Module Descriptor

Title	Introduction to Thermo-Fluids		
Session	2026/27	**Status**	Published
Code	ENGG08021	**SCQF Level**	8
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Engineering and Physical Sciences** **Computing, Engineering and Physical Sciences**		
Module Co-ordinator	N 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 covers the fundamental properties and classification of fluids, fluid statics, and fluid dynamics. Fluid statics introduces the concepts of pressure and head, discussing the effects of fluid forces on submerged and floating bodies. Fluid dynamics begins with the concept of shear stress and its relationship with friction and pressure drop in flow systems, including losses due to pipe fittings. The conservation laws; mass, momentum, and energy are then introduced, leading to fundamental equations such as Bernoulli's equation, the Navier-Stokes equations, and Euler's equation. Flow in pipes, channels, and between reservoirs is analyzed through examples. The principles of similarity are used to introduce key dimensionless groups such as the Reynolds number, highlighting the distinction between laminar and turbulent flow. Shear stress–shear rate relations are also used to introduce students to Non-Newtonian fluids and their significance in both engineering and physiological systems. Additionally, compressible flow and multiphase flow are introduced. The discussion also covers fluid movers, including pumps, blowers, and compressors, along with common flow measurement techniques.

The engineering thermodynamics part of the module builds on basic concepts such as work, heat, enthalpy, internal energy, temperature scales, and p-v diagrams. The First Law of Thermodynamics is applied to both non-flow and flow systems, deriving energy balance equations for various equipment (e.g., boilers, condensers, compressors, and nozzles). Students will develop the ability to analyze common power cycles numerically. The module also introduces the Second Law of Thermodynamics, covering entropy, reversibility, efficiency, and T-S diagrams. Compressibility is discussed through the ideal gas law and other models that describe real gases. The importance of safety in thermal systems, energy conservation, and sustainability is emphasized. Additionally, students will be introduced to systematic methods for identifying process hazards, such as HAZOP, and assessing their consequences, including impacts on people, environmental reputation, financial risks, and security concerns.

Heat Transfer begins with conduction, introducing Fourier's law and applying it to steady-state problems. The topic of convection covers both natural and forced convection, along with empirical techniques for estimating heat transfer coefficients. The concept of the effective average driving force, such as the Log Mean Temperature Difference (LMTD), is introduced. The fundamentals of heat transfer by radiation are also discussed, exploring key concepts such as reflection, absorption, transmission, and emission.

The module includes laboratory sessions to reinforce theoretical concepts through practical experiments.

During the course of this module students will develop their UWS Graduate Attributes (https://www.uws.ac.uk/current- students/your-graduate-attributes/) in the following areas-

Universal: Academic - Critical thinking, analytical & inquiring mind; Personal- Ethical; Professional- Research Minded

Work-Ready: Academic - Knowledgeable, Digitally Literate, Problem Solver; Personal - Effective Communicator; Professional - Ambitious

Successful : Academic - Autonomous; Personal - Resilient; Professional- Driven

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	**On-Campus**[1] x☒	**Hybrid**[2] ☐	**Online**[3] ☐	**Work -Based Learning**[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley **x**	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☐	Term 2	x☒	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	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. (AHEP4 Learning Outcome C1; M1).

[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

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. (AHEP4 Learning Outcome C2; M2).
L3	Identify and analyse fluid flow, heat transfer and engineering thermodynamics problems using experimental, tabulated, literature and other numerical data. AHEP4 Learning Outcome C2; M2).
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. AHEP4 Learning Outcome C12; M12).
L5	N/A

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 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 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 8** Be able to compare suggested solutions with expected values.
Communication, ICT and Numeracy Skills	**SCQF 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 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.

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.

The learning and teaching activity for this module include lectures, laboratories, 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** (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
n/a	0
n/a	0
TOTAL	200

Indicative Resources

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

Access to Fluid Dynamics laboratories.

Cengel, Y.A. and Cimbala, J.M. (2014) Fluid Mechanics: Fundamentals and Applications. 4th edn. New York: McGraw-Hill.

Cengel, Y.A., Cimbala, J.M. and Turner, R.H. (2022) Fundamentals of Thermal-fluid Sciences. 6th edn. New York: McGraw-Hill.

Douglas, J.F., Gasiorek, J.M., Swaffield, J.A. and Jack, L.B. (2011) Fluid Mechanics. 6th edn. Harlow: Prentice Hall.

White, F.M. (2021) Fluid Mechanics. 9th edn. New York: McGraw-Hill.

(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:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. Students will scan their attendance, via the attendance scanners, each time they are on-campus, they will have their attendance recorded in class and they will be expected to login to the VLE several times per week. Students who are unable to attend a timetabled session,

due to illness or other circumstance, should notify their Programme Leader. Across the School an 80% attendance threshold is set. Students who fall below this, will be referred to the Student Success Team to see how they can be best supported in their studies.

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 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 be 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. This module has laboratory-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies 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	**Engineering Physical Sciences**
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	Engineering
Moderator	B Rakhshani
External Examiner	P Weston
Accreditation Details	This module is part of the IMechE accredited programmes BEng/MEng (Hons) Mechanical Engineering
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	2.21 Module Descriptor copied to 2026/27 template and resources list updated to reflect ILR feedback. Attendance, Engagement and EDI statements updated. The module summary has been updated to align with the content on fluid mechanics, thermodynamics, and heat transfer. External Examiner updated from E Tingas to P Weston. The module learning outcomes have been mapped to the AHEP4 learning outcomes.

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Assessment Category 1: Class Test (Unseen, Closed Book), Weight – 60%
Assessment 2
Assessment Category 2: Laboratory, Weight - 40%
Assessment 3
N/A
(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**
Unseen Closed Book (Class Test)	Error! Bookmark not defined.	x☒	x☒	☐	☐	60	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Laboratory	☒	☒	☐	x☒	☐	40	4

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
N/A	☐	☐	☐	☐	☐		
Combined total for all components						100%	6 hours

Change Control

What	**When**	**Who**
Module Descriptor copied to 2025/26 template and resources list updated to reflect ILR feedback, Attendance, Engagement and EDI statements updated. External Examiner updated from E Tingas to P Weston.	March 2025	N Kamaruddin
The module learning outcomes have been mapped to the AHEP4 learning outcomes.	March 2026	N Kamaruddin
