Module Descriptor

Title	Thermodynamics & Heat Transfer		
Session	2025/26	**Status**	Published
Code	ENGG09040	**SCQF Level**	9
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	C Alutu		

Summary of Module

This module advances students' knowledge of engineering thermodynamics and heat transfer and direct them further towards applied problems encountered in the process industry in particular and engineering in general.

This nodule builds on the module Introduction to Thermofluids.

The module examines and applies several thermodynamics cycles, eg. The Carnot cycle, the Rankine cycle and its derivatives, the Otto cycles, the diesel cycle and the refrigeration cycle.

Boiling discusses the principles of both pool and nucleate boiling in non-flowing systems. Condensation examines both dropwise and filmwise mechanisms.

Applied heat transfer covers the design (with TEMA codes) and sizing of shell and tube heat exchangers – single and multi-pass co- and counter- current flow; LMTD correction factors, fouling resistances – plus the identification of non-tubular designs and selecting appropriate materials.

Transient heat transfer problems are solved using lumped capacitance method, analytical and graphical solutions to temperature distribution within solids.

Also discussed are pressure drop in heat exchangers, finned surfaces, contact resistances and heat exchanger rating.

Safety of thermal systems and principles of thermal relief are also discussed. Dangers of explosions and fires in pressurised systems are also covered when discussing boilers and power cycles.

The course is illustrated by appropriate experiments, carried out in groups.

During the course of this module students will develop their UWS Graduate Attributes (http://www.uws.ac.uk/current-students/your-graduate-attributes/). Universal: Academic attributes – critical thinking and analytical & inquiring mind; Work-Ready: Academic attributes – safe laboratory working and presenting drawings of designed items; Successful: autonomous, driven and resilient.

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

Terms for Module Delivery	Term 1	☒	Term 2	☐	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	Understand the different thermodynamics cycles and develop the ability to carry out calculations of engineering significance.
L2	Identify and analyse heat transfer problems using experimental, tabulated, properly cited literature and other numerical data.
L3	Discuss critically the open-ended nature of selecting and sizing heat exchangers for process plant in working industry.
L4	Demonstrate ability to obtain and critically evaluate pilot plant data by set procedures and safety guidelines.
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 9** Demonstrate a broad and integrated knowledge and understanding of the main areas of thermodynamics and heat transfer. Demonstrating a critical understanding of a selection of their principal theories, principles, concepts, and terminology.
Practice: Applied Knowledge and Understanding	**SCQF 9** Use a selection of the principal skills, techniques, practices and/or materials associated with industrial tasks.

[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

	Use iterative multivariable techniques in design and sizing of equipment. Practice routine searches for thermophysical data of fluids
Generic Cognitive skills	**SCQF 9** Be able to compare suggested solutions with expected values.
Communication, ICT and Numeracy Skills	**SCQF 9** Use a range of IT applications to facilitate calculations and provision of report and presentations. Interpret, use, and evaluate numerical and graphical data to realize calculations in sizing of equipment.
Autonomy, Accountability and Working with Others	**SCQF 9** Take some responsibility for use of appropriate data resources. Practice in ways which take account of own role and responsibilities. Work with peers on laboratory experiments and data. Work under guidance with qualified practitioners.

Prerequisites	**Module Code** ENGG08021	**Module Title** Introduction to Thermo-Fluids
	Other Or any other suitable engineering background.	
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.	
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	12
Tutorial / Synchronous Support Activity	24
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
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:

Çengel, Y.A., Cimbala, J.M. and Turner, R.H. (2021) Fundamentals of thermal-fluid sciences. 6th ed. New York: McGraw-Hill Education.

Holman, J.P. (2018) Heat transfer. 10th ed. New York: McGraw-Hill Education.

Incropera, F.P., DeWitt, D.P., Bergman, T.L. and Lavine, A.S. (2011) Fundamentals of heat and mass transfer. 7th ed. Hoboken, NJ: John Wiley & Sons.

Rogers, G.F.C. and Mayhew, Y.R. (1992) Engineering thermodynamics: Work and heat transfer. 4th ed. Harlow: Longman Scientific & Technical.

Rogers, G.F.C. and Mayhew, Y.R. (1994) Thermodynamic and transport properties of fluids. 5th ed. Oxford: Blackwell Publishers.

Sinnott, R.K. and Towler, G. (2020) Chemical engineering design. 6th ed. Oxford: Butterworth-Heinemann.

(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:

Campus attendance as per teaching delivery Engagement in classrooms.

Prompt Attendance of Lectures- Students are expected to attend scheduled lectures promptly and actively participate by taking notes, asking questions, and contributing to discussions.

Prompt Attendance of Tutorials- Students are expected to attend tutorials on time, prepared with any assigned readings or tasks. Active participation in tutorial discussions and activities is strongly encouraged.

Prompt attendance of Laboratory session- Students are expected to attend laboratory on time, prepared with any assigned readings or tasks (lab risk assessment and procedure). Active participation in lab activities is strongly encouraged.

Weekly Access to Materials on Aula- Students are required to access Aula on a weekly basis to stay informed about updates, download lecture slides or readings, and engage with any online activities or discussions

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your 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 lab-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. More information on the University's EDI policies can be accessed at: https://www.uws.ac.uk/about-uws/uws-commitments/equality-diversity-inclusion/
(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	Design
Moderator	L Sun
External Examiner	P Weston
Accreditation Details	This module is part of the BEng(Hons) Chemical Engineering programme accredited by the IChemE.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	2.17 External Examiner updated- Peter Weston Attendance and Engagement Requirement updated Equality and Diversity updated

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Final written class test worth 70% of the final mark
Assessment 2
Continuous assessment worth 30% of the final mark. This continuous assessment component consist of the following elements: (i) Heat exchanger design exercise worth 12% and (ii) laboratory practical report worth 18% of the final mark.

Assessment 3
(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**
Closed book class test	☒	☐	☒	☐	☐	70	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Design/Diagram/ Drawing/Photograph/Sketch Laboratory/Clinical/Field notebook	☐	☒	☒	☒	☐	30	12

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
	☐	☐	☐	☐	☐		
Combined total for all components						100%	14 hours

Change Control

What	**When**	**Who**
External Examiner updated- Peter Weston Attendance and Engagement Requirement updated. Equality and Diversity updated. Indicatives resources updated.	March 2025	C Alutu