SEE6103: ENERGY CONVERSION: THEORY AND METHODOLOGY

Effective Term
Semester A 2025/26

Part I Course Overview

Course Title
Energy Conversion: Theory and Methodology

Subject Code
SEE - School of Energy and Environment
Course Number
6103

Academic Unit
School of Energy and Environment (E2)

College/School
School of Energy and Environment (E2)

Course Duration
One Semester

Credit Units
3

Level
P5, P6 - Postgraduate Degree

Medium of Instruction
English

Medium of Assessment
English

Prerequisites
Nil

Precursors
Nil

Equivalent Courses
Nil

Exclusive Courses
Nil

Part II Course Details

Abstract

This course explores the fundamental principles, methods, and advanced technologies associated with energy conversion. It delves into the core principles of thermodynamics, chemistry, and transport in energy conversion techniques. Encompassing a wide spectrum of topics, it scrutinizes the conversion and storage of energy in thermal, mechanical, chemical, and electrochemical processes utilized in power and transportation systems. Emphasis is placed on factors such as efficiency, performance, and the environmental consequences of energy conversion. The course is designed to cultivate students' abilities to analyze diverse energy conversion processes, grasp emerging trends in energy conversion techniques, and enhance their problem-solving skills in tackling energy conversion challenges.

Course Intended Learning Outcomes (CILOs)

	CILOs	Weighting (if app.)	DEC-A1	DEC-A2	DEC-A3
1	Develop a deep understanding of energy conversion theory and principles.	20	x	x	
2	Explore various energy conversion technologies and their applications.	20	x	x	
3	Analyze and evaluate energy efficiency in different conversion processes.	30	x	x	x
4	Grasp emerging trends and innovations in energy conversion research.	10		x	x
5	Enhance problem-solving skills in tackling energy conversion challenges.	20		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	Lecture	Lectures to explain key concepts and theories related to energy conversion.	1, 2, 3, 4, 5	2.5 hrs/wk
2	Tutorial or class demon	Show students prototypes of energy conversion devices and teach students how to solve problems about energy conversion and efficiency.	1, 2, 3, 4, 5	0.5 hr/wk

Assessment Tasks / Activities (ATs)

	ATs	CILO No.	Weighting (%)	Remarks ("-" for nil entry)	Allow Use of GenAI?
1	Assignments Homework assignments will encompass a mix of technical problem-solving and open-ended inquiries. These assignments serve a dual purpose: first, to aid students in reinforcing the concepts acquired in class, and second, to encourage them to explore the real-life applications of these principles in our everyday existence.	1, 2, 3, 4	30	Summative Assessment Tasks	No
2	In-class test/ quiz: Problems are assigned to students to assess their comprehension of the concepts.	1, 2, 3, 4	10	-	No
3	Project report: Students will engage in a practical, hands-on project focused on energy conversion. They will be tasked with designing a project that applies the concepts learned in class, providing a tangible demonstration of their understanding.	1, 2, 3, 4, 5	20	Summative Assessment Tasks	No

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:
1) 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);
2) 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

Assignment (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

Criterion

Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent

(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good

(B+, B, B-) Can use the correct concepts to solve problems, but may make occasional errors

Fair

(C+, C, C-) Can use the correct concepts to solve problems to some extent, but may make significant errors

Marginal

(D) Can analyze the problem in a correct direction and show some understanding

Failure

(F) Fail to correctly analyze a question or solve it

Assessment Task

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

Criterion

Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent

(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good

(B+, B, B-) Can use the correct concepts to solve problems, but may make occasional errors

Fair

(C+, C, C-) Can use the correct concepts to solve problems to some extent, but may make significant errors

Marginal

(D) Can analyze the problem in a correct direction and show some understanding

Failure
(F) Fail to correctly analyze a question or solve it

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

Criterion
Ability to analyze the current status and developing trends of energy conversion technologies

Excellent
(A+, A, A-) Excellent analysis with strong insights

Good
(B+, B, B-) Good summary with acceptable insights

Fair
(C+, C, C-) Moderate summary with a few insights

Marginal
(D) Poor summary with no personal insights

Failure
(F) Minimal attempt or irrelevant summary

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

Criterion
Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent
(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good
(B+, B, B-) Can use the correct concepts to solve problems, but may make occasional errors

Fair
(C+, C, C-) Can use the correct concepts to solve problems to some extent, but may make significant errors

Marginal
(D) Can analyze the problem in a correct direction and show some understanding

Failure
(F) Fail to correctly analyze a question or solve it

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

Criterion

Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent
(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good
(B+, B) Can use the correct concepts to solve problems, but may make occasional errors

Marginal
(B-, C+, C) Can use the correct concepts to solve problems to some extent but may make significant errors

Failure
(F) Fail to correctly analyze a question or solve it

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

Criterion
Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent
(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good
(B+, B) Can use the correct concepts to solve problems, but may make occasional errors

Marginal
(B-, C+, C) Can use the correct concepts to solve problems to some extent but may make significant errors

Failure
(F) Fail to correctly analyze a question or solve it

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

Criterion
Ability to analyze the current status and developing trends of energy conversion technologies

Excellent
(A+, A, A-) Excellent analysis with strong insights

Good
(B+, B) Good summary with acceptable insights

Marginal
(B-, C+, C) Poor summary with no personal insights

Failure
(F) Minimal attempt or irrelevant summary

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

Criterion
Proficiency in analyzing and resolving technical problems pertaining to energy conversion

Excellent
(A+, A, A-) Can use the correct concepts to solve problems without any errors

Good
(B+, B) Can use the correct concepts to solve problems, but may make occasional errors

Marginal
(B-, C+, C) Can use the correct concepts to solve problems to some extent but may make significant errors

Failure
(F) Fail to correctly analyze a question or solve it

Part III Other Information

Keyword Syllabus

- Chemical energy conversion
- Electrochemical energy conversion
- Thermal energy conversion
- Mechanical energy conversion
- Alternative fuels
- Hydrogen
- Fuel cells
- Battery
- Combustion
- Catalysis
- Chemical thermodynamics
- Energy efficiency

Reading List

Compulsory Readings

	Title
1	""Energy Conversion 2nd Edition" by D. Yogi Goswami and Frank Kreith"
2	""Principles of Energy Conversion" by Arch C. J. Trewin"
3	""Introduction to Combustion" by Stephen R. Turns"
4	""Renewable and Efficient Electric Power Systems" by Gilbert M. Masters"
5	""Principles and Applications of Lithium Secondary Batteries" by Jongheop Yi"
6	""Introduction to Energy Storage: Materials, Systems, and Applications" by Richard C. Dorf and Daniel J. Turner"
7	""Electrochemical Energy Storage for Renewable Sources and Grid Balancing" by Patrick T. Moseley, Jurgen Garche, and Chris Dyer"
8	""Principles and Applications of Lithium Secondary Batteries" by Jongheop Yi"

9	""Introduction to Heat Transfer" by Frank P. Incropera and David P. DeWitt"
10	""Energy Storage: A Nontechnical Guide" by Richard Baxter"

Additional Readings

	Title
1	""Advanced Battery Management Technologies for Electric Vehicles""
2	""Energy and the Environment" by Robert Ristinen and Jack Kraushaar"
3	""Introduction to Fluid Mechanics" by William S. Janna"
4	Hong Kong Government Electrical & Mechanical Services Department website: http://www.emsd.gov.hk/