PHYSICS 130 FALL 2004 MWF 12:00-12:50

GENERAL PHYSICS I

Description: Study of mechanics, fluids, material properties and vibrations. Emphasis will be placed on applications in the biological and medical sciences.

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Office Hours: MTWF 10:00 - 10:30 a.m. & M-F 1:00 – 1:30 p.m. Feel free to come by at any other time too! If I'm in, I'll be happy to address any questions or concerns you may have.

Textbook: Physics by J.D. Cutnell & K.W. Johnson, 6th edition (John Wiley & Sons). Copies of the text are still available in the bookstore.

Website: URL: http://knowledge.udmercy.edu/. On the website, you can access the lecture notes, solutions to assignments, general course information, as well as online quizzes!

Lectures: MWF 12:00 - 12:50 p.m. and F 2:00 - 2:50 p.m. A tentative syllabus for the semester is provided, which may be revised during the semester. The Friday discussion sessions will be set aside for problem solving purposes only. Attendance is not compulsory.

Prerequisites: There are no formal prerequisites for this course. However, you are expected to be familiar and comfortable with arithmetic and algebra, including trigonometric functions, ratios, solutions of simple simultaneous equations etc.

Objectives: This course is designed to help you learn how to describe the motion of solid and fluid objects (kinematics) using graphs, pictures, equations, and words. You will also learn to analyze what causes objects to move (dynamics) and the effects of motion. Finally, you will study the different ways (rotation, translation, deformation etc) by which objects can be moved, deformed etc.

Outcomes: Through this course, you should able to

1. Be able to use and inter-convert between the SI and cgs systems of units.
2. Describe and/or analyze motion of objects through kinematic graphs.
3. Apply kinematic equations to solve problems on straight-line and rotational motion.
4. Identify various forces (gravitation, friction, normal forces, tension) acting on objects in a given situation and draw free-body diagrams to depict the vectors for these forces.
5. Solve equilibrium and non-equilibrium problems on straight-line motion using Newton's Laws and free-body diagrams.
6. Calculate torques, moments of inertia and angular momenta for rotating objects.
7. Apply the equations for mechanical equilibrium to solve problems on rigid body motion.
8. Calculate work done on objects and apply the principle of conservation of mechanical energy to solve problems in particle motion.
9. Solve collision problems in one-dimension using the law of conservation of linear momentum.
10. Apply Pascal's and Archimedes problems to problems in fluid statics
11. Calculate fluid pressure, densities and velocities using Bernoulli's principle and the equation of continuity for fluid motion.
12. Solve problems in deformation of objects due to applied forces and temperature changes.

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Homework: Problems sets will be assigned every week. Some of the problems may appear verbatim on the exams. Therefore, it is in your best interest to understand and solve the homework problems. Homework is due at class time. **LATE ASSIGNMENTS WILL NOT BE ACCEPTED!** Homework constitutes 25% of your final grade. See the attached sheet for all the relevant rules on homework assignments.

Readings: It is essential that you come prepared for class by doing the necessary reading and ***completing a short reading assignmen***t. Assignments must be completed online on the course website. You will be asked to answer three short questions based on the reading. ***Assignments must be submitted by 9:00 a.m. the day of clas***s. Late submissions will not be accepted. Answers to assignments will be graded on a two-point scale (2 = satisfactory; 1 = needs improvement; 0 = unsatisfactory or not submitted). Your grade will reflect your participation, conscientious effort and level of preparation for class. The assignments constitute 10% of your final grade.

Participation: Attendance and participation in in-class discussions and online exercises is very important. Without this, you cannot hope to gain much from this course. I may take attendance in class from time to time! Every two unexplained absences will cost you 1% of your grade up to a maximum of 5%. Class participation will be worth 5% of your final grade. Good participation involves:
a) Coming to class on time and staying till the end of class.
b) Acting in a responsible, respectful and courteous manner while in class.
c) Actively participating in in-class discussions and activities, as well as online quizzes.

Exams: The course will include two in-class one-hour exams and a final one-hour exam as scheduled by the university. The total exam grade will be 60%. It will be distributed as follows: Highest exam score: 25%; Next best score: 20%; Lowest score: 15%. As a rule, exams given later in the semester will expect you to remember important concepts presented earlier in the semester!

Exam Dates: Exam #1 - Monday, 10/11
Exam #2 - Monday, 11/8
Exam #3 - Thursday, 12/16, 11:00 a.m. – 12:50 p.m.

Grading:

90-100 : A	78-81 : B	63-67 : C-
86-89 : A-	73-77 : B-	58-62 : D
82-85 : B+	68-72 : C	<58 : F

Remember:

September 13	: Last day to add a class
October 1	: Last day to drop a course without a "W"
October 26	: Mid-term grades due
November 22	: Last day to withdraw from class

Honesty: The fundamental assumption under which the University operates is that work submitted by a student is the product of her or his own legitimate efforts. In other words, make sure the assignments (homework, exams etc) you submit reflect your own work! Any student suspected of cheating or plagiarism will be dealt with according to the policy set out in the Engineering and Science Student Handbook.

