PHYS1312 Honors General Physics I Fall 2024-25

1. Instructor (s) – Name and Contact Details

Name: Prof. LEUNG, Pak Wo
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2. Teaching Assistant (s) - Name and Contact Details

Name	**Duty**	**email**
LIU Man Fai Jerry		phymfliu@ust.hk

3. Meeting Time and Venue – Lectures, Tutorials/ Laboratory

Section	Date & Time	Venue
L1	WeFr 01:30PM - 02:50PM	Rm 5583, Lift 29-30
T1	Mo 06:00PM - 06:50PM	Rm 2404, Lift 17-18

4. Course Description - Credit Points, Pre-requisite, Exclusion, Brief Information/synopsis

PHYS 1111 and PHYS 1112 target students who have learned the most basic knowledge in physics in high

This course is a more in-depth version of PHYS 1112. It is intended to provide a solid foundation to students who wish to take more advanced physics courses in the future. Key topics include motions and Newton's Laws, work and energy, conservation of energy and momentum, rotation, rigid body, simple harmonic and damped oscillations, forced oscillations, standing waves and sound waves, kinetic theory and the laws of thermodynamics. Students without the prerequisite may seek instructor's approval for enrolling in the course. For students under the 4-year degree only.

Credit Points: 3

Pre-requisite: (Level 5* or above in HKDSE 1/2x Physics OR in HKDSE 1x Physics) AND (Level 5 or above in HKDSE Mathematics Extended Module M1/M2)

Exclusion: PHYS 1111, PHYS 1112

5. Intended Learning Outcomes

(State what the student is expected to be able to do at the end of the course according to a given standard of performance)

On successful completion of this course, students are expected to be able to:

1. Use Newton's laws of motion to solve simple dynamics problems.
2. Use the principles of conservation of energy and momentum to solve simple dynamics problems and problems with rotational motion, and explain common physical phenomena.
3. Explain physical phenomena unique to waves such as superposition, interference, formulation of standing waves, resonance, beats and Doppler effects.
4. Use kinetic theory to explain the properties of gases.
5. Use the first and second laws of thermodynamics to solve problems involving ideal gases.
6. Use scientific language to explain phenomena in the physical world.
7. Use calculus to analyze and solve physical problems.

6. Assessment Scheme

Online Homework	10%
Written Homework	10%
Midterm Exam	35%
Final Exam	45%

7. Student Learning Resources - Lecture Notes, Readings

Textbook:

University Physics Volume 1 Ch 1-20 W/MasteringPhysics, Edition 15
Author: Hugh D Young
Publisher: Pearson

8. Teaching and Learning Activities -
   a. Lectures: focus on …..
   b. Tutorials/Laboratory: focus on…..

9. Course Schedule
   a. Topics taught
   b. Weeks or dates of teaching specific topics (optional)

Lecture	Topic	Textbook Chapter (15e)	Demo
1 Wed Sept 4	Physical quantities, vectors & Motion in 2D - projectile	1, 3.1-3.3	Monkey and Hunter *
2 Fri Sept 6	Newton's laws of motion I - Relative Motion - Reference Frame - Newton's Three Laws	3.5, 4, 5.1, 5.2	1. Relative motion 2. Fan cart More Video Demos (not live in class): Ballistic Cart Inerial Ball
3 Mon Sept 9 (T1 timeslot)	Newton's laws of motion II - Friction - Circular motion	5.3, 3.4, 5.4	Vertical circular motion
4	Work and kinetic energy - work-energy theorem	6	

Wed Sept 11	- work done by a varying force		
5 Fri Sept 13	Potential energy and energy conservation - gravitational (mgh) and elastic PE - conservative and non-conservative forces	7	1. Maxwell's wheel 2. Energy stored in a spring
6 Fri Sept 20	Momentum, impulse and collision I - impulse-momentum theorem - conservation of momentum - elastic, inelastic, and completely elastic collision - rocket propulsion	8.1 - 8.3, 8.6	
7 Wed Sept 25	Momentum, impulse, and collision II - elastic collision - center of mass	8.4 - 8.5	1. Newton's cradle * 2. Velocity amplification* 3. Gaussian gun
8 Fri Sept 27	Dynamics of rigid bodies I - angular displacement, velocity and acceleration - rotational kinetic energy and moment of inertia - calculation of moment of inertial	9.1 - 9.6	Euler's disk
9	Dynamics of rigid bodies II - torque	10.1, 10.2, 10.3	Faster than g *

Wed Oct 2	- rigid body rotation about a moving axis		Maxwell's wheel*
10 Fri Oct 4	Dynamics of rigid bodies III - rolling without slipping - work and power in rotation motion	10.3, 10.4	1. Rotation of a spool* 2. Ring and disk* 3. Rolling vs sliding*
11 Wed Oct 9	Angular momentum - conservation of angular momentum - gyroscope	10.5 - 10.7 (excluding the calculation of the precession speed, starting from Eq. 10.33)	1. Conservation of angular momentum: Turn-table and wheel/dumbbells (a spinning physics professor) 2. Bicycle wheel gyroscope 3. Gyroscope
12 Wed Oct 16	Gravitation I - Newton's law of gravitation - gravitational force and potential energy - Kepler's laws of planetary motion	13.1 - 13.3, 13.5	
13 Mon Oct 21 (T1 timeslot)	Gravitation II - satellite motion - spherical mass distribution - apparent weight due to earth's rotation - black hole	13.4, 13.6 - 13.8	Gravity Well

14 Wed Oct 23	Periodic motion I - simple harmonic motion	14.1 - 14.3	
15 Fri Oct 25	Periodic motion II - various types of SHM, pendulum - damped and forced oscillations - resonance	14.4 - 14.8	1. SHM: Simple pendulum vs physical pendulum* 2.Resonance Wine Glass
16 Wed Oct 30	Wave motion and sound I - mathematical description of wave - power propagation - reflection of traveling waves	15.1-15.6	1. Slinky* 2. Wave motion demonstrator*
17 Fri Nov 1	Wave motion and sound II - standing wave - beat - Doppler effect - Sonic boom	15.7,15.8, 16.7-16.9	1. Standing waves 2. Beats 3. Beat animation
18 Wed Nov 6	Temperature and heat - thermal expansion - heat capacity and latent heat - heat transfer	17 (excluding thermal stress in 17.4)	

19 Fri Nov 8	Thermal properties of matter I - equation of state - kinetic theory of ideal gas	18.1-18.3	Kinetic theory
20 Wed Nov 13	Thermal properties of matter II - heat capacity of gases - molecular speed distribution -Phases of matter	18.4-18.5	
21 Fri Nov 15	First law of Thermodynamics I - first law of thermodynamics - heat and work in thermodynamic processes	19.1-19.4	
22 Wed Nov 20	First law of Thermodynamics II - typical thermodynamic processes - heat capacities of ideal gas under different conditions - adiabatic process of ideal gas	19.5-19.8	1. Adiabatic compression 2. Adiabatic Expansion (Formation of cloud in a plastic bottle)
23 Fri Nov 22	Second law of Thermodynamics I - heat engines and refrigerators - different forms of the second law	20.1 - 20.5	1. Stirling Engine * 2. Thermo-electric Converter*

	- reversible processes and Carnot cycle		
24 Wed Nov 27	Second law of Thermodynamics II -Carnot cycle and engine -Entropy and the second law	20.6, 20.7	
25 Fri Nov 29	Second law of Thermodynamics III -Entropy in reversible and irreversible processes -Microscopic definition of entropy	20.7, 20.8	

* Live demonstration in class