

PHY 2811 Physics Laboratory I

Course Description

This lab course is designed to help students develop basic skills used in experimental physics, including data acquisition, graph plotting, data analysis, error analysis and report writing. The experiments also illustrate the principles taught in the physics courses at the 2000-level.

Course Content

	Topics	Highlights of Fundamental Concepts
1.	Short test on error analysis	Experimental skill: error analysis (meaning of errors, statistical distribution, linear least square fit with error estimation by Excel, propagation of error)
2.	Lab 1: Water drop experiment	Physics: terminal velocity, Gaussian distribution, standard error. Equipment: electronic balance.
3.	Lab 2: Distance measurement with ultrasonic waves	Physics: ultrasonic wave, emission, reflection and detection; and distance measurement. Equipment: ultrasonic emitter and receiver, amplifier, conventional oscilloscope.
4.	Lab 3: Doppler Effect	Physics: Doppler Effect of ultrasonic wave; conservation of energy. Equipment: special setup (with simple pendulum, ultrasonic emitter and receiver), amplifier, digital oscilloscope.
5.	Lab 4: Torsional pendulum (two experiments)	Physics: torsional pendulum, moment of inertia, dimensional analysis. Equipment: torsional pendulum with wire & strips
6.	Lab 5: Cavendish's Experiment	Physics: Newton's universal law of gravitation, Cavendish's Experiment, and damped oscillator. Equipment: Cavendish's setup
7.	Lab 6: Frictional force on rolling objects	Physics: friction on rolling object. Equipment: Smart Timer, special setup
8.	Lab 7: Damped oscillator, forced oscillator and resonance (three experiments)	Physics: Damped oscillator, forced oscillator and resonance, solutions of second order differential equation, and initial condition. Equipment: LRC circuit, digital oscilloscope, digital multimeter, and LRZ meter.
9.	Lab 8: Vibrating string and superposition of waves	Physics: Superposition of waves in a vibrating string, Fourier analysis, forced oscillation, standing wave, resonance. Equipment: microphone, guitar, digital oscilloscope.
10.	Short test on use of equipment	

Learning Outcomes

1.	Learn basic skills used in experimental physics.
2.	Learn basic instrumentation in physics lab.
3.	Learn how to collect, analyze & handle (plot) data and estimate errors by Excel.
4.	Learn how to write a short report.
5.	Use experiments to illustrate the principles taught in the physics courses at the 2000-level.

Learning Activities

Lecture		Tutorial		Exercise Class and Assignment		Laboratory		Project / Report		Presentation		Case study		Web teaching		Other 1 (specify)		Other 2 (specify)		
(hr / week) in class out class		(hr / week) in class out class		(hr / week) in class out class		(hr / week) in class out class		(hr in total) in class out class		(hr in total) in class out class		(hr in total) in class out class		(hr / week) in class out class		(hr in total) in class out class		(hr in total) in class out class		
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NA	NA	NA	NA	NA	NA	M	M	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

M: Mandatory activity in the course O: Optional activity NA: Not applicable

	Learning Activity	Description
1.	Prelab exercises	Prelab exercises for each lab are given in lab manual. This homework will help clarify the lab content. Students are not required to hand in their homework. The solutions of Prelab exercises are available for download in the course page.

Assessment Scheme

	Component	Description	Weight
1.	Preparation	Write the first page of lab report before coming to lab	12%
2.	Performance	Performance in lab rated by TA	12%
3.	Lab report	The lab reports will be graded by the TAs and the graded reports will be returned to you. If you have enquiries concerning the grading, please feel free to contact me or the TAs.	56%
4.	Examination	One test on error analysis and one test on equipment	20%

