City University of Hong Kong
Course Syllabus

offered by School of Energy and Environment
with effect from Semester A 2017/18

Part I Course Overview

Course Title:	Emerging Energy Technologies
Course Code:	SEE 8125
Course Duration:	One semester
Credit Units:	3
Level:	R8
Proposed Area: *(for GE courses only)*	☐ Arts and Humanities ☐ Study of Societies, Social and Business Organisations ☐ Science and Technology
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)*	SEE6118 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)

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 equation; describe the process of carbon capture and storage and its importance in the integration of fossil fuel utilisation.	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 fuel cells, namely hydrogen fuel cell, direct methanol fuel cell and solid oxide fuel cell.	40%	✓	✓	✓
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.	40%	✓	✓	
	** If weighting is assigned to CILOs, they should add up to 100%.*	100%			

 # Please specify the alignment of CILOs to the Gateway Education Programme Intended Learning outcomes (PILOs) in Section A of Annex.

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 self-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. Teaching and Learning Activities (TLAs)

TLA	Brief Description	CILO No.			Hours/week (if applicable)
		1	2	3	
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		✓	✓	
Lab-based experiment	Hands-on task in constructing and assessing emerging energy systems		✓	✓	
Presentation	General presentation to share research findings with classmates		✓	✓	

4. Assessment Tasks/Activities (ATs)

Assessment Tasks/Activities	CILO No.			Weighting*	Remarks
	1	2	3		
Continuous Assessment: 100%					
Assignment	✓	✓	✓	80%	
Lab work and report		✓	✓	15%	
Oral presentation		✓	✓	5%	
Examination: 0% (duration: N/A , 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

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. Lab work and report	Ability to apply hands-on skills in constructing and assessing energy systems, and further report writing	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Oral presentation	Ability to convey research findings orally in a convincing and systematic manner	High	Significant	Moderate	Basic	Not even reaching marginal levels

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

1. Keyword Syllabus

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

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

Nil