MODULE DESCRIPTION FORM

DEPARTMENT OF MECHANICAL AND AEROSPACE ENGINEERING

ME404 ENERGY SYSTEMS MODELLING

Module Registrar: Dr. D Cóstola daniel.costola@strath.ac.uk	**Taught To (Course): Cohorts for whom class is compulsory**	
Other Lecturers Involved:	**Credit Weighting: 10**	**Semester: 2**
Compulsory class	**Academic Level: 4**	**Suitable for Exchange: Y**

Required prerequisites

Knowledge of thermodynamics, fluid mechanics and environmental engineering

Module Format and Delivery (HOURS i.e. 1 credit = 10hrs of study):

Lecture	Tutorial	Laboratory	Groupwork	External	Online	Project	Assignments	Private Study	**Total**
20	10						30	40	100

Educational Aim

This module examines state-of-the-art modelling methods as used to appraise the performance of buildings, their environmental control plant, and associated renewable energy supply technologies. The aim is to:

- impart an appreciation of the mathematical models for the underlying heat and mass transfer processes, and the numerical methods by which such process models may be conflated to form an integrated simulation program.
- give insight into the range of possible applications of integrated energy simulation and procedures to orchestrate such applications.
- identify the adjustments required to organisation work practices to incorporate state-of-the-art energy systems simulation as a best practice business approach.

Learning Outcomes

On completion of the module, students are expected to have attained the following learning outcomes.

LO1 Appreciate that environments result from a complex interaction of heat and mass transfer mechanisms.
LO2 Have a basic knowledge of how to apply modelling and simulation to address this complexity.
LO3 Understand the theoretical and operational principles underlying contemporary energy modelling programs.
LO4 Appreciate the limitations of current design tools and the issues related to their effective use in practice.

Syllabus

The module will cover the following topics:

1. Types of energy system, energy transfer mechanisms, performance assessment criteria.
2. Weather parameters, severity assessment and radiation prediction.
3. Response function and numerical methods.
4. Discretisation, conservation equations, domain equations linking, imposing control and numerical solution.
5. Modelling of HVAC and renewable energy conversion systems, and controls.
6. Modelling of air, moisture, and electricity flow.
7. Buoyancy driven and forced convection at internal and external surfaces.
8. Long- and short-wave radiation at external and internal surfaces of a body.
9. Validity, applicability, user interfaces, use in practice, performance assessment method, uncertainty.

Assessment of Learning Outcomes

For each Module Learning Outcome, the following criteria will be used to make judgements on student learning.

Students should demonstrate:

LO1 C1 The ability to describe the interacting energy/mass flows that occur in all energy systems and identify the principal causal factors in each case.

LO2 C1 The ability to describe the processes involved in applying modelling and simulation in practice to ensure acceptable overall performance of designs of arbitrary complexity.

LO3 C1 The ability to describe the mathematical models employed to represent the energy flows underpinning energy systems.

LO4 C1 The ability to describe the limitations of existing design tools in the context of the range of possible applications in practice.

The standards set for each criterion per Module Learning Outcome to achieve a pass grade are indicated on the assessment sheet for all assessment.

Principles of Assessment and Feedback
(within Assessment and Feedback Policy at: https://www.strath.ac.uk/professionalservices/staff/policies/academic/)

- Formal, summative feedback is provided by the return of examination marks after assessment. Individual feedback on examination performance will be given on request.
- Informal feedback is provided at weekly tutorial sessions through discussion with groups and, where appropriate, individuals.

Assessment Method(s) Including Percentage Breakdown and Duration of Exams *(individual weightings)*

Examination				Coursework		Practical		Project	
Number	Month(s)	Duration	***Weighting***	Number	***Weighting***	Number	***Weighting***	Number	***Weighting***
1	Apr/May	2 hours	100%	1	Pass req'd				
*All				*All		*		*	

* ***L/Os:*** *Indicate which Learning Outcomes (L01, L02, etc) are to be assessed by exam/coursework/practical/project as required.*

Coursework / Submissions deadlines (*academic weeks*): Weekly at tutorial sessions.

Resit Assessment Procedures:
2hr examination in August diet.

PLEASE NOTE:
Students must gain a summative mark of 40% to pass the module. Students who fail the module at the first attempt will be re-assessed during the August diet. This re-assessment will consist entirely of exam. Students who fail the coursework part will also be required to undertake an additional assignment. No marks from any previous attempts will be transferred to a new resit attempt.

Recommended Reading

*****Purchase recommended **Highly recommended reading *For reference (do NOT purchase)**

- J A Clarke, 'Energy Simulation in Building Design (2nd Edition)', Butterworth-Heinemann, ISBN 0 7506 5082 6 *
- Case studies available at http://www.hpbmagazine.org *

Additional Student Feedback
(Please specify details of when additional feedback will be provided)

Date	Time	Room No
Announced in class.		Check timetable webpages for details.

Session: 2021/22

Approved:

Course Director Signature: Dr E Henderson (SG)

Date of Last Modifications: September 13, 2021

(updated August 2021)

MODULE TIMETABLE

Module Code:	**ME404**	**Module Title:**	**Energy Systems Modelling**

Brief Description of Assessment:

2 hour examination in Apr/May diet.
Contribution to tutorial and Group discussion required – provides formative feedback.

Assessment Timing:-

Indicate on the table below the start/submission dates for each assignment/project and the timing of each exam/assessment using the dropdowns provided. Dropdowns can be left blank. Add extra notes below the dropdowns.

Please note: Timings can and will change, this should only be used as a guide.

Semester One	W&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item. Choose an item.	Choose an item.

Semester Two	C&D Wk	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9	WK10	WK11	Exam Period
		Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Group presentation & tutorial feedback	Presentation Learning outcome summary & future career advice	Presentation Group presentation & tutorial feedback		Exam