University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Energy Systems Analysis and Design			
Code: ENGG10084	**SCQF Level: 10 (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:	Mojtaba Mirzaeian		

Summary of Module

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

- 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

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

Pre-requisites:	Before undertaking this module the student should have undertaken the following:	
	Module Code: ENGG08021	**Module Title:** Introduction to Thermo-Fluids
	Other:	
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	24
Tutorial/Synchronous Support Activity	12
Independent Study	164
	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: F N Incropera, D P DeWitt, T. L. Bergman and A. S. Lavine, Fundamentals of heat and mass transfer, 6th Edition, Wiley, 2007. R Paul Singh and D R Heldman, Introduction to Food Engineering, 5th Edition, Academic Press, 2013. CJ Schaschke, Food Processing, 2nd Edition, BookBoon, 2018. 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.

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	R. Ocone
Accreditation Details	This module is part of BEng (Hons) Chemical Engineering and BEng (Hons) Mechanical Engineering Programmes accredited by IChemE and IMechE.
Changes/Version Number	1.02 - Updated student learning hours - Change of delivery from Blended to “Face to Face”.

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 and as part of the preparation for written submissions. Summative assessment is provided by written assessment elements as well as a final exam.
Assessment 1 - Final exam worth 70% of the final mark.
Assessment 2- continuous assessments consist of written assignment worth 30% of the final mark. The continuous assessment component in this module will consist of the following elements: i) Project on renewable energy and energy storage systems (includes report and MS Power Point presentation) 15% of the final mark. ii) Submission of written assignment with calculations worth 15% 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)

Component 1							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Unseen open book	✓		✓	✓	✓	70	3

Component 2							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Design/ Diagram/ Drawing/ Photograph/ Sketch			✓		✓	15	0

Component 3							
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Learning Outcome (4)**	**Learning Outcome (5)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Report of practical/ field/ clinical work		✓				15	0
Combined Total for All Components						**100%**	**3 hours**