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:	**Emerging Energy Technologies**
Course Code:	**SEE6118**
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)*	**SEE8125 Emerging Energy Technologies**
Exclusive Courses: *(Course Code and Title)*	**Nil**

Part II Course Details

1. Abstract

The course aims to provide students with the fundamental knowledge on the emerging energy technologies. This includes technologies that are expected to be the next state-of-the-art in the near future, from innovative clean energy conversion to energy storage. The acquired knowledge shall equip students for the rapidly evolving energy frontiers, and serve as a common ground for potential innovations in these technologies.

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.	Describe basic principles in the conversion of fossil fuel (coal and natural gas) to ultraclean fuel, as well as their importance in the future energy equations; describe the process of carbon capture and storage and its importance in the integration of fossil fuel	20%	✓	✓	
2.	Describe the various means of solar energy conversion from first to third generation photovoltaic solar cells, and photoelectrochemical conversion; describe the working principles of different types of fuel cells.	30%	✓	✓	✓
3.	Describe the principles of energy storage through lithium ion batteries and supercapacitors, and their advantages; describe the principles of hydrogen storage such as metal hydrides and carbon nanotubes	30%	✓	✓	
4.	Apply the principles to evaluate the performances and challenges in various technologies.	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	
Lecture	Regular lectures to enrich students with the required science fundamentals for the	✓	✓	✓		

	applications of emerging technologies in energy conversion and storage					
Tutorial	Mathematical-based in-class exercise to consolidate the skills of students in designing energy systems based on emerging technologies		✓	✓	✓	
Topical Workgroup	In-depth understanding of selected technologies by problem-solving		✓	✓	✓	
Presentation	General presentation to share research findings with classmates		✓	✓		

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		
Continuous Assessment: 100%						
Assignment			✓	✓	85%	
Oral presentation	✓	✓	✓	✓	15%	
Examination: 0% (duration: , if applicable)						
** The weightings should add up to 100%.*					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	Ability to apply mathematical skills in designing energy storage and conversion systems based on emerging technologies	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Oral presentation	Ability to convey research findings orally in a convincing and systematic manner	High	Significant	Moderate	Basic	Not even reaching marginal levels

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	Ability to apply mathematical skills in designing energy storage and conversion systems based on emerging technologies	High	Significant	Moderate to Basic	Not even reaching marginal levels
2. Oral presentation	Ability to convey research findings orally in a convincing and systematic manner	High	Significant	Moderate to Basic	Not even reaching marginal levels

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.)

Ultraclean fossil fuel conversion:
Gas-to-liquid conversion
Clean coal technologies
Carbon capture and storage

Energy conversion:
First, second and third generation solar cells
Photoelectrochemical conversion
Hydrogen fuel cells, direct methanol fuel cells, solid oxide fuel cells

Energy storage:
Lithium-ion batteries
Supercapacitor
Hydrogen storage

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.	Raimondi, F., Scherer, G.G., Kötz, R., Wokaun, A. Nanoparticles in energy technology: Examples from electrochemistry and catalysis, *Angew. Chem. Int. Ed.* **2005**, *44*, 2190.	
2.	Somorjai, G.A., Frei, H., Park, J.Y. Advancing the frontiers in nanocatalysis, biointerfaces and renewable energy conversion by innovations of surface techniques, *J. Am. Chem. Soc.* **2009**, *131*, 16589.	
3.	Kamat, P.V. Meeting the clean energy demand. Nanostructure architectures for solar energy conversion, *J. Phys. Chem. C*, **2007**, *111*, 2834.	
4.	Winter, M., Brodd, R.J. What are batteries, fuel cells, and supercapacitors? *Chem. Rev.* **2004**, *104*, 4245.	

2.2 Additional Readings

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

Nil