Syllabus for PHYS 2231 (Honors Physics I)

Course description:

This 5 credit hour course covers fundamental topics in Classical Mechanics. It is the Honors version of PHYS 2211, intended for students who want a more rigorous treatment of the subject matter. The course is designed for physics majors and very curious engineering/science students. Topics include Vectors and Kinematics, Newton's Laws, Particle Dynamics, Conservation Laws, Rotational Dynamics, Gravitation and Orbital Motion, and Oscillations. In addition to the lectures, the course includes a laboratory component. Two-thirds of the scheduled weekly Lab contact hours are devoted to conventional laboratory experiments, whereas one third of the contact hours are used for Problem Solving Studio sessions, in which students work collaboratively to identify essential physics concepts in a variety of contextual situations, and to formulate a systematic, organized solution to the problem identified.

Course learning outcomes:

Students who successfully complete this course will know how to quantitatively describe and analyze the motion of point objects and extended bodies, and how to apply Newton's Laws of Motion and fundamental conservation laws to problems of classical mechanics.

Required course materials:

Physics, Volume 1 (Fifth Edition), by Halliday, Resnick and Krane.

Chapters 1—14 and 17 will be covered in the course.

Tentative Lecture Schedule

Lecture day #	Topic	Reading (book chapters)
1	Intro, Elapsed Time, Position, Displacement	1.1 – 1.7
2	Vectors & Components	2.1 – 2.2
3	Vector Operations; Vector Change	handouts
4	Vector Kinematics, Uniform Motion	2.3 – 2.4
5	Uniformly Accelerated Motion, Free Fall	2.5 – 2.6
6	First & Second Laws of Motion	3.1 – 3.5
7	Third Law Law of Motion, Gravity, Weight & Apparent Weight	3.6 – 3.8
8	Motion in 3D; Projectiles	4.1 – 4.3
9	Drag Forces	4.4

10	Circular Motion	4.5
11	Relative Motion	4.6
12	Tension & Normal Forces	5.1 – 5.2
13	Friction, Forces in Circular Motion	5.3 – 5.3
14	Test 1 (on material from chapters 1 – 4)	
15	Pseudoforces	5.5 – 5.7
16	Linear Momentum, Impulse-Momentum Theorem	6.1 – 6.3
17	Momentum Conservation	6.4 – 6.5
18	Momentum Conservation: calculated examples	6.4 – 6.5
19	Extended Bodies and Systems of Particles	7.1 – 7.5
20	Center of Mass Calculations	7.4 – 7.5
21	Momentum Conservation in Systems with Variable Mass	7.6
22	Rotational Kinematics	8.1 – 8.4
23	Torque	8.5 – 8.6, 9.1
24	Rotational 2nd Law, Equilibrium Applications	9.2 – 9.5
25	Nonequilibrium, Coupled Rotation and Translation	9.6 – 9.7
26	Angular Momentum	10.1 – 10.3
27	Angular Momentum Conservation, Gyroscope	10.4 – 10.6
28	Work and Power	11.1 – 11.4
29	Test 2 (on material from chapters 5 – 9)	
30	Work in 2D; Work by Variable Forces, Springs	11.4 – 11.5
31	Work-Kinetic Energy Theorem	11.6 – 11.8
32	Potential Energy, Conservation of Mechanical Energy	12.1 – 12.3
33	Example Problems, Energy Diagrams	12.4 – 12.6
34	Work & Internal Energy for a System	13.1 – 13.3
35	System Energy and Center of Mass Energy	13.4 – 13.7
36	Simple Harmonic Motion	17.1 – 17.4
37	Simple Harmonic Motio: Examples	17.5 – 17.6
38	Test 3 (on material from chapters 10 – 13)	
39	Damped Oscillation, Forced Oscil. & Resonance	17.7 – 17.8
40	The Universal Law of Gravitation	14.1 – 14.4
41	Gravitational Potential Energy	14.5 – 14.6
42	Orbital and Two-Body Central Force Motion	14.7 – 14.9
43	Course Conclusion	

Grading policy:

The total course score will be calculated from scores on individual course deliverables using the following weights:

Final Exam - 25 %

Weighted average of 3 tests - 45 % (strongest individual test score: 20%, second strongest: 15%, weakest: 10%)

Labs:

- Laboratory attendance and lab reports - 10%
- Problem Solving Studio - 5%

Homework + Participation - 15%

- Homework assignments - up to 12 points (with homework + participation capped at 15 points)
- Class participation - up to 6 points (with homework + participation capped at 15 points)

(Sum: total weight of 100%)

The achieved percentage score will translate to the following letter grades

Letter grade: Percent

A: 90 or more

B: 80-89

C: 70-79

D: 60-69

F: 59 or less

Attendance policy:

Lab: Attendance in the lab is a course requirement. To pass this course, students must pass the laboratory portion with an average of 60% or more. Two unexcused absences from lab will result in an automatic deduction of 20% from your final lab average. Three unexcused absences from lab will result in automatic failure of the lab, and therefore, of the course.

Lectures: Irregular attendance of the lectures will lead to a poor participation grade.

Tests: An unexcused absence during a test will result in a test score of 0. If a student misses a test, and the absence is excused (by the Student Academic and Financial Affairs Committee of the Academic Senate or by the instructor on the recommendation of the

Dean of Students), the missing grade will be marked as "excused" and replaced by the final exam grade at the end of the semester.

Academic honesty/integrity statement:

Students are expected to maintain the highest standards of academic integrity. All work submitted must be original. Plagiarism, cheating, or any form of academic dishonesty will result in immediate consequences as outlined in the university's academic integrity policy.

Core IMPACTS statement(s) (if applicable):

This is a Core IMPACTS course that is part of the Technology, Mathematics & Sciences area.

Core IMPACTS refers to the core curriculum, which provides students with essential knowledge in foundational academic areas. This course will help master course content, and support students' broad academic and career goals.

This course should direct students toward a broad Orienting Question:

- How do I ask scientific questions or use data, mathematics or technology to understand the universe?

Completion of this course should enable students to meet the following Learning Outcome:

- Students will use the scientific method and laboratory procedures or mathematical and computational methods to analyze data, solve problems and explain natural phenomena.

Course content, activities and exercises in this course should help students develop the following Career-Ready Competencies:

- Inquiry and Analysis
- Problem-Solving
- Teamwork