SEE8130: ADVANCED THERMOSCIENCES FOR ENERGY ENGINEERING

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Advanced Thermosciences for Energy Engineering

Subject Code
SEE - School of Energy and Environment
Course Number
8130

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
R8 - Research Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
SEE6122 Advanced Thermosciences for Energy Engineering

Exclusive Courses
Nil

Part II Course Details

Abstract

This course aims to introduce the concept of thermosciences (including but not limited to thermodynamics and heat transfer) and applies them to a wide range of engineering technologies related to energy. These principles will help the students to build a strong foundation for further innovative studies of energy engineering. Problems-solving in energy engineering would be explored and the skills in critical thinking would be developed.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Describe and apply principles of thermosciences in the context of energy engineering (including but not limited to thermodynamics and heats transfer)	40	x	x	
2	Analyse the energy production and consumption processes through case studies in processes and advanced/smart engineering devices.	40	x	x	
3	Apply the principles to problem-solving and designing of new energy systems (not limited to energy generation, utilisation and storage). Use a systems approach to simplify a complex problem.	20		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	Lecture	A format of two-third lectures and one-third tutorials will be used to help the students to understand and explore key issues, their underlying theory and the selection of case studies.	1, 2, 3	2 hours/week
2	Tutorial	Topic-related tutorials will give the students an opportunity to practice. Mathematical-based and conceptual-based exercises will be used in a blended manner.	1, 2, 3	1 hour/week

3	Presentations (optional)	The oral presentation is designed to develop information literacy skills and to acquire depth of knowledge on selected topics (depends on class condition)	1, 2, 3	

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	In-class quizzes (two quizzes)	1, 2, 3	30	-	No
2	Assignments (individual/ group-based)	2, 3	30	-	Yes

Continuous Assessment (%)

60

Examination (%)

40

Examination Duration (Hours)

2

Minimum Continuous Assessment Passing Requirement (%)

30

Minimum Examination Passing Requirement (%)

30

Additional Information for ATs

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

a. obtain at least 30% of the total marks allocated towards coursework (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

3.meet the criteria listed in the section on Assessment Rubrics

Assessment Rubrics (AR)

Assessment Task

In-class quizzes (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Ability to analyse and solve mathematical-based and conceptual-based problems

Excellent

(A+, A, A-) High

Good

(B+, B, B-) Significant

Fair

(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching basic levels

Assessment Task
Assignment (Individual/group based) (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
It is a formative assessment on technical content (knowledge, comprehension, application, analysis) and the ability to engage in a structured way with the course materials.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching basic levels

Assessment Task
Final Examination (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion
Summative assessment on the technical accuracy of calculations and clarity of conceptual understanding of topics.

Excellent
(A+, A, A-) High

Good
(B+, B, B-) Significant

Fair
(C+, C, C-) Moderate

Marginal
(D) Basic

Failure
(F) Not even reaching basic levels

Assessment Task
In-class quizzes (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Ability to analyse and solve mathematical-based and conceptual-based problems

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic to Moderate

Failure
(F) Not even reaching basic levels

Assessment Task
Assignment (Individual/group based) (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
It is a formative assessment on technical content (knowledge, comprehension, application, analysis) and the ability to engage in a structured way with the course materials.

Excellent
(A+, A, A-) High

Good
(B+, B) Significant

Marginal
(B-, C+, C) Basic to Moderate

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(F) Not even reaching basic levels

Assessment Task
Final Examination (for students admitted from Semester A 2022/23 to Summer Term 2024)

Criterion
Summative assessment on the technical accuracy of calculations and clarity of conceptual understanding of topics.

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(A+, A, A-) High

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Marginal
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Failure

(F) Not even reaching basic levels

Part III Other Information

Keyword Syllabus

-Advanced Thermodynamics

-Heat Transfer in reactions, devices etc.

-Energy Production and Consumption Process

-Thermal Reaction Engineering

-Separation and Equilibrium

Reading List

Compulsory Readings

	Title
1	B. R. Munson, D. F. Young, T. H. Okiishi, W. W. Huebsch, Fundamentals of Fluid Mechanics (any edition), Wiley.
2	Y. A. Cengel, J. M .Cimbala, R. H. Turner, Fundamentals of Thermal-Fluid Sciences (any edition), McGraw Hill Education.
3	P. Atkins, J. de Paula, Physical Chemistry: Thermodynamics, Structure, and Change (any edition), W. H. Freeman and Company New York.

Additional Readings

	Title
1	H. Scott Fogler, M. Nihat Gurmen, Elements of Chemical Reaction Engineering (any edition), Wiley
2	L. Theodore, Heat Transfer Applications for Practicing Engineer, Wiley.
3	S. K. Agrawal, Applied Thermosciences: Principles and Applications, Anshan.
4	Additional Notes from lectures