Module Descriptor

Title	Energy Systems Analysis and Design		
Session	2025/26	**Status**	Published
Code	ENGG10084	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	M Mirzaeian		

Summary of Module

This module deals with important aspects of the design and analysis of energy systems:

• The fundamentals and the up-to-date technologies associated mainly with Biomass and Energy storage systems and also renewable energy such as wind, solar, bioenergy, and hydro energy are discussed. An overview of the storage systems that are popularly linked to the renewable energy resources is covered. The limits of available technologies and the potential of new and emerging technologies are discussed.

• Different applications and case studies including diverse geographical and economic situations and discussion regarding common technical and non-technical barriers and issues limiting the widespread use and dissemination of renewable energy will also be covered and investigated, and strength and weakness of each case will be clarified.

• Radiation discusses reflection, absorption and transmission of surfaces before moving on to emission, blackbody radiation, Stefan-Boltzmann law; radiation properties of surface, view-factor concept and the calculation of view factors from formulae, charts and cross-string method, radiation shields, then moving to radiation through absorbing media for boiler and furnace design.

• Heat transfer properties of solids and solution to their transient heat transfer problems using graphical representation of temperature distribution in solids with two and three dimensions are discussed. Unsteady-state heat transfer and its applications in areas such as the food processing industry are discussed with example operations such as thermal processing and freezing.

• The use of the software and design calculations are also practiced as the practical element of the module.

This module will work to develop a number of the key 'I am UWS' Graduate Attributes (https://www.uws.ac.uk/current-students/your-graduate-attributes/) to make those who complete this module: Universal (Critical Thinker, Ethically-minded, Research-minded); Work Ready (Problem-Solver, Effective Communicator, Ambitious); Successful (Autonomous ,Resilient, Driven).

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	Outline the fundamentals associated with the renewable energy resources and the storage systems linked to them.
L2	Critically evaluate renewable energy technologies and compare them to each other in term of capacity, durability and cost, and their limits and also the potential of new and emerging technologies considering the technical and non technical barriers that limit the wide spread of renewable energy
L3	Develop comprehensive understanding of more complex aspects of energy balance and heat transfer.
L4	Demonstrate the ability to select appropriate equipment for heat transfer and to carry out equipment sizing calculation for both steady state and unsteady state heat transfer processes
L5	Develop a critical awareness of the transfer properties of materials and the interaction between heat, temperature and the properties of material being processed and its transformation to end product in terms of their functionality especially in the food industry.

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 10** • Develop a critical understanding of renewable energy in the global context, its principles and concepts and the benefits and challenges facing renewable energy.

[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

	• Critical understanding of the inherent challenges faced by environmental issues. • Develop a deep understanding of issues related to heat transfer and energy use in chemical and process plants. • Master practical techniques for the design of more complex thermal systems and the sizing of heat transfer equipment in such systems. • Understand the commercial, economic, and social context of the processes and technologies.
Practice: Applied Knowledge and Understanding	**SCQF 10** • Carry out detailed calculation for the design of thermal systems. • Develop critical understanding of the use of design software to size heat transfer equipment and apply this to practical situations. • Developing leadership awareness on the environmental related issues. • Practice the use-case utilisation of digital technologies in a predefined context and library resources.
Generic Cognitive skills	**SCQF 10** • Demonstrate the ability to gather information from different sources and indifferent formats and to use the information to make sound judgement about the design, operation and monitoring of thermal systems. • Apply critical analysis, evaluation and synthesis to issues which are at the forefront of, or informed by, developments at the forefront of renewable energy. • Identify, conceptualise, and define new and abstract problems and issues related to renewable energy. • Critically review, consolidate, and extend knowledge, skills practices and thinking in renewable energy. • Understand complex issues regarding renewable energy and storage systems and relate these issues to environmental protection.
Communication, ICT and Numeracy Skills	**SCQF 10** • Gather relevant information from different sources and in different formats. • Appropriate use of software (e.g. Excel, Mathcad, Polymath) to analyse and specify equipment details. • Appropriate use of ICT in support of research objectives (e.g. data collection and analysis of renewable energy project) and also for written and oral presentation.
Autonomy, Accountability and Working with Others	**SCQF 10** • Work effectively and cooperatively with others in practical sessions. • Adopt an inclusive approach to engineering practice, recognising the responsibilities, benefits, and importance of supporting equality, diversity and inclusion. • Identify and address individual learning needs in the subject area associated with the module.

Prerequisites	Module Code ENGG08021	Module Title Introduction to Thermo-Fluids
	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.	
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	24
Tutorial / Synchronous Support Activity	12
Independent Study	164
n/a	0
n/a	0
n/a	0
TOTAL	200 Hours Total

Indicative Resources
The following materials form essential underpinning for the module content and ultimately for the learning outcomes: F N Incropera, D P DeWitt, T. L. Bergman and A. S. Lavine (2007) Fundamentals of heat and mass transfer, 6th Edition, Wiley. J. P. Holman (2010) Heat Transfer,J. P. Holman, 10th Edition, McGraw-Hill. R Paul Singh and D R Heldman (2013) Introduction to Food Engineering, 5th Edition, Academic Press. Aldo Vieira da Rosa (2013) Fundamentals of Renewable Energy Processes. Oxford Academic. Stefan Emeis (2013) Wind Energy Meteorology: Atmospheric Physics for Wind Power Generation. Berlin; New York: Springer. Wanger, Herman-Josef and J Mathur (2011) Introduction to Hydro Energy Systems: Basics, Technology and Operation. Berlin; Heidelberg : Springer-Verlag.
(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. 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. Specialist assistive equipment, support provision and adjustment to assessment practice 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	Design
Moderator	L Sun
External Examiner	P Weston
Accreditation Details	This module is part of BEng (Hons) Chemical Engineering and BEng (Hons) Mechanical Engineering Programmes accredited by IChemE and IMechE.
Module Appears in CPD catalogue	☐ **Yes** ☒ **No**
Changes / Version Number	1.03 - Updated Indicative Resources. - Updated Attendance and Engagement Procedure. - Updated Equality and Diversity. - Updated external examiner.

	- Updated Assessment section, Closed book class test replaces open book examination.. -Updated indicatives resources

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Unseen Closed Book written Class Test worth 70% of the final mark.
Assessment 2
Written assignment with calculations worth 15% of the final mark
Assessment 3
Project on renewable energy and energy storage systems (includes report 7.5% and MS Power Point presentation7.5%) 15% of the final mark.
(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	☒	☐	☒	☒	☒	70	3

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Design/ Diagram/ Drawing/ Photograph/ Sketch	☐	☐	☒	☐	☒	15	0

Component 3							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Report of practical/ field/ clinical work	☐	☒	☐	☐	☐	15	1
Combined total for all components						100%	4 hours

Change Control

What	**When**	**Who**
- Updated Indicative Resources.	March 2025	M Mirzaeian

- Updated Attendance and Engagement Procedure. - Updated Equality and Diversity. - Updated external examiner. - Updated Assessment section. -Updated indicatives resources - Closed book class test replaces open book examination.		