City University of Hong Kong
Course Syllabus

offered by College/School/Department of Electronic Engineering
with effect from Semester B in 2017/2018

Part I Course Overview

Course Title: Integrating Green Energy into Society

Course Code: GE2317

Course Duration: One Semester (13 weeks)

Credit Units: 3

Level: B2

Proposed Area:
(for GE courses only)

- [ ] Arts and Humanities
- [ ] Study of Societies, Social and Business Organisations
- [1] 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) Nil

Exclusive Courses:
(Course Code and Title) Nil

Part II Course Details

1. Abstract

Green energy processing and utilization have experienced a drastic growth due to confluence of various advancements in areas such as microelectronics, signal processing, material science, and energy processing techniques. It is thus essential to get students know to grasp the relationships among those disciplines. This course is using problem-based-learning method to facilitate students to "learn to learn" and to work cooperatively in groups to seek solutions to real energy processing, utilization issues and integration into society. Apart from acquiring technological knowhow, the ultimate goal is to also let students be able to apply the disciplinary content, develop critical thinking abilities, and acquire skills of life-long learning, communication, and team building.

This course aims to develop an understanding of the operating principles, engineering design and analysis of various technologies for generating power from renewable sources, and to let students understand the environmental, operational and economic issues associated with 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.	Understand and explore different types of renewable energy generation devices using power electronics technology, fluid mechanics, thermodynamics and heat transfer	60	✓	✓	
2.	Relate the environmental, economic and operational issues associated with these devices	40		✓	✓
		100%			

** If weighting is assigned to CILOs, they should add up to 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)

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

TLA	Brief Description	CILO No.						Hours/week (if applicable)
		1	2					
Lecture in PBL mode	Explain key concepts by studying several cases	✓	✓					3hrs/week
Lab work	Investigate the performance characteristics of various renewables sources, such as solar, wind, and fuel cells	✓	✓					3 hrs/week for 3 weeks
Group project	Conduct detailed investigation into timely topics related to green energy sources	✓	✓					3 hrs/week for 4 weeks
Site visit	Study the installation and architecture of systems with renewable sources integrated	✓	✓					3hrs/week for 1 week
		Timetabling Information						3 hrs/wk (Lect/Tut/Lab)

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						
Continuous Assessment: 70%								
Case study, including presentation and written reports	✓	✓					30%	
Mid-term and end-of-term tests	✓	✓					20%	
Lab work	✓						20%	
Examination: 30% duration: 2 hours)								
** The weightings should add up to 100%.*							100%	

Remark:

To pass the course, students are required to achieve at least 30% in continuous assessment and 30% in the examination.

5. Assessment Rubrics

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

Assessment Task	Criterion	Excellent (A+, A, A-)	Good (B+, B, B-)	Fair (C+, C, C-)	Marginal (D)	Failure (F)
1. Lab report	1.1 CAPACITY for SELF-DIRECTED LEARNING to understand the principles of various renewable energy sources	High	Significant	Moderate	Basic	Not even reaching marginal levels
	1.2 ABILITY to EXPLAIN the operating principles and characteristics of various renewable energy sources	High	Significant	Moderate	Basic	Not even reaching marginal levels
2. Group Project and Presentation	ABILITY to EXPLAIN in DETAIL and with ACCURACY methods of inquiry useful in analyzing the relationship and the impact of various energy resources	High	Significant	Moderate	Basic	Not even reaching marginal levels
3. Mid-term and End-of-term Tests	Achievements in CILOs	High	Significant	Moderate	Basic	Not even reaching marginal levels
4. Examinations	Achievements in CILOs	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

Course content will include

- motivations - climate change
- first and second law efficiencies, energy
- solar energy - photovoltaic, solar thermal
- wind energy - turbine design, choice of site, operational issues
- wave and tidal energy - analysis of different wave generation devices
- geothermal energy - geological considerations, choice of site, large scale plants, geothermal energy in buildings
- hydro-electric power - design and function of hydro-electric power plants, operational issues
- biofuels - types, applications, carbon budget analysis
- general issues - variable output, integration of renewable energy sources into power grid.

