Spring 2015: PHYSICS 170 – GENERAL PHYSICS I

MWF 11:30-12:20 am (Section 3-5) WAT 420
Instructor: Milincic Radovan (milincic@hawaii.edu)
Office hours (tentative): MW 10:25–11:30 PSB 204

Course description:
This course is a calculus-based introduction to general physics, covering the mechanics of particles and rigid bodies, wave motion, thermodynamics and kinetic theory. The primary goals of the course are to gain a solid understanding of fundamental physical principles and their mathematical expression, as required for applications in the physical sciences and engineering, and to introduce and develop the application of mathematics as the basic language of physics. While these goals are achieved in part through the working of assigned problems, the
course is not one in problem-solving techniques. Indeed, advances in the physical sciences can be realized only by properly recognizing and formulating new problems in the first place. And to perceive and tackle new problems, it is a solid understanding of fundamental physical and mathematical principles which is critical.

Prerequisites:
MATH 242 or concurrent, or MATH 252A or concurrent. (MATH 216 with consent.)

Textbook (required):
Young and Freedman, *University Physics, Volume 1*, 13th ed., Pearson Addison-Wesley, SanFrancisco, 2012.

Course Website: https:/laulima.hawaii.edu

Internet (required):
This course uses the online resource *Mastering Physics*TM for homework assignments.
iClickers (required): Available at the UH Bookstore.

Grade distribution:

*Mastering Physics*TM Homework	: 3% BONUS
Chapter Homework	:5%
iClickers	: 2% BONUS
Recitation	: 15%
Midterm Exams (25% each)	:50%
Final Examination	:30%

Grade assignment:

	A+ 93 >	B+ 81–85	C+ 66–70	D 50–55
(*approximate*)	A 89–93	B 74–80	C 60–65	F < 50
	A– 86–88	B- 70-73	C– 56–59	

COURSE OUTLINE:

Week	*Text section* *Lectures*	Exer. # *Chapter*	*Homework*
1.	Chapter 1	HW	Ch 1: 11, 35, 39, 47, 68
2.	Chapter 2: secs. 1-5 Chapter 3: secs. 1-2	HW	Ch 2: 8, 18, 23, 31, 40
3.	Chapter 3: secs. 3-5 Chapter 4	HW HW	Ch 3: 3, 7, 19 , 30, 33 Ch 4: 7, 10, 14, 24, 28
4.	Chapter 5	HW	Ch 5: 6, 18, 34, 42, 46
5.	Chapter 6	HW	Ch 6: 10, 14, 28, 32, 58
F	**MIDTERM 1 Chapters 1-5 -- **calculator allowed ****		
6.	Chapter 7	HW	Ch 7: 3, 9, 15, 26, 36
7.	Chapter 8: secs. 1-5	HW	Ch 8: 6, 10, 22, 31, 50
8.	Chapter 9: secs. 1-5	HW	Ch 9: 3, 16, 24, 36, 49
F	**MIDTERM 2 Chapters 6, 7 and 8 -- **calculator allowed ****		
9.	Chapter 10: secs. 1-5	HW	Ch 10: 3, 17, 34, 38, 43
.	Chapter 11: secs. 1-3	HW	Ch 11: 5, 15, 18, 20, 22
10.	Chapter 12: secs. 1-5 Chapter 13: secs. 1-2	HW	Ch 12: 4, 9, 15, 31, 44
11.	Chapter 13: secs.3-5 Chapter 14: secs.1-3	HW	Ch 13: 9, 15, 18, 25, 36
12.	Chapter 14: secs.5-8 Chapter 15: secs.1-4	HW	Ch 14: 9, 31, 34, 45, 62
13.	Chapter 15: secs.5-8 Chapter 16:	HW HW	Ch 15: 6, 13, 22, 26, 49 Ch 16: 5, 11, 13, 30, 43

14.	Chapter 17: Chapter 18: secs.1-4	HW Ch 17: 9, 15, 33, 38, 70

F **MIDTERM 3 Chapters 9—16 -- **calculator allowed **

15.	Chapter 18: secs. 5,6 Chapter 19:	HW Ch 18: 2, 23, 35, 42, 52 HW Ch 19: 6, 11, 22, 29, 36
16.	Chapter 20: secs. 1-3, 5-7 Review	HW Ch 20: 4, 14, 18, 21, 31

FINAL EXAM -- TBD * calculator allowed *

This Schedule is subject to Change

Homework Assignments:

*Mastering Physics*TM Homework assignment (~ 2 problems) will be assigned from the *Mastering Physics* website (required). Some of the homework may involve simple calculations or be of conceptual nature.

Mastering Physics course code: MPMILINCIC47458

Written weekly problem set (consisting of problems from Exercises and Problem section) will be due each Monday at the start of the class. Please submit solutions that are clear and detailed in addition to being correct.

Guidelines for Weekly Problem Sets

For presentation:

1. Solutions should be written in complete and proper English.
2. Proper units must accompany all final numerical results.
3. Draw diagrams whenever possible, and label them clearly.
4. Do not insert numerical values until the *final step* in a calculation.

(Physics is learned symbolically. If you simply insert numbers at the start of a calculation and crunch
away, nothing will ever make sense.)

