

PHY 2001 Introduction to Mechanics

Course Description

Particle kinematics and dynamics. Systems of particles and collisions. Rotational dynamics. Oscillations. Newton's law of gravitation. Fluid statics and dynamics. Wave motion.

Course Content

	Topics	Highlights of Fundamental Concepts
1.	Vectors	Vectors and scalars; the algebra of vectors (addition, dot and cross products); components of vectors; base vectors in rectangular and plane polar coordinates; position and displacement vectors.
2.	Particle kinematics and dynamics	(1) Motion in one, two, and three dimensions: Velocity and acceleration; motion with constant acceleration, projectile motion; velocity and acceleration in plane polar coordinates; uniform circular motion; solution of kinematical equations; relative motion. (2) Force and Newton's Laws, Particle Dynamics: Force and mass; Newton's laws; frictional force; dynamics of uniform circular motion; solution of equations of motion (constant and non-constant forces); drag forces and the motion of projectiles. (3) Work and energy, conservation of energy: Work done by a variable force in one- and two-dimensional spaces; kinetic energy; work-energy theorem; power; conservative forces; potential energy and force; conservation of mechanical energy.
3.	Systems of particles	Momentum; center of mass; conservation of linear momentum; variable mass problem; impulse; collisions in one and two dimensions; elastic and inelastic collisions; center of mass frame.
4.	Rotational dynamics	Rotational kinematics; angular velocity and acceleration; rotation with constant angular acceleration; kinetic energy of rotating rigid bodies; moment of inertia; torque; combined rotational and translational motion; angular momentum; conservation of angular momentum; gyroscope; equilibrium of rigid bodies.
5.	Oscillations	Simple harmonic motion; damped oscillation; forced oscillation; resonance; quality factor; two-body oscillations; reduced mass.
6.	Gravitation	Newton's law of gravitation; gravitational effect of a spherical body; gravitational potential; effective potential and energy diagram; equation of motion for planets and comets in plane polar coordinates; Kepler's laws.
7.	Fluids	Pressure; Archimedes' principle; surface tension; fluid flow and continuity equation; Bernoulli's equation; viscosity.
8.	Wave motion	Mechanical waves, traveling waves, interference of waves, standing waves.

Learning Outcomes

1.	Provide a solid understanding on Newtonian Mechanics, within a formalism using vectors and calculus.
2.	Provide necessary background to move on to Lagrangian and Hamiltonian mechanics in PHY3011.
3.	Appreciate the quantitative (exact) nature of physics.
4.	Build-up skills for solving relevant problems.
5.	Aware of complex/unsolved problems in classical mechanics and related fields.

Learning Activities

Lecture		Tutorial		Exercise Class and Assignment		Laboratory		Project / Report		Presentation		Case study		Web teaching		Other 1 (specify)		Other 2 (specify)	
(hr / week)		(hr / week)		(hr / week)		(hr / week)		(hr in total)		(hr in total)		(hr in total)		(hr / week)		(hr in total)		(hr in total)	
in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class	in class	out class
3	2			0.75	3				20										
M	M	NA	NA	M	M	NA	NA	NA	M	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.	Demonstrations	Some demonstrations on relevant phenomena will be conducted either in class or in a teaching laboratory.

Assessment Scheme

	Component	Description	Weight
1.	Homework	Continuous assessments include homework problem sets, short project, etc.	20%
2.	Mid-term Examination	The schedule and venue of the mid-term examination will be announced later.	30%
3.	Final Examination	The final examination will be centrally arranged by the university.	50%

Learning Resources

	Resource	Web link or ref no. in library
1.	[Textbook] R Resnick, D Halliday, and K S Krane, "Physics", Vol 1, 5th ed, John Wiley & Sons, 2002.	QA805.K62 1973
2.	D Kleppner and R J Kolenkow, "An Introduction to Mechanics", McGraw-Hill, 1973.	QC21.2.R47
3.	R Resnick, D Halliday, and J Walker, "Fundamental of Physics", 6th ed, John Wiley & Sons, 2001.	QC21.2.H35
4.	H D Young and R A Freedman, "University Physics", 9th ed, extended version, Addison-Wesley, 1996.	QC21.2 .S36 1996

Feedback for Evaluation

1.	Talk to the teacher after classes, send email to him, give him a call, or come to his office; especially for issues that require immediate action;
2.	express your views in the mid-term and 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.	Vectors	1	Lectures, relevant chapters in textbooks/Refs
2.	Particle kinematics and dynamics	2-4	Lectures, relevant chapters in text books/Refs; Demonstrations using an air track.
3.	Systems of particles	4-6	Lectures, relevant chapters in text books/Refs
4.	Rotational dynamics	6-8	Lectures, relevant chapters in text books/Refs; Demonstration using a yo-yo and demonstration on conservation of angular momentum.
5.	Oscillations	8-9	Lectures, relevant chapters in text books/Refs
6.	Gravitation	9-11	Lectures, relevant chapters in text books/Refs
7.	Fluids	11-12	Lectures, relevant chapters in text books/Refs
8.	Wave motion	12-13	Lectures, relevant chapters in text books/Refs; Demonstration on interference using two loudspeakers and a signal generator. Demonstration on diffraction using a laser and some apertures.

Teachers' or TAs' Contact Details

Teacher's Name	Contact	Additional Information
HARK Sui Kong Teacher	Office : SC 306 Tel. no. : 2609 6321 Email : skhark@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/academic honesty/>.

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/course/2009-2010/1/phy2001) contains the following useful information and resources: (a) All course materials, including lecture notes, homework, suggested homework solutions and projects. The password for download will be given to you in the first lecture. (b) A notice board for announcements of assignments, latest download, and important events (e.g. examination 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.
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