City University of Hong Kong

Information on a Course
offered by School of Energy and Environment
with effect from Semester A in 2013 / 2014

Part I

Course Title: Emerging Energy Technologies

Course Code: SEE 8125

Course Duration: One semester

No. of Credit Units: 3

Level: R8

Medium of Instruction: English

Prerequisites: Nil

Precursors: Nil

Equivalent Courses: SEE6118 Emerging Energy Technologies

Exclusive Courses: Nil

Part II

1. Course Aims:

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)

Upon successful completion of this course, students should be able to:

No	CILOs	Level of Importance
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.	1
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.	1
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.	1
4	Describe the principles and applications of biomass energy, the theory behind the conversion processes, advantages and limitations of various biofuels production technologies.	1

3. Teaching and Learning Activities (TLAs)

(designed to facilitate students' achievement of the CILOs)

CILO No.	TLAs	Hours/week (if applicable)
CILO 1	Lectures; Tutorials	3
CILO 2	Lectures; Lab-based mini project	3
CILO 3	Lectures; Tutorials	3
CILO 4	Lectures; Lab-based mini project	3

4. Assessment Tasks/Activities
(designed to assess how well the students achieve the CILOs)

CILO No.	Type of Assessment Tasks/Activities	Weighting (if applicable)	Remarks
CILO 1	Quiz (10%); Assignments (10%);	20%	
CILO 2	Quiz (5%); Assignments (5%); Project report (20%)	30%	
CILO 3	Quiz (10%); Assignments (10%);	20%	
CILO 4	Quiz (5%); Assignments (5%); Project report (20%)	30%	

Coursework: 100%

5. Grading of Student Achievement:

Grade A
The student completes all assessment tasks/activities and the work demonstrates excellent understanding of the scientific principles and the working mechanisms. He/she can thoroughly identify and explain how the principles are applied to science and technology for solving energy-related problems. The student's work shows strong evidence of original thinking, supported by a variety of properly documented information sources other than taught materials. He/she is able to communicate ideas effectively and persuasively via written texts and/or oral presentation.

Grade B
The student completes all assessment tasks/activities and can describe and explain the scientific principles. He/she provides a detailed evaluation of how the principles are applied to science and technology for solving energy-related problems. He/she demonstrates an ability to integrate taught concepts, analytical techniques and applications via clear oral and/or written communication.

Grade C
The student completes all assessment tasks/activities and can describe and explain some scientific principles. He/she provides simple but accurate evaluations of how the principles are applied to science and technology for solving energy-related problems. He/she can communicate ideas clearly in written texts and/or in oral presentations.

Grade D
The student completes all assessment tasks/activities but can only briefly describe some scientific principles. Only some of the analysis is appropriate to show how the principles are applied to science and technology for solving energy-related problems. He/she can communicate simple ideas in writing and/or oral presentation.

Grade F
The student fails to complete all assessment tasks/activities and/or cannot accurately describe and explain the scientific principles. He/she fails to identify

and explain how the principles are applied to science and technology for solving energy-related problems objectively or systematically. He/she is weak in communicating ideas and/or the student's work shows evidence of plagiarism.

Part III

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

Biofuel conversion:
Biomass
First, second and third generation biofuels
Microbial fuel cells
Biochemical principles

Recommended Reading:

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.

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.

Kamat, P.V. Meeting the clean energy demand. Nanostructure architectures for solar energy conversion, *J. Phys. Chem. C*, **2007**, *111*, 2834.

Winter, M., Brodd, R.J. What are batteries, fuel cells, and supercapacitors? *Chem. Rev.* **2004**, *104*, 4245.

Wall, J., C. S. Harwood, and A. L. Demain (eds.). 2008. Bioenergy. ASM Press.