City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2024/25

Part I Course Overview

Course Title:	**Energy Conversion: Theory and Methodology**
Course Code:	**SEE6103**
Course Duration:	**One semester**
Credit Units:	**3 credits**
Level:	**P6**
Medium of Instruction:	**English**
Medium of Assessment:	**English**
Prerequisites: *(Course Code and Title)*	**Nil**
Precursors: *(Course Code and Title)*	**Nil**
Equivalent Courses: *(Course Code and Title)*	**Nil**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. 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.

2. Course Intended Learning Outcomes (CILOs)

(CILOs state what the student is expected to be able to do at the end of the course according to a given standard of performance.)

No.	CILOs	Weighting (if applicable)	Discovery-enriched curriculum related learning outcomes (please tick where appropriate)		
			A1	*A2*	*A3*
1.	Develop a deep understanding of energy conversion theory and principles.	20%	✓	✓	
2.	Explore various energy conversion technologies and their applications.	20%	✓	✓	
3.	Analyze and evaluate energy efficiency in different conversion processes.	30%	✓	✓	✓
4	Grasp emerging trends and innovations in energy conversion research.	10%		✓	✓
5	Enhance problem-solving skills in tackling energy conversion challenges.	20%		✓	✓
		100%			

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.

3. Learning and Teaching Activities (LTAs)

(LTAs designed to facilitate students' achievement of the CILOs.)

LTA	Brief Description	CILO No.					Hours/week (if applicable)
		1	2	3	4	**5**	
Lecture	Lectures to explain key concepts and theories related to energy conversion.	✓	✓	✓	✓	✓	2.5 hrs/wk

Tutorial or class demon	Show students prototypes of energy conversion devices and teach students how to solve problems about energy conversion and efficiency.	✓	✓	✓	✓	✓	0.5 hr/wk

4. Assessment Tasks/Activities (ATs)

(ATs are designed to assess how well the students achieve the CILOs.)

Assessment Tasks/Activities	CILO No.					Weighting	Remarks
	1	2	3	4	5		
Continuous Assessment: 60%							
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.	✓	✓	✓	✓		30%	
In-class test/quiz Problems are assigned to students to assess their comprehension of the concepts.	✓	✓	✓	✓		10%	
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.	✓	✓	✓	✓	✓	20%	
Examination: 40% (duration: 2 hours, if applicable)							
						100%	

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

5. Assessment Rubrics

(Grading of student achievements is based on student performance in assessment tasks/activities with the following rubrics.)

Applicable to students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Assignment	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make significant errors	Can analyze the problem in a correct direction and show some understanding	Fail to correctly analyze a question or solve it
2. In-class test/quiz	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make significant errors	Can analyze the problem in a correct direction and show some understanding	Fail to correctly analyze a question or solve it
3. Project report	Ability to analyze the current status and developing trends of energy conversion technologies	Excellent analysis with strong insights	Good summary with acceptable insights	Moderate summary with a few insights	Poor summary with no personal insights	Minimal attempt or irrelevant summary
4. Final exam	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make significant errors	Can analyze the problem in a correct direction and show some understanding	Fail to correctly analyze a question or solve it

Applicable to students admitted from Semester A 2022/23 to Summer Term 2024

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B)	Marginal (B-, C+, C)	Failure (F)
1. Assignment	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make	Fail to correctly analyze a question or solve it

				significant errors	
2. In-class test/quiz	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make significant errors	Fail to correctly analyze a question or solve it
3. Project report	Ability to analyze the current status and developing trends of energy conversion technologies	Excellent analysis with strong insights	Good summary with acceptable insights	Poor summary with no personal insights	Minimal attempt or irrelevant summary
4. Final exam	Proficiency in analyzing and resolving technical problems pertaining to energy conversion	Can use the correct concepts to solve problems without any errors	Can use the correct concepts to solve problems, but may make occasional errors	Can use the correct concepts to solve problems to some extent, but may make significant errors	Fail to correctly analyze a question or solve it

Part III Other Information (more details can be provided separately in the teaching plan)

1. Keyword Syllabus

(An indication of the key topics of the course.)

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

2. Reading List

2.1 Compulsory Readings

(Compulsory readings can include books, book chapters, or journal/magazine articles. There are also collections of e-books, e-journals available from the CityU Library.)

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

2.2 Additional Readings

(Additional references for students to learn to expand their knowledge about the subject.)

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/