1. Motivation
   - Global warming
   - Problems with our current energy system
   - Renewables: Fuel of the future?
   - Policy and markets
   - Electricity system restructuring and renewables
   - Renewables portfolio standard
   - Green certificates

2. Wind energy
   - Energy and power in the wind: Offshore wind energy
   - Wind turbines: concept, horizontal axis and vertical axis wind turbines
   - Environmental impact: electromagnetic interference, visual impact, turbines and birds
   - Planning and economics
   - Grid-connected wind power systems
   - Resources and future prospects

3. Tidal power
   - Basics: basic physics and power generation
   - Tidal current turbines and assessment
   - Tidal energy potential
   - Technical and environmental factors
   - Economics and future prospects

4. Geothermal energy
   - An overview
   - The physics of geothermal resources
   - Technologies for geothermal resource exploitation
   - Environmental implications
   - Economics and world potential

5. Hydroelectric power
   - World resource, world capacity and output
   - Brief history
   - Types of hydroelectric plant
   - Turbines: Francis, impulse
   - Applications
   - Environmental considerations and integration
   - Economics and future prospects

6. Biofuels
   - Bioenergy past and present
   - Bioenergy sources: energy crops and wastes
   - Combustion of solid biomass
   - Production of gaseous fuels from biomass
   - Applications, carbon budget analysis
   - Environmental benefits and impacts
   - Economics and future prospects

7. Integration
   - How much renewable energy is available?
   - Are renewable energy supplies available where we want them?
   - Are renewable energy supplies available when we want them?
   - Some system solutions
   - Balancing economic options
   - Global scenarios

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.	Nil

2.2 Additional Readings

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

1.	Roland Wengenmayr and Thomas Bührke, *Renewable Energy: Sustainable Energy Concepts for the Future*, Wiley-VCH Verlag GmbH&Co., 2008
2.	Godfrey Boyle, *Renewable Energy*, Oxford, 2004
3.	Gregory McNamee, *Careers in Renewable Energy: Get a Green Energy Job*, PixyJack Press, 2008
4.	Paul Komor, *Renewable Energy Policy*, iUniverse, 2004

Annex
(for GE courses only)

A. Please specify the Gateway Education Programme Intended Learning Outcomes (PILOs) that the course is aligned to and relate them to the CILOs stated in Part II, Section 2 of this form:

GE PILO	**Please indicate which CILO(s) is/are related to this PILO, if any** ***(can be more than one CILOs in each PILO)***
PILO 1: Demonstrate the capacity for self-directed learning	CILO1, CILO2
PILO 2: Explain the basic methodologies and techniques of inquiry of the arts and humanities, social sciences, business, and science and technology	CILO1, CILO2
PILO 3: Demonstrate critical thinking skills	CILO1, CILO2
PILO 4: Interpret information and numerical data	CILO1, CILO2
PILO 5: Produce structured, well-organised and fluent text	
PILO 6: Demonstrate effective oral communication skills	
PILO 7: Demonstrate an ability to work effectively in a team	CILO1, CILO2
PILO 8: Recognise important characteristics of their own culture(s) and at least one other culture, and their impact on global issues	
PILO 9: Value ethical and socially responsible actions	CILO1, CILO2
PILO 10: Demonstrate the attitude and/or ability to accomplish discovery and/or innovation	CILO1, CILO2

GE course leaders should cover the mandatory PILOs for the GE area (Area 1: Arts and Humanities; Area 2: Study of Societies, Social and Business Organisations; Area 3: Science and Technology) for which they have classified their course; for quality assurance purposes, they are advised to carefully consider if it is beneficial to claim any coverage of additional PILOs. General advice would be to restrict PILOs to only the essential ones. (Please refer to the curricular mapping of GE programme: http://www.cityu.edu.hk/edge/ge/faculty/curricular_mapping.htm.)

B. Please select an assessment task for collecting evidence of student achievement for quality assurance purposes. Please retain at least one sample of student achievement across a period of three years.

Selected Assessment Task
Written report of the case study