PHYSICS 2420: Introductory Mechanics for Physics Majors  
Spring 2012

This course is the foundation upon which your study of physics is built. The harder you work in this course, the easier all your future work in physics will be. For those of you who are pre-med, this course is what the MCAT physics section is all about. While I will be challenging, pushing, and nagging you, I will also make every effort to help you achieve the goals we will be setting on the first day. You are going to learn physics conceptually AND mathematically. Your math skills will improve dramatically with the practice of applying mathematics to REAL physical phenomena that we will directly experience in lab and through demonstrations. This special section of physics is designed just for physics majors, but keeping in mind that not all of you have had strong physics backgrounds. We are using a succinct book and sophisticated online program called smartPhysics (see last page). This program has been proven to work more effectively than traditional courses but you are responsible for several things: 1) carefully watching video prelections before my lectures, 2) completing online “Check-points,” and 3) completing online homework. You cannot learn physics by listening to me and watching me solve problems: you must actively wrestle with these ideas and make them your own. All the work will be worth it though: you are starting an intellectual adventure of the best kind!

Instructor: Dr. Eric Hagedorn; ehagedorn@utep.edu  Office: PSCI 221B  Phone: 7540  
Lecture: MWF 8:30-9:20  PSCI 314  Office Hours: MWTh 2:30-4:00 pm and by appointment.

Structure: Three 50-minute lectures weekly (LART 211, MWF, 8:30-9:20) CRN 26122  
1 LAB per week (PSCI 319, W 5:30-7:20) CRN 21981  
1 recitation/discussion per week (LART 211, Th 2:00-3:50) CRN 26689

Online component (PreLectures, CheckPoints, Homework) (see last page of syllabus).

Laboratory: To be provided

Homework: Online: the most critical aspect of your success is doing this homework regularly

Quizzes: Quizzes will be given during recitation.

Exams: Closed book. Will include both conceptual and problem solving type questions

Grading: 10% Final Exam (cumulative with emphasis on most recent):  
24% Exams: Four exams during the semester, lowest one dropped (8% each).  
10% Quizzes (lowest grade dropped)  
11% attendance: critical  
20% Lab: where you experience physics in reality  
25% Homework: to be submitted online (or on paper when asked).
Learning Goals
This semester you will be learning how to carefully describe HOW objects move and explain WHY objects move the way they do. You will be doing this in terms of words (carefully defined terminology), quantitative variables, tabulated measurement, and graphs of measurements. The list following provides details about what physical phenomena you will be studying and the mathematics involved. It is very important that you not only learn the terminology and understand the concepts, but that you learn how to solve mathematical word problems describing specific examples of these phenomena. I will provide you with carefully developed problem solving strategies, guidance, and plenty of practice.

1. You will describe how objects move (kinematics), which requires carefully understanding:
   a. a reference frame and coordinate system
   b. how you define position (where something is)
   c. how you define displacement (going from one place to another)
   d. average and instantaneous speed (how fast something is moving)
   e. average and instantaneous velocity (how fast something is moving AND its direction)
   f. average and instantaneous acceleration (the rate of change of velocity: speeding up, slowing down and/or turning)

2. Mathematically, this entails:
   a. using an xy (and later xyz) coordinate system
   b. understanding the hypotenuse of a right triangle
   c. understanding the sine, cosine, and tangent as applied to a right triangle
   d. understanding the inverse tangent as applied to a right triangle
   e. manipulating algebraic expressions (using letter variables to represent physical quantities)
   f. calculating slopes and rates of change
   g. taking the first derivative of a function
   h. integrating a function (anti-differentiating)

3. You will describe how objects move when undergoing constant acceleration, which can be completely described (position and velocity) by four equations affectionately referred to as the “Big 3.”

