SEE4112: SUSTAINABLE ENGINEERING SYSTEMS: MODELLING AND ANALYSIS

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Sustainable Engineering Systems: Modelling and Analysis

Subject Code
SEE - School of Energy and Environment
Course Number
4112

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
B1, B2, B3, B4 - Bachelor's Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
SEE3101 Engineering Thermofluids II or equivalent

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to give an introduction to effective modelling methods applicable for assessing the dynamic behaviours of complex systems for energy supply and conversion.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Assess the capabilities and limitations of various sustainable engineering systems.	20		x	x
2	Implement modelling methods to simulate and analyse the performance of sustainable engineering systems.	30		x	x
3	Demonstrate knowledge and comprehension of theoretical principles and operational skills underlying engineering system modelling.	20	x	x	
4	Apply modelling skills and analytical methods for performance improvement of various engineering systems.	30	x	x	x

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

Learning and Teaching Activities (LTAs)

	LTAs	Brief Description	CILO No.	Hours/week (if applicable)
1	Lectures	Students will engage in lectures with discussion to learn theoretical principles and modelling methods of sustainable engineering systems.	1, 2, 4	
2	Tutorials	Students will participate in case studies and demonstrations to master the practical modelling aspects of sustainable engineering systems.	1, 2, 4	
3	Computer labs	Students will apply modelling skills to simulate and analyse sustainable engineering systems.	1, 2, 3, 4	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	In-class tests Students will complete several in-class tests to practice and solidify the knowledge and methods related to modelling and analysis of sustainable engineering systems.	1, 2, 3, 4	30	-	No
2	Assignments Students will complete several assignments to demonstrate their deep understanding, critical thinking and modelling skills related to sustainable engineering systems.	1, 2, 3, 4	30	-	Yes

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

3

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

Final exam will test students' ability to integrate knowledge and methods learned throughout the course to model and analyse various sustainable engineering systems.

Examination duration: 3 hours

Percentage of continuous assessment, examination, etc.: 60% by continuous assessment; 40% by exam

To pass a course, a student must do ALL of the following:

a. obtain at least 30% of the total marks allocated towards continuous assessment (combination of assignments, pop quizzes, term paper, lab reports and/ or quiz, if applicable);

b. obtain at least 30% of the total marks allocated towards final examination (if applicable); and
c. meet the criteria listed in the section on Assessment Rubrics.

Assessment Rubrics (AR)

Assessment Task
1. In-class tests

Criterion
Ability to model and analyse sustainable engineering systems

Excellent (A+, A, A-)
Excellent numerical and analytical skills to model and analyse sustainable engineering systems

Good (B+, B, B-)
Good numerical and analytical skills to model and analyse sustainable engineering systems

Fair (C+, C, C-)
Acceptable numerical and analytical skills to model and analyse sustainable engineering systems

Marginal (D)
Marginal numerical and analytical skills to model and analyse sustainable engineering systems

Failure (F)
Poor numerical and analytical skills to model and analyse sustainable engineering systems

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Assessment Task
2. Assignments

Criterion
Ability to explain concepts and model/analyse/improve sustainable engineering systems

Excellent (A+, A, A-)
Excellent understanding of concepts; excellent numerical and analytical skills to model/analyse/improve sustainable engineering systems

Good (B+, B, B-)
Good understanding of concepts; good numerical and analytical skills to model/analyse/improve sustainable engineering systems

Fair (C+, C, C-)
Acceptable understanding of concepts; acceptable numerical and analytical skills to model/analyse/improve sustainable engineering systems

Marginal (D)
Marginal understanding of concepts; marginal numerical and analytical skills to model/analyse/improve sustainable engineering systems

Failure (F)
Poor understanding of concepts; poor numerical and analytical skills to model/analyse/improve sustainable engineering systems

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Assessment Task

3. Examination

Criterion

Ability to explain concepts and model/analyse/improve sustainable engineering systems

Excellent (A+, A, A-)

Excellent understanding of concepts; excellent numerical and analytical skills to model/analyse/improve sustainable engineering systems

Good (B+, B, B-)

Good understanding of concepts; good numerical and analytical skills to model/analyse/improve sustainable engineering systems

Fair (C+, C, C-)

Acceptable understanding of concepts; acceptable numerical and analytical skills to model/analyse/improve sustainable engineering systems

Marginal (D)

Marginal understanding of concepts; marginal numerical and analytical skills to model/analyse/improve sustainable engineering systems

Failure (F)

Poor understanding of concepts; poor numerical and analytical skills to model/analyse/improve sustainable engineering systems

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Part III Other Information

Keyword Syllabus

Sustainable energy systems; Energy transfer mechanisms; Dynamic modelling techniques; Boundary conditions; Integrative modelling techniques; Numerical simulation; System design and control; Renewable energy systems; Energy saving technologies; Energy management opportunities; Building energy efficiency; Applicability; User interfaces; Performance assessment method; Zero energy.

Reading List

Compulsory Readings

	Title
1	Nil

Additional Readings

	Title
1	Brackney, L., Parker, A., Macumber, D., Benne, K. Building Energy Modeling with OpenStudio. Springer, 2018.
2	OpenStudio documents. https://www.openstudio.net/
3	EnergyPlus documents. https://energyplus.net/
4	Bohne, D. Building Services and Energy Efficient Buildings. Springer, 2023.
5	Code of Practice for Energy Efficiency of Building Services Installation. EMSD, 2018.