Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 2026 RENEWABLE ENERGY SOURCES AND TECHNOLOGIES II (3,3,1)**

Course Aims: This course covers the working principles of renewable energy sources such as solar and water energy and their technologies in energy storage. By means of fostering innovative teaching and learning activities, students apply their academic knowledge and skills learnt in this subject to serve the community, or to implement a practical project.

Pre-requisites: Year 2 standing or consent of instructor

Course Reviewed by: Dr. Jeff Huang and Dr. Mau-hing Chan

Course Intended Learning Outcomes (CILOs):

No.	Upon successful completion of this course, students should be able to:
1	Illustrate the perspectives and working principles of renewable energy sources.
2	Identify the technology of renewable energy generation.
3	Illustrate the basic science and equipment of energy conversion.
4	Be aware of the needs of the community in learning and applications of renewable energy sources.
5	Develop communication skills with the community.

Teaching & Learning Activities (TLAs)

CILOs	TLAs will include the following:
1 - 3	Lectures and class discussion to highlight basic working principles in energy production from various sources including, waves, tides, and solar energy.
1 - 3	Using case studies to illustrate the viability and practicality of harvesting energy from wind and ocean.
1 - 3	Classroom demonstrations or service-learning group project with small-scale energy generation educational gargets to illustrate energy extraction and conversion processes.
4 - 5	Group projects (eg., service-learning teaching the community of applications of renewable energy sources in our daily-life living).

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Assessment Methods (AMs):

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous Assessments (eg., Service-Learning Group Project or Practical Group Project)	60%	1-5	For service-learning group project, report, presentation, and reflection of group service project (eg., experiential learning cycle) are used to evaluate the quality of service learning.
2	Final Examination	40%	1-5	The final examination is designed to assess students understanding on this course.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
I. Solar energy	1 - 3	6
II. Ocean energy	1 - 3	6
III. Energy storage technologies	1 - 3	12
IV. Group Project (eg., Service-Learning Project)	4, 5	12

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References:

- Robert Ehrlich, Harold A. Geller, *Renewable Energy: A First Course* (CRC Press, 2017).
- Vaughn C. Nelson, Kenneth L. Starcher, *Introduction to Renewable Energy* (CRC Press, 2015).

Course Content in Outline:

	Topic	**Hours**
I	Solar energy	6
	Black body and solar radiation	
	Energy balance of the Earth	
	Energy conversion of photovoltaic cell	
	Solar cells and their maximum energy conversion efficiency	
II	Ocean energy	6
	A. Fundamentals of oceanography and ocean wave mechanics	
	B. Ocean wave energy conversion (OWEC) technology	
	C. Ocean tidal and ocean current energy conversion technology	
	D. Oscillating Water Column energy conversion system	
	E. Osmotic ocean energy conversion (salinity difference) technology	
	F. Ocean Thermal Energy Conversion (OTEC) technology	
III	Renewable Energy and Energy storage technologies	12
	A. Potential energy storage (hydro and compressed gas)	
	B. Kinetic energy storage (flywheel)	
	C. Thermodynamics and thermal energy	
	D. Heat and mass transfer mechanisms	
	E. Thermal energy storage	
	F. Phase change materials	
	G. Thermal energy conversion devices	
	H. Waste heat recovery	
	I. Solar ponds	
	J. Heat pipe	
	K. Electrical and magnetic storage	
	L. Wireless energy transfer	
	M. Demonstration experiments/kits of energy harvesting/storage devices	
IV	Group Project (eg., Service-Learning Group Project)	12
	A. Pre-service preparatory work (such as development of teaching gadgets for renewable energy community education)	
	B. Pre-service training	
	C. Off-campus renewable energy educational service	