4. You will describe why objects move (dynamics) in terms of forces and acceleration using:
   a. Newton’s first law (inertia)
   b. Newton’s second law (net force causes acceleration)
   c. Newton’s third law (forces are interactions between at least two objects – when one object exerts a force on another, the other object exerts the same force back)
   d. Free body diagrams (a useful way to

5. You will describe why objects move (in terms of work, kinetic & potential energies) using:
   a. Work-Kinetic Energy Theorem: work changes an object’s kinetic energy
   b. Work done by varying forces
   c. Conservative forces (such as gravity or springs)
   d. Conservation of Mechanical Energy (kinetic AND potential energy)
   e. Work and potential energy and force from potential energy

6. Mathematically, calculating the work done by a varying force entails
a. integrating (definite & indefinite)

7. You will learn how systems of particles move in terms of their center of mass.

8. You will describe why objects move (in terms of momentum), which specifically entails understanding that:
   a. In collisions momentum is conserved
   b. In elastic collisions momentum and kinetic energy are conserved
   c. In inelastic collisions, only momentum is conserved

9. Mathematically, integrating an impulse as a function of time gives you the momentum change.

10. You will describe circular motion (kinematics)
    a. is similar to linear kinematics (displacement, velocity, acceleration) each linear quantity has a counterpart in angular kinematics
    b. in terms of angular displacement (radians)
    c. in terms of angular velocity (radians per second)
    d. in terms of angular acceleration (radians per second squared)
    e. with constant angular acceleration is very similar to doing so with constant linear acceleration: the “Big 3” equations have angular counterparts

11. Mathematically, describing circular motion requires an understanding of the relationships between angles (in radians), radii, and arc lengths.
    a. You should be able to work with angular displacements in degrees, radians, and revolutions

Missed Exam
Make up exams will only be considered if you have a signed letter from your medical doctor or other appropriate authority. These letters must be verifiable. Contact information must be provided and when the appropriate individual is contacted, they will need to be able to corroborate the absence. If the letter cannot be verified, the case will be turned over to the Dean of Students as being suspected of Academic Dishonesty.

Students with Disabilities
If you have a disability (physical or psychological) and require reasonable accommodations to enable you to participate in this course (such as note takers, readers, or extended time on exams and assignments) please contact your lecture instructor as soon as possible and provide the appropriate documentation from Disabled Student Services (747-5148 or dss@utep.edu). Without this documentation, no accommodations will be made. Please take care of this before the first exam.

UTEP Policies on Academic Dishonesty
If an instructor suspects a student of cheating, he/she is to collect evidence that he/she believes indicates this (e.g. exams, student work, etc). This evidence is then turned over to the Assistant Dean of Students (ADS). The student will receive an incomplete on whatever piece of work is under consideration. No other actions will be taken by the instructor until the case is closed: no discussion, no accusation, and no different treatment. The student is encouraged to continue participating in the class. The ADS will consider the evidence provided her and then contact the accused student (and possibly peers) and investigate the allegations. The ADS will then make a decision as to whether cheating occurred and determine what the consequences will be. The instructor will be consulted by the ADS as to whether the results of the investigation are acceptable to him/her. If acceptable, the instructor will simply carry out the consequences sent
to both the student in question and the instructor in a formal letter from the Dean of Students. While the seriousness of the identified dishonest actions determines the nature of the consequences, possible consequences include: a counted “zero” on the piece of work, a letter grade reduction, or being placed on academic probation. Students have the right to appeal a decision and participate in a formal public hearing.

Gary Gladding, Mats Selen, and Tim Stelzer. W.H. Freeman & Company

smartPhysics includes:
1. Online PreLectures (animated lessons, completed before lecture)
2. Online CheckPoints (quizzes to check knowledge, completed before lecture)
3. Lectures (interactive, with clicker activities)
4. Online homework exercises
5. Printed textbook (reference, problems)

To access smartPhysics: Go to www.smartphysics.com

Create a smartPhysics account
1. Go to smartphysics.com
2. Locate and select “Get access to smartPhysics > Students”
3. Begin the process of registering for the site. Enter your email address (your institutional email address) and select “No, this is my first time using smartPhysics”.
4. Click “Register”
5. Complete the form (name, email address, password) and click “Create Account.”
6. Verify your email by following the instructions on the screen.

Register by purchasing access.

- If you wish to purchase access online, choose that option on the screen. Complete the billing and credit card information. Save your confirmation screen.

Join my course so you can see my assignments and get credit for your work.

- Click “Join Course” and enter the Course Access Key: _course1830__________.