In general:

5. Regarding significant figures: *Do not round the results of any intermediate calculations … ever!* Leave at least three significant figures when reporting numerical results.

6. Form the habit of checking the dimensions of any equations that you derive. Many times, this simple
exercise will reveal whether you made an error somewhere along the line.
7. If possible, ask yourself whether an answer makes sense physically.

MIDTERMS:

Three in-class 50-min. midterms will be given during the term. If you miss a midterm and have a documented, valid reason for doing so, please come and discuss it with me as soon as possible. It is not enough just to send an e-mail message about your absence from a midterm. You must state in writing why you missed a midterm (the form to fill out is at the end of the syllabus). A single make-up midterm will be given toward the end of the term. If I get nothing in writing from you, a score of zero will be assigned for the midterm you missed.
A one week notice will be given for each test

(**NOTE**: **If you are going to be away on a scheduled UH-related activity and miss a midterm, it is your responsibility to discuss it with me at least two weeks before such an expected absence.)**

FINAL EXAM:

The final exam is comprehensive – it will be based on all the subject material covered in the course. However, the material covered during the second half of the term is given more emphasis.

Student Learning Objectives

After completing this course, students will be expected to be familiar with the following:
• the general differential relationships between the kinematic quantities: position , velocity , acceleration
• the specific relationships between these quantities for the case of [*a* = constant]
• the graphical representations of these quantities, e.g. [*a* = constant] on a *v*-*t* curve
• the definition and physical significance of a SCALAR quantity
• the definition and physical significance of a VECTOR quantity
• the vectorial nature of displacement, velocity, and acceleration, and the differential relationships between them
• that all fundamental physical relationships (studied in this course) are expressed mathematically either as [SCALAR = SCALAR] or [VECTOR = VECTOR]; and the meaning of these equations
• Newton's First, Second, and Third Laws
• the definition and physical significance of an inertial reference frame
• how to determine which forces are acting on an object, and how to depict them in a free-body diagram, e.g. weight, tension, normal force, etc.
• how to resolve the components of the depicted forces in a chosen coordinate system

• how to apply and solve $F = ma$; e.g. how to obtain the acceleration a from the given sum of forces F ; or how to determine the magnitudes of unknown forces for the case in which a is known, eg. due to constraints
• how to apply Newton's Third Law when two or more objects interact with each other
• how to determine the direction and magnitude of the frictional force
• the nature and analysis of centripetal acceleration and motion in a circle
• the definition of work done by a force F on an object which moves along a path r ,
• the physical significance and the mathematical definition of the dot product
• the WORK-ENERGY theorem and the definition of kinetic energy K
• the significance of the potential energy function U for a conservative force
• the definition of total mechanical energy Emech = $K+U$
• how to determine the total mechanical energy of a system of two or more objects, e.g. to find *all contributions* to the potential and kinetic energy
• the contributions to the total energy of a system
• the Law of Conservation of Energy
• the definition of the center of mass
• The PHYSICAL SIGNIFICANCE of the center of mass
• the definition of momentum of a particle and system of particles
• the VECTOR NATURE of momentum
• Newton's Law in terms of momentum
• the *Law of Conservation of Momentum;* application to rocket propulsion
• the fundamental relation between *Newton's Third Law* and the *Law of Conservation of Momentum*
• the distinction between an elastic and inelastic collision
• the application of the Laws of Conservation of Momentum and Energy in the analysis of collisions
• the kinematic description of rotation in terms of the *angular position* , *angular velocity* , and *angular*
acceleration, and the differential relations between them
• the relationship between the angular variables and the linear variables along the arc
• the definition of the MOMENT OF INERTIA of a particle or rigid body
• the rotational kinetic energy of a rigid body about a specified axis of rotation
• the definition of the TORQUE of a force *with respect to a specified axis*
• Newton's Law for Rotation *with respect to a specified axis*
• the vector nature of rotation
• the definition of the CROSS PRODUCT of two vectors A and B
• the algebraic properties of the cross product
• the definition of angular momentum *about a point*
• Newton's Law for rotation of a *system of particles*
• the Law of Conservation of Angular Momentum and its application
• Kepler’s laws of planetary motion
• Newton’s universal law of gravitation,
• analysis of circular orbits, orbital energy, and escape velocity
• the importance of simple harmonic motion in physics
• the mathematical description of simple harmonic motion and oscillations
• the physical nature of waves and wave motion

- the mathematical description of waves and the wave equation
- the superposition principle
- the analysis of harmonic waves and wave energy
- the concept of thermal equilibrium
- the definition and measurement of temperature; the zeroth law of thermodynamics
- the kinetic theory of gases and the ideal gas law
- the concept of state variables and the use of state diagrams (eg. *P*-*V*)
- conservation of energy and the First Law of thermodynamics; heat flow
- internal energy and heat capacities of a thermodynamic system
- heat engines and refrigerators; the Carnot cycles for these systems
- entropy and the Second Law of thermodynamics

PERMISSION TO TAKE THE MAKE-UP MIDTERM

Name_____

(please print)

Student ID:_____

MIDTERM missed: MIDTERM-I MIDTERM-II
(circle one)

Reason for missing the midterm: (please be very brief)

By submitting this form, I understand that if I miss the make-up midterm for any reason whatsoever my grade in the missed midterm will be zero.

Signature: _____