Hong Kong Baptist University
Faculty of Science – Department of Physics

Title (Units): **PHYS 2018 EXPERIMENTAL LAB I (1,0,3)**

Course Aims: By way of lecture and a series of experiments related to principles and application of physical laws, this practical course introduces Year 2 students to the basic concepts and methodologies behind experimentation. This lab course covers the topics on mechanical motion and thermodynamics.

Co-requisite: PHYS 2005 Heat and Motion or consent of instructor.

Course Reviewed by: Dr. Jue Shi and Dr. Mau Hing Chan

Course Intended Learning Outcomes (CILOs):

No.	**Upon successful completion of this course, students should be able to:**
1	Plan and perform measurements in the lab to quantitatively explore physical laws.
2	Produce the desired technological outcomes based on sound understanding of appropriate physics laws and principles.
3	Operate scientific instruments to acquire useful data.
4	Analyze experimental data and error, and assess different technologies.
5	Write a clear lab report.

Teaching & Learning Activities (TLAs)

CILOs	**TLAs will include the following:**
1, 4	Students will attend 1 lecture given by the instructor to learn the general concepts of experimentation and data processing, including error and statistical analysis.
1-5	By conducting four experiments either independently or in groups, students will learn how to apply principles and laws of physics to measure distinct quantities, and how to conduct experiments and analyze data to assess technological performance.
2, 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	Game scores	50%	1-3	In most experiments, students are asked to fulfill specific missions in the lab. These missions are carefully designed to test students' understanding of the physics principles behind natural phenomena and modern technology as well as their ability to use lab instruments.
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)	Teaching (lecture hours)
I. Data and error analysis for experimentation	1, 4		3
II. Experiments (4 in total)	1-5	24	

Textbook: No textbook, lab manuals provided.

References:
1. P.R. Bevington and D.K. Robinson, Data Reduction and Error Analysis, 3rd ed., McGraw-Hill 2003.
2. D. Halliday, R. Resnick, and K.S. Krane, Physics, 5th Ed., Vols. 1 and 2, Wiley, 2001.

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Course Content in Outline:

	Topic	**Hours**
I.	Data and error analysis	3
	A lecture to introduce basic concepts and methods to analyze experimental data and evaluate associated error.	
II	Experiments (four selected from the following)	24
	(a) Projectiles (6 hours)	
	To launch marbles onto target sites (1) on a plane, and (2) on elevated platforms	
	(b) Velocity Dependent Forces (6 hours)	
	To (1) simulate, on a computer, one-dimensional projectile motion in the presence of a drag force, and (2) perform free-fall measurements to determine the drag coefficient of air.	
	(c) Rotational Dynamics (6 hours)	
	To study the rotational dynamics of a disk spinning about a fixed axis.	
	(d) Flywheel (6 hours)	
	To study the working principles of using flywheel as an energy storage device.	
	(e) Wind Turbine (6 hours)	
	To study the mechanism and efficiency of wind turbine	
	(f) Heat transfer (6 hours)	
	To study the heat transfer process, measure the specific heat of different materials and investigate applications of heat transfer in utilizing thermal energy.	
	(g) Heat pump (6 hours)	
	To study the Coefficient of Performance (COP) of heat pump	
	(h) Thermal electric energy harvesting (6 hours)	
	To study the heat flow and thermal conductivity of different materials as well as application of these materials in thermal electric energy harvesting	