Learning Resources

	Resource	Web link or ref no. in library
1.	Lab manual & Short Notes on Error Analysis	
2.	References are given for each experiment in lab manual	
3.	References for error analysis: Select one of the following books.	(all reserved at UL)
	(1) L. Kirkup, "Data Analysis with Excel"	Q180.55S7K57 2002
	(2) John R. Taylor, "An introduction to error analysis : the study of uncertainties in physical measurements"	QA275.T38 1982
	(3) L. Lyons, "A practical guide to Data analysis for physical science students"	QC33L9 1991
	(4) D.C. Baird, "Experimentation"	QC39B17 1995

Feedback for Evaluation

1.	Send email to the teacher, give him a call, or come to his office, especially for issues that require immediate action;
2.	express your views in the term-end course evaluation;
3.	express your views (or ask a student representative to help you convey the messages) in the staff-student consultation meeting held every year;
4.	post a message on the forum of the course website.

Course Schedule

	Topics	Week No.	Activities / Readings / References
1.		1	Distribution of lab manual & "Short Notes on Error Analysis". Prepare for Test 1.
2.	Short test on error analysis	2	Test. Prepare for Experiment 1.
3.	Lab 1: Water drop experiment	3	Do Experiment 1, write report and submit report in the same lab session. Prepare for Experiment 2.
4.	Lab 2: Distance measurement with ultrasonic waves	4	Do Experiment 2, write report and submit report in the same lab session. Prepare for Experiment 3.
5.	Lab 3: Doppler effect	6	Do Experiment 3, write report and submit report in the same lab session.
6.	Break		Prepare for Experiment 4.
7.	Lab 4: Torsional pendulum (two experiments)	7	Do Experiment 4, write report and submit report in the same lab session.
8.	Break		Prepare for Experiment 5.
9.	Lab 5: Cavendish's Experiment	10	Do Experiment 5, write report and submit report next week. Prepare for Experiment 6.

10.	Lab 6: Frictional force on rolling objects	8	Do Experiment 6, write report and submit report next week. Prepare for Experiment 7.
11.	Lab 7: Damped oscillator, forced oscillator and resonance (three experiments)	11	Do Experiment 7, write report and submit report next week. Prepare for Experiment 8.
12.	Lab 8: Vibrating string and superposition of waves (two experiments)	12	Do Experiment 8, write report and submit report next week. Prepare for Test 2.
13.	Short test on use of equipment	13	Test

Teachers' or TAs' Contact Details

Teacher's Name	Contact	Additional Information
WONG Hong Kuen Teacher	Office : SC 208 Tel. no. : 2609 6355 Email : hwong@phy.cuhk.edu.hk Office hr: half an hour before lab session	•
TA's Name	Contact	Additional Information
LEE Chung Kay Lab Manager	Office : SC 214 Tel. no. : 2609 6356 Email : ckleee@phy.cuhk.edu.hk Office hr: half an hour before lab session	•
TA's Name	Contact	Additional Information
WU Chin Nam Lab Technician	Office : SC 214 Tel. no. : 2609 6356 Email : cnwu@phy.cuhk.edu.hk	•
TA's Name	Contact	Additional Information
• To be arranged		

Academic Honesty and Plagiarism

Attention is drawn to University policy and regulations on honesty in academic work, and to the disciplinary guidelines and procedures applicable to breaches of such policy and regulations. Details can be found at <http://www.cuhk.edu.hk/policy/academichonesty/>.

1.	After the course registration, you are required to submit "Declaration of Honesty in Academic Work" declaring that you are aware of these policies, regulations and procedures. The form can be found at http://www.phy.cuhk.edu.hk/ .
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Facilities for Posting Announcements and Materials

1.	The course website (http://www.phy.cuhk.edu.hk/hkwong/phy2811/) contains the following useful information and resources: (a) The lab schedule, staff contact information, list of reference books, solutions of prelab exercises. (b) A notice board for announcements of important events (e.g. first meeting day, change of lab schedule). (c) A web forum for you to ask questions, discuss problems with teachers and classmates. You are also welcome to express your comments on the course in the forum. The password for this forum will be given to you in the first lecture.
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