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Course Syllabus

DATE	TOPICS	SECTIONS
Week 1: 9/6		
Monday	Labor Day Holiday	
Wednesday	Overview of the Course	
Friday	Units & Measurements	1.1-1.5
Week 2: 9/13		
Monday	Vectors	1.6-1.8
Wednesday	Displacement & Distance	2.1
Friday	Speed & Velocity	2.2
Week 3: 9/20		
Monday	Acceleration & Equations of Kinematics	2.3-2.4
Wednesday	Application of Kinematic Equations	2.5-2.6
Friday	Displacement, Velocity & Acceleration in 2D	3.1-3.2
Week 4: 9/27		
Monday	Introduction to Dynamics	4.1
Wednesday	Newton's 1^{st} Law	4.2
Friday	Newton's 2^{nd} Law	4.3-4.4
Week 5: 10/4		
Monday	Problem Solving	
Wednesday	Newton's 3^{rd} Law	4.5
Friday	Applications & Examples	4.11-4.12
Week 6: 10/11		
Monday	**Exam #1**	
Wednesday	Gravitational Force	4.6-4.7
Friday	Frictional Forces	4.9
Week 7: 10/18		
Monday	Normal Forces & Tension	4.8 & 4.10
Wednesday	Impulse	7.1
Friday	Definition of Linear Momentum	7.1

Course Syllabus (continued)

DATE	TOPICS	SECTIONS
Week 8: 10/25		
Monday	Conservation of Linear Momentum	7.2
Wednesday	Application to Collision Problems	7.3
Friday	The Definition of Work	6.1
Week 9: 11/1		
Monday	Work-Energy Theorem & Kinetic Energy	6.2
Wednesday	Energy in Various Forms: Potential Energy	6.3-6.4
Friday	Conservation of Mechanical Energy	6.5
Week 10: 11/8		
Monday	**Exam #2**	
Wednesday	Rotational Kinematics	8.1-8.3
Friday	The Definition of Torque	9.1
Week 11: 11/15		
Monday	Torque and the Conditions for Equilibrium	9.2
Wednesday	Center-of-Mass & Center-of-Gravity	7.5 & 9.3
Friday	Newton's 2nd Law for Rotation	9.4
Week 12: 11/22		
Monday	Angular Momentum	9.6
Wednesday	Definition of Density & Pressure	11.1 & 11.2
Friday	Thanksgiving Break	11.3 & 11.4
Week 13: 11/29		
Monday	Pressure and Depth in Static Fluids	11.5
Wednesday	Pascal's Principle & Applications	11.6
Friday	Archimedes Principle & Applications	
Week 14: 12/6		
Monday	Fluids in Motion: Equation of Continuity	11.7-11.8
Wednesday	Bernoulli's Equation	11.9
Friday	Applications & Examples	11.10
Week 15: 12/13		
Thursday 12/16	**Final Exam: 11:00 a.m. - 12:50 p.m.**	

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Homework Assignments

Introduction: Problems sets will be assigned every week. Some of the problems may appear verbatim on the exams. Therefore, it is in your best interest to understand and solve the homework problems. Homework is due at the beginning of class. Be sure to hand in your assignments on time because **LATE ASSIGNMENTS WILL NOT BE ACCEPTED!** Homework constitutes 25% of your final grade.

Requirements: The following rules apply for homework assignments

- Students can work on homework assignments individually or in teams of two. Each student in a team will receive the same grade for the assignment.
- Homework should be submitted using the specific type of paper required. This paper is called *engineering paper* and is available in the campus bookstore. Assignments submitted on any other paper will not be accepted.
- You will be using only one side (the non-ruled side) of the paper. DO NOT write on both sides of the paper because that will make it impossible for me to read.
- Each homework problem should be solved in the specific format provided. Failure to do so will result in a failing grade for that assignment.
- Your solution to each homework problem should begin on a new page.
- It is your responsibility to hand in a neat, complete, and stapled assignment on time! No excuses will be allowed.
- The lowest score will be dropped in calculating your grade.

Homework Grading

Each Problem Set will be graded out of 20 points. The grading philosophy for problem sets is explicitly designed to reward effort and good thinking skills. Each problem will be graded as follows:

4: Solution is complete and well written
3: Solution is missing some minor parts or important conceptual explanations
2: Solution is missing major parts and has few conceptual explanations
1: Solution is incoherent and reflects less than average effort
0: Solution to required problem was not submitted

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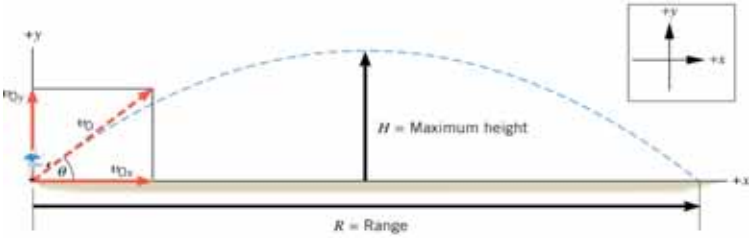
Sample Homework Solution

Ques: Suppose a golf ball is hit off the tee with an initial velocity of 30.0 m/s at an angle of 35^0 to the horizontal. a) What is the maximum height reached by the ball? b) What is its range? Note: You need **NOT** type in the question when you are doing your assignment)

Ans:

Diagram:



Given:
Initial velocity, $v_0 = 30.0$ m/s
Angle with horizontal, $\theta = 35^0$
Acceleration in the y-direction (vertical), $a_y = -g = -9.8$ m/s^2

Find:
a) Maximum height reached, $y_{max} = ?$
b) Range of the golf ball, $R = x_{max} = ?$

Reasoning:
a) When the ball passes through the maximum height, the vertical component of its velocity is changing from positive ("going up") to negative ("going down"). Therefore, the vertical velocity of the ball at the maximum height is zero, $v_y = 0$. Combining this data with the ball's initial vertical velocity, v_{y0}, and acceleration in the vertical direction, we solve for the maximum height.

Solution:
$v_{y0} = v_0 \sin\theta = 30.0$ m/s $(\sin 35^0) = 17.2$ m/s
$v_y^2 = v_{y0}^2 + 2\, a_y\, y_{max}$ => $0 = (17.2\text{m/s})^2 - 2(9.8\text{ m/s}^2)\, y_{max}$ => $\mathbf{y_{max} = 15.1\ m}$

Then, do the same for part b)…