Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 4055 ADVANCED EXPERIMENTAL LAB (3,0,3)**

Course Aims: By providing physics laboratory apparatus such as sensor/detector, accelerometer, and measuring devices, students design and set up their own experiments to implement assigned experimental tasks.

Co-requisite: PHYS 2018 Experimental Physics Lab I or PHYS019 Experimental Physics II, or PHYS3017 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	Enhance self-learning motivation in searching for literatures
2	Design experiments to implement physics problems and handle real world situations.
3	Design and perform measurements in the lab to quantitatively explore physical laws.
4	Interpret experimental data and error.
5	Organize scientific lab reports.

Teaching & Learning Activities (TLAs)

CILOs	TLAs will include the following:
1	Groups of students are assigned lab physics problems or real world physics problems. Students then search for literatures and suggest an experimental methodology to implement the assigned problems. Discussions between Instructor and Students are highly encouraged.
2 - 3	Students design and set up their own experiments to implement the assigned physics problems. Students may apply computer interfacing and programming techniques to handle the assigned physics problems.
2 - 4	By conducting experiments with their own setup, students will learn how to apply physics principles and laws to measure distinct quantities, and to analyze data to solve the assigned physics problems.
1, 5	By writing lab reports for the four individual experiments, students will practice and learn how to analyze experimental data and derive a sound scientific understanding of physical laws and modern technology.

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Assessment Methods (AMs):

No.	Assessment Methods	Weighting	CILOs to be addressed	Remarks
1	Continuous Assessment	50%	1-5	The continuous assessment includes the quality of literature review, experimental design to implement physics problems, data measurements during laboratory hours, and discussions with instructor.
2	Lab reports	50%	1-5	Written reports on experiments when clarity of presentation, quality of results, and answers to problems posed in the lab manual are graded.

Learning Outcomes and Weighting:

Content	CILO No.	Teaching (lab hours)
I. Experiments	1- 5	36

Textbook: No textbook, lab manuals provided.

References: No reference, lab manuals provided.

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Course Content in Outline:

	Topic	**Hours**
	Two selected from the following (but not limited to):	
I.	Vibration Analysis of Selected Vibration Sources	18
	Daily examples of vibration sources include human walking, moving vehicles, and machines in operations. Vibration analysis determines the physical characteristics of the vibration sources.	
II.	Solar Cell and Solar Concentrator	18
	To study working principles of solar cell and the use of solar concentrator or solar tracking platform to harvest solar energy.	
III.	Speed of Ultrasonic Sound in Solutions	18
	With the application of acousto-optic effect and measuring periodic refractive index grating in solutions by ultrasonic waves, the physical properties, such as salt concentration, of solutions can be characterized. In industry, this is a non-destructive testing method to characterize physical properties of liquid.	
IV.	Piezoelectric Effect and its Applications	18
	Physical properties of piezoelectric materials such as piezoelectric coefficient and resonant frequency will be studied. These parameters can be used for real applications such as piezoelectric energy harvesting converters and passive sensors in physics laboratory.	
V.	Characterization of Optical Diffraction Grating and its Applications	18
	Visible/IR spectroscopy has long been applied for characterization and identification of inorganic, organic, and biological materials. This experiment employs low-cost holographic diffraction grating film to produce diffraction patterns of different samples. Students will practice optical diffraction experimentally and apply diffraction equation.	
VI.	Microwave/Visible Michelson Interferometer	18
	Michelson Interferometer gives students practical applications of interferometer. Gravitational wave observation is currently a hot topic in physics, and the observation can be achieved by Michelson Interferometer.	