PHY 310
Mechanics: Statics and Dynamics

Dillard University – Spring 2005

Meeting Times:
M W F (4:00 PM- 4:50 PM) Main Campus / Stern Hall / 217 ****MAY BE ALTERED DUE TO SCHEDULING CONFLICTS****

Instructor: **Rob Salgado** Office: **Stern 307A** Voice: **(504)-816-4510**	E-mail: **rsalgado@dillard.edu** Instant-Messengers: AOL, MSN, Yahoo: **dillardphysics** (do *not* email here)	Office hours: **-to be announced**

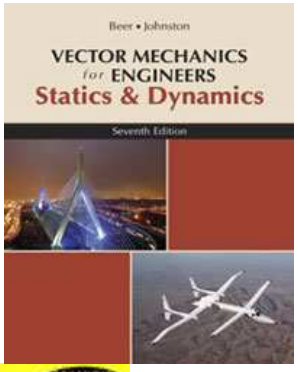
Catalog Description:

PHY 310 Mechanics: Statics and Dynamics (3 credits)
A study of fundamental concepts of static and dynamics, two or three-dimensional forces on rigid bodies in equilibrium and in motion, structured analysis (simple trusses, methods of joints and sections, zero force system, space trusses, frame and machines). The course will also cover the concepts of kinematics (force, works, energy impulse and momentum). Class meets three hours per week. *[Prerequisite: PHY 220 (General Physics I) and MAT 203 (Analytic Geometry and Calculus III).]*

My Description:

The physics of this course can be summarized in two vector equations: $\sum \vec{F} = m\vec{a}$ and $\sum \vec{M}_O = I\vec{\alpha}$.

For most of this course---the "statics" part, the right-hand-sides are zero. This course will show you how to efficiently analyze and calculate the forces on a particle and on a rigid body.



Required Textbook:

"Vector Mechanics for Engineers: Statics and Dynamics, 7/e" by Beer, Johnston
(published by McGraw-Hill, 2004, ISBN: 007230491x)
**Homework is assigned from the 7th-edition.
If you use another edition, it is your responsibility to get and do the 7th-edition problem or its equivalent in your edition.

(Optional) Highly-recommended supplements:
"Schaum's Outline of Engineering Mechanics, 5th Edition" by Nelson, Best, McLean
(pubished by MGraw-Hill,1998, ISBN 0070461937)
"800 Solved Problems In Vector Mechanics for Engineers, Vol. I: Statics" by Shelley
(published by McGraw-Hill, 1989, ISBN: 0070568359)
"700 Solved Problems In Vector Mechanics for Engineers: Vol II: Dynamics" by Shelley
(published by McGraw-Hill, 1991, ISBN: 0070566879)

Electronic Materials:

I will maintain a website (for now: **`http://physics.syr.edu/~salgado/310/`**) that lists the assigned problems and solutions. I will also try to make available the whiteboard/PowerPoint notes and any computer source code (e.g., Python, Maple) that I use for simulations or computations.

Classroom Rules:

Come to class **ON TIME**. Attendance is **REQUIRED.**
"Academic dishonesty will not be tolerated." (2003-2005 University Catalog, page 15)
Come to class PREPARED and EQUIPPED, having read or written any assignments. Bring your HOMEWORK NOTEBOOK and TEXT.
Limit all discussions to the PHYSICS topic under discussion.
Turn OFF all phones, pagers, radios, and other disruptive devices.

Grades (for the lecture portion):

25% HOMEWORK NOTEBOOK
25% TAKE-HOME EXAMS (FORMAT: several short homework-type problems)
25% IN-CLASS MIDTERM EXAM (FORMAT: several short homework-type problems)
25% FINAL EXAM (FORMAT: like two regular exams but cumulative)
A≥88%, B≥76%, C≥64%, D≥50%, F<50%. This class is not graded on a curve.
Borderline cases (between two letter grades): If your exams show an upward trend, your grade may be nudged upwards.

Exams: There are numerous take-home exams. There is a cumulative one-hour *in-class* MIDTERM and a cumulative two-hour *in-class FINAL*.

Missed exams: There are **no** makeup exams. There are **no** exceptions.
If you are **absent** for an exam, *within one week*, you must present to me a **written excuse from Division of Natural Sciences**.
Only if that excuse is valid, **your final exam will carry the weight of your missed exam.**
Otherwise, you will get no credit for the missed exam.

***HOMEWORK will be assigned (See HOMEWORK NOTEBOOK below.)**
HOMEWORK solutions will be discussed only during a weekly Special Session of Office Hours (submit your schedules to me.)

Sequence of PHY 310 topics that I will emphasize, what you should review in preparation, and the Learning Objectives:

Ch 2 STATICS OF PARTICLES *[You should review Free-Body Diagrams from PHY220 with emphasis on vector algebra.]*
Analyze and interpret forces as vectors.

Ch 3 RIGID BODIES: EQUIVALENT SYSTEMS OF FORCES
Analyze and interpret a system of forces on a rigid body. Define moment and couple. Perform and interpret vector algebraic operations, including the scalar dot product and vector cross product. Determine an "equivalent system of forces" in order to simplify the analysis of the system of forces.

Ch 4 EQUILIBRIUM OF RIGID BODIES *[You should review algebraic methods for solving systems of linear equations.]*
Identify reaction forces at supports. Formulate and solve static equilibrium problems.

Ch 5 DISTRIBUTED FORCES: CENTROIDS AND CENTERS OF GRAVITY *[You should review integral calculus.]*
Analyze and interpret a system of distributed forces on a rigid body. Define and determine the centroid of a rigid body.

Ch 6 ANALYSIS OF STRUCTURES
Define truss, frame, and machine. Analyze and interpret the internal forces within these structures.

Ch 7 FORCES IN BEAMS AND CABLES *[You should again review integral calculus.]*
Define shear and bending moment. Analyze and interpret the internal forces within beams and cables.

Ch 8 FRICTION *[You should review Friction from PHY220 with emphasis on vector algebra.]*
Analyze static equilibrium when frictional forces are not negligible.

Ch 9 DISTRIBUTED FORCES: MOMENTS OF INERTIA *[You should again review integral calculus.]*
Analyze and interpret a system of distributed forces on a rigid body. Define and determine the moment-of-inertia of a rigid body. Define and use the "Parallel-Axis Theorem".

Ch 11 KINEMATICS OF PARTICLES *[You should review Kinematics from PHY220 with emphasis on calculus.]*
Define, determine, and interpret position vectors, velocity vectors, and acceleration vectors. Define, determine, and interpret vector components: rectangular, tangential-and-normal, and (polar) radial-and-transverse.

Ch 12 KINETICS OF PARTICLES: NEWTON'S SECOND LAW *[You should review Newton's Second Law from PHY220.]*
Analyze dynamical problems using Newton's Laws. Define and interpret [Linear-]Momentum and Angular-Momentum. Describe, analyze, and interpret the "central force problem", in particular Newton's Law of Gravitation. Define and use the "Conservation of [Linear-]Momentum" and the "Conservation of Angular Momentum".

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       January
Su Mo Tu We Th Fr Sa
   10    12    14       STATICS OF PARTICLES (Most of this should be a review for you.)
   []    19    21       RIGID BODIES: EQUