Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 3046 NON-FOSSIL FUELS (3,3,1)**

Course Aims: This course covers the physics and working principles of important non-fossil fuels, including nuclear and solar energy sources. Environmental impacts of the various technologies are explained. Selected examples of emerging technologies and latest developments are also discussed.

Pre-requisites: PHYS 3005 Atomic and Nuclear Physic or consent of instructor.

Course Reviewed by: Prof. So Shu Kong and Dr. Alex Mok

Course Intended Learning Outcomes (CILOs):

No.	Upon successful completion of this course, students should be able to:
1	Describe the physical principles of nuclear power generation and their applications to nuclear reactors, fuel cycle, and nuclear safety.
2	Estimate the system performance of harvesting energy from the sun.
3	Demonstrate familiarity with emerging energy technologies by comparing their efficiency and return on investment.
4	Estimate and analyze cost of various forms of non-fossil fuels.

Teaching & Learning Activities (TLAs)

CILOs	TLAs will include the following:
1-4	Lectures will highlight the connections of basic physics principles in energy production from various non-fossil fuels.
1	Using case studies to illustrate the viability, practicality and safety of harvesting energy from nuclear fission.
2, 4	Using demonstrations to illustrate some of the energy extraction processes. For example, thermal and electrical energy can be harvested from solar radiation.

CILOs	TLAs will include the following:
1-4	Classroom discussion, homework assignment and project presentations on various topics.
2-4	Carry out small scale experiments to illustrate the theoretical concepts. For example, students may be asked to measure the conversion efficiency of solar cells.

Hong Kong Baptist University
Faculty of Science – Department of Physics

Assessment Methods (AMs):

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Semester test, tutorial assignments and project presentations	50%	1-4	Test, classroom debates and assignments are designed to guide the learning process of students on how to express known facts in the form of equations. From the known data the students can then learn the basic skills in problem solving.
2	Final Examination	50%	1-4	Final Examination questions are designed to see how far students have achieved their intended learning outcomes. Questions will primarily be analysis and skills-based to assess the student's versatility in solving problems that can be used in a wide range of problems.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
I. Nuclear energy	1, 4	15
II. Solar energy	2, 4	15
III. Special topics	3, 4	6

Textbook: None

References:

- Aldo V. da Rosa, *Fundamentals of Renewable Energy Processes*, 3rd ed., (Elsevier, 2012)
- Godfrey Boyle, *Renewable Energy: Power For a Sustainable Future*, 3rd ed., (Oxford, 2012)
- Ronald DiPippo, *Geothermal Power Plants: Principles, Applications, Case Studies and Environmental Impact*, 4th ed., (Butterworth-Heinemann, 2015)
- Raymond Murray and Keith E. Holbert, *Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of Nuclear Processes*, 7th ed., (Elsevier, 2014)
- Ronald Allen Knief, *Nuclear Engineering: Theory and Technology of Commercial Nuclear Power*, 2nd ed., (American Nuclear Society, 2014)
- David Bodansky, *Nuclear Energy: Principles, Practices, and Prospects*, 2nd ed., (Springer, 2008)
- Paul A. Lynn, *Electricity from Sunlight: An Introduction to Photovoltaics* (Wiley, 2010)
- Soteris A. Kalogirou, *Solar Energy Engineering: Processes and Systems*, 2nd ed., (Academic Press, 2013)
- C. Julian Chen, *Physics of solar energy* (Wiley, 2011)

Hong Kong Baptist University
Faculty of Science – Department of Physics

Course Content in Outline:

	Topic	**Hours**
I	Nuclear energy	15
	A. Physical principles of thermal nuclear power	
	B. Reactor kinetics and operations	
	C. Fuel cycle and waste management	
	D. Nuclear safety	
	E. Environmental concerns	
II	Solar energy	15
	A. Solar physics	
	B. Solar thermal energy	
	C. Solar cells and systems	
	D. Environmental impacts	
III	Special topics (for example, high efficiency solar cells, laser inertial fusion energy)	6