Details	This module is part of the BEng (Hons) Chemical and Mechanical Engineering programmes accredited by the IChemE & IMechE
Changes/Version Number	2.18 Module Coordinator changed to TBC Hybrid C Selected in lieu of Blended/Face-To-Face Learning Activites updated to reflect delivery. Assessment Changed to Unseen Closed Book Class Test from Unseen Open Book Examination. Equality and Diversity Statement Updated. v2.17 Delivery hours updated to reflect CF principles. v2.16 Minor amendments to LO to reflect AHEP4 V2.15 Module summary: updated to reflect CF principles Learning hours are modified to; Lecture/Core Content Delivery: 24 hrs Tutorial/Synchronous Support Activity: 22 hrs Laboratory/Practical Demonstration/Workshop: 2 hrs Independent Study: 152 hrs Hours Total: 200. Assessments: Assessment Category 2: Continuous assessment worth 50% of the final mark. The continuous assessment component in this module will consist of the following elements: Practical with reports worth 50% of the final mark. Reference to 'unseen closed book examination' replaced with 'unseen open book examination' as per revised University policy. Change confirmed with accrediting body. Class test time changed to 1.5hrs from 3hrs, was added as 3hrs in error. v2.13 Alterations to Module Summary, Learning Outcomes and Employability/PDP Skills to comply with new IChemE guidelines following Engineering Council AHEP4. assessment component 1 changed from unseen open book to unseen closed book. accreditation details: This module is part of the BEng(Hons) Chemical Engineering programme accredited by the IChemE v2.12 MC changed to Ross Birney, was Cristina Rodriguez. As a result of the Covid-19 situation, assessment component 1 changed from Unseen Closed Book to Unseen Open Book and Blended added as a Module Delivery Method 2.10 - Updated core texts - Updated students learning hours 2.09 Minor edit of module summary to better reflect all material taught. Addition of Graduates Attributes Correction of pre-requisites as Applied Engineering Science no longer exists as running module. Replaced by Applied Engineering Science 2 Clarification of engagement policy

	Update of learning resources editions V1.6 Change of Module Coordinator Change of Module Moderator Correction of the number of contact hours V1.5 Correction of typos. Adjustment of hours to fit with the 11 weeks teaching structure Clear identification of scheduled time for class tests and the laboratory V1.4 Change of module coordinator from H Wu to Z El-Hassan Edit module summary to comply with the 250 words summary. Material moved to the box for module scope. Edit “Assessment” section to include information about formative assessment. Add CRN number (currently shown as unknown). Change Trimester from 1 to 2. V1.3 Change of module coordinator Change of module moderator V1.2 Implement KIS changes 1.0 - New module 1.1 - accreditation details added

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. Summative assessment is provided by class test, written assessment elements as well as a final unseen closed book class test. Assessment Category 1: Closed Book Class Test worth 50% of the final mark
Assessment Category 2: Laboratory - 50% of Final Mark Further details, and the academic calendar when assessment is likely to feature, will be provided within the Module Information Pack.
(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 Handbook.)

Assessment Outcome Grids (Footnote A.)

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
Class test (written)	✓	✓	✓		50	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	✓	✓		✓	50	2
				Combined Total For All Components	100%	4 hours

Footnotes
A. Referred to within Assessment Section above
B. Identified in the Learning Outcome Section above

Note(s):
1. More than one assessment method can be used to assess individual learning outcomes.
2. Schools are responsible for determining student contact hours. Please refer to University Policy on contact hours (extract contained within section 10 of the Module Descriptor guidance note).
   This will normally be variable across Schools, dependent on Programmes &/or Professional requirements.

Equality and Diversity

Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. Specialist assistive equipment, support provision and adjustment to assessment practice in accordance with the University's policies and regulations. More information on the University's EDI policies can be accessed at: https://www.uws.ac.uk/about-uws/uws-commitments/equality-diversity-inclusion/
UWS Equality and Diversity Policy

(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)