Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 4006 ADVANCED GREEN ENERGY LABORATORY (METROLOGY) (3,0,3)**

Course Aims: This laboratory course uses LabVIEW based software to perform experiments. The teaching mode includes lectures, lab exercises, and project-based experiments related to (i) energy harvesting; (ii) energy conversion efficiency; (iii) energy conservation; (iv) measurements of meteorological parameters and atmospheric constituents; (v) meteorological instrumentation; and (vi) characterizations of energy harvesting materials and solar cells.

Prerequisite: PHYS 3017 Green Energy Lab with Computers and Personal Mobile Devices or consent of instructor.

Course Reviewed by: Dr. Mau-hing Chan and Prof. Shu-kong So

Course Intended Learning Outcomes: (CILOs):

No.	**Upon successful completion of this course, students should be able to:**
1	Construct experiments using LabVIEW based software.
2	Interpret experimental data.
3	Demonstrate a practical skill to operate advanced scientific instruments.
4	Manipulate experiments and present information from raw data.
5	Manipulate experimental techniques.

Teaching & Learning Activities (TLAs):

CILOS	**TLAs will include the following:**
1 – 5	Lecture will address the desired learning outcomes. The instructor will provide electronic copies of lecture notes and supplementary materials.
1 – 5	Students will develop their practical skill by means of lab exercises and project-based experiments. LabVIEW will be the programming platform for the development.

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Assessment:

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous Assessment	100%	1 - 5	Continuous assessment includes lab exercises and a set of practical project-based experiments to achieve learning outcomes 1-6. Students will group into a team to conduct the designed experiments. After the experiments, students are expected to submit a group report, which is used to assess students understanding on the experiments.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (in hours)
Laboratory sessions – a set of practical experiments are designed for hands-on experience.	1 - 5	36

References:

1. Selected laboratory and operation manuals, textbooks and journal papers.

Course Content in Outline:
Experiments will vary from year to year. The mode of teaching and learning will be part lecture and part experiments. A set of experiments will be in the areas chosen from the list (not exhaustive) below:

	Topics	**Hours**
I.	Meteorological Parameters and Atmospheric Constituents.	6
	A. Air Temperature, Atmospheric Pressure, Relative Humidity, Windfield, UV Index, and Visibility	
	B. Spectroscopic Measurements of Water Vapor, Oxygen, Carbon Dioxide, Nitrogen Dioxide, Ozone, and Aerosols.	
	C. LIDAR	

II.	Solar Spectrum, Direct and Diffuse Solar Radiation	6
III.	Energy Conversion Efficiency	6
	A. Fuel Cell	
	B. Piezoelectric	
	C. Thermoelectric	
	D. Faraday Generator	
	E. Photovoltaic Cells (Inorganic and Organic	
IV.	Energy Harvesting in Daily Life	6
V.	Energy Conservation	6
VI.	Characterization of Energy Harvesting Materials	6
	A. Semiconductor Solar Cell	
	B. Polymer Solar Cell	
	C. Piezoelectric Materials	