PHYaa 250: Mechanics, Fluids, Waves and Light

Fall 202

General Information

Class Schedule: Tuesday/Thursday 15:30 – 17:25

Class room: Ada Byron

Professor: Anabela Turlione

Contact: anabela.turlione@digipen.edu - int:1029

Class web page: PHY250 at distance.digipen.edu

Office hours: by appointment

Prerequisites

PHY200 Motion dynamics and MAT200 Calculus and Analytical Geometry II.

It will be assumed that the student has knowledge in Kinematics, Newtonian Dynamics, work and the law of conservation of energy. It will also be assumed that the student has some basic knowledge in calculus of derivatives, basic trigonometrical curves and operations, common geometrical relations, integral calculus and power series. The students should revisit the above topics before entering in deeper physics.

Description

This calculus-based course provides a fundamental understanding of clasical mechanics, fluid dynamics, oscillations, waves and optics. Attention will be paid to numerical applications that are relevant to simulations.

Course Objectives and Learning Outcomes

Upon a successfully completion of this course the students will gain a fundamental understanding of :

1. System of particles, particle collision. Rigid bodies. Rotational Kinetics and dynamics.

2. Main characteristic of fluids which will allow them to solve buoyancy problems and describe laminar flow with and without viscosity.

3. The causes of the oscillations and its mathematical description. The students will be able to find the frequency of simple and physical pendula as well as of an oscillating elastic body.

4. Creation and propagation of mechanical waves and its description through the wave equation.

5. Interferences between traveling waves, and their interferences templates.

6. The phenomena of standing waves and resonance. The students will learn to find the nodes and the harmonic frequencies of resonance.

7. The sound and the common effects of its propagation, Doppler effect, beats, etc.

8. Ray model of light, the foundations of ray tracers and the dual nature of the light.

Textbooks

- Physics for Scientists and Engineers, Prentice Hall 4th Edition, by Giancoli Chapters: 13-16, 32-34, 17-20 ISBN: $0 - 13 - 149508 - 9$

- Physics for Scientists and Engineers: Foundations and Connections with Modern Physics, by Deborah M. Katz, Cengage Learning 2017. Chapters: 9, 15-22, 35-38. ISBN: 978-1-305-85698-1

Optional Textbooks

University Physics, Addison-Wesley 9th Edition, by Young/Freedman ISBN: $0 - 201 - 57157 - 9$

Relation with other subjects

PHY250 closes PHY300.

Grading Policy

The breakdown of the weighting of the Total Score will be as follows:

1. Homeworks (30 %)

2. Mid term (30%)

3. Final exam (40%)

 The minimum grade to pass the subject is 60 %

Mechanisms and Procedures

1. Before the class: To optimize the learning experience and the efficient use of our time, reading the relevant book sections before the material is taught is recommended.

2. Attendance: attendance in class is mandatory. If you are absent for 2 weeks or more you are considered to have withdrawn from the course. If you decide to drop the course it is your responsibility to follow the correct procedures.

3. No food is allowed in class. I strongly recommend to take notes during the class.

4. Working problems is essential in mastering the material. There will be approximately an assignment every two weeks. At least, one of the assigments will be a programming assignments. Programming assignments must be submitted to Moodle before the deadline.

5. Late Policy: Late homework will not be accepted.

6. Please fell free to send me an email whenever you need help.

7. A calculator is required for tests and homework. You can use any programming calculator without an Internet connection during any test or exam.

8. All exams are closed book. As this course is about understanding and not memorization, one sheet of notes is permitted for an exam with the formulas you consider. This sheet of notes must be handwritten by you, and no larger than a 'normal' (DIN4) piece of paper. Front and back of the page may be used.

9. Missing a test without a timely, valid excuse will result in a 0 score for the test. There are NO make up exams unless you have a compelling and well documented reason for missing a test. Notice that make ups are only considered under relevant medical, familiar or administrative situations that cannot be postponed.

Rubrics and Assessment

To get full credit you need to show all the important steps of your work which are:

1. Do a drawing of the schedule/body diagram in each problem.

2. Indicate the law/theory applied (or your reasoning).

3. Develop your calculus. The level of detail required is what your colleagues would need to see in order to understand your solution, without having to work it out for themselves.

