University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Thermodynamics & Heat Transfer			
Code: ENGG09040	**SCQF Level: 9 (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:	Chimaobi 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					
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:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☒	Term 2	☐	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
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.
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 **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 Level **9** Use a selection of the principal skills, techniques, practices and/or materials associated with industrial tasks. Use iterative multivariable techniques in design and sizing of equipment. Practice routine searches for thermophysical data of fluids	
Generic Cognitive skills	SCQF Level **9** Be able to compare suggested solutions with expected values.	
Communication, ICT and Numeracy Skills	SCQF Level **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 Level **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.	
Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: ENGG08021	**Module Title:** Introduction to Thermo-Fluids
	Other:	Or any other suitable engineering background.
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

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** (Normally totalling 200 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
	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:

Cengel, Y.A, J M Cimbala and R H Turner, Fundamentals of Thermal Fluid Sciences, McGraw-Hill, 6th Edition, 2021

Holman, J., Heat Transfer, McGraw-Hill, 10th edition, 2018

Incropera, F.N, D P DeWitt, T. L. Bergman and A.S. Lavine, Fundamentals of Heat and mass transfer, 7th Edition, Wiley, 2011.

Rogers, G.F.C and Mayhew, Y., Engineering thermodynamics: work and heat transfer, Prentice Hall, 1992.

Rogers & Mayhew, Thermodynamic and Transport properties of Fluids, Blackwell 5th edition 1994, (ISBN = 0-631-19703-6)

Sinnott, R.K and Towler G, Chemical Engineering Design: SI Edition, Butterworth-Heinemann 6th Edition, 2019.

(**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
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Engineering
Moderator	Li Sun
External Examiner	Raffaella Ocone
Accreditation Details	This module is art of the BEng(Hons) Chemical Engineering programme accredited by the IChemE.
Changes/Version Number	2.17

Assessment: (also refer to Assessment Outcomes Grids below)

Combined Total For All Components	100%	14 hours

Assessment for the module includes both formative and summative assessment. Formative assessment is provided during lectures in the form of class exercise problems, during tutorial sessions, during laboratory sessions and as part of the preparation for written submissions.
Summative assessment includes class tests, written assessment elements, and a final class test.
Assessment will be based on the following: (a) final written class test worth 70% of the final mark, and

(b) continuous assessment worth 30% of the final mark.

The continuous assessment component in this module will consist of the following elements: (i) Heat exchanger design exercise worth 12% and (ii) practical report worth 18% of the 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 Module Handbook.)

Assessment Outcome Grids (See Guidance Note)

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Closed book class test	✓		✓		70	2

Assessment Type (Footnote B.)	Learning Outcome (1)	Learning Outcome (2)	Learning Outcome (3)	Learning Outcome (4)	Weighting (%) of Assessment Element	Timetabled Contact Hours
Design/Diagram/ Drawing/Photograph/Sketch		✓	✓		12	0
Laboratory/ Clinical/Field notebook		✓		✓	18	12