4. Give the solution, specifying the unit of each magnitude and the direction of them (it's a vector). A penalty of 10

- Before submitting an assignment your grade is a 0, not a 100. This means that you obtain points for doing things right, and I do not subtract points from that non existing 100.

- Partial credit will be given only if your work is clearly presented and mostly correct.

- If the process that you follow is correct but you arrive to a conclusion that is totally inconsistent with the theory learned in class, you will get a zero in that exercises with the note "misconception" attached.

- If an error is accumulative along an exercise, that will not penalize the rest of the exercise unless this means inconsistency with the theory learned in class.

- Any material covered in the course is valid for testing, including concepts covered in lecture, homework, or other communications and/or assigned work (as reading the textbook).

- No messy tests/homework will be graded.

Relevance/Statement

It is important to keep up with the material, to study regularly at home (at least 2 hours for every hour in class) and to do as many problems as you can (don't limit yourself to the assigned or recommended problems, or merely the problems that are due).

You are welcome to work with other students, so long as the aim is furthering your understanding of the concepts and problem solving techniques. I am happy to help work through problems, either in office hours or in class. Just remember, doing a problem yourself is very different from watching another person do so. If you work together on problem sets, be sure to provide your own solution to every problem proving that you understand your writing. In addition, some exam questions may be a resemblance to homework questions, so you're encouraged to fully understand what you turn in. Again, reading the relevant book sections before the material is taught is highly recommended.

Last Day to Withdraw: 1st November

Academic Integrity Policy

Academic dishonesty in any form will not be tolerated in this course. Cheating, copying from any sources (including current or past students work, online sources or books), plagiarizing, or any other form of academic dishonesty (including doing someone else's individual assignments) will result in, at the extreme minimum, a zero on the assignment in question, and could result in a failing grade in the course or even expulsion from DigiPen. Assisting others in cheating is prohibited and will be equally punished.

Disability Support Services

If students have disabilities and will need formal accommodations in order to fully participate or effectively demonstrate learning in this class, they should contact the Administration Office at 946365163. The Administration Office welcomes the opportunity to meet with students to discuss how the accommodations will be implemented. Also, if you may need assistance in the event of an evacuation, please let the instructor know.

Outline and Tentative Dates

Timeline	Topic	HW	Approximate book Section
Week 1	Conservation of Linear Momentum. Impulse and Collisions		Ch 9
Week 2	Center of Mass (CM). Translation of CM	HW 1	Ch 9
Week 3	Rotational Kinematics. Torque and Rotational Dynamics		Ch 10-11
Week 4	Rigid Bodies and Inertia	HW 2	Ch 11
Week 5	Rolling. Angular Momentum Conservation of Angular Momentum		Ch 11
Week 6	Static Equilibrium, Elasticity	HW 3	Ch 12
Week 7	Fluids mechanics: Density, Pressure and Pascal Principle, Buoyancy and Archimedes Principle		Ch 13
Week 8	Flow, Equation of Continuity, Bernoulli's equation Surface Tension, Viscosity, Poiseuille's equation, Drag forces **MIDTERM**	HW 4	Ch 13
Week 9	Fluids Oscillations: SHM (Math equation, change of phase)		Ch 14
Week 10	Energy of SHM, Potential Diagram. Simple Pendulum. Physical Pendulum. Oscillations in 2D, DHM, Resonance	HW 5	Ch 14
Week 11	Waves: Wave Motion, Mathematical Representation Traveling Waves, Longitudinal and Transversal Waves		Ch 15
Week 12	Energy on a Wave. Principle of Superposition. Interference, Standing Waves	HW 6	Ch 15
Week 13	Sources of sound: Resonance. Sound I: Intensity (dB), Sound Level, Ear Response. Beats. Sound II: Doppler Effect, Shocks Waves.		Ch 16
Week 14	Light Reflection: Plane Mirror, Spherical Mirror. Light Refraction: Snell's Laws, spherical refraction. Thin lenses, ray tracing. Difraction.	HW 7	Ch 16, Ch 32
Week 15	**FINAL EXAM**		

[This entire syllabus, particularly the time line, may be adjusted or changed at any time by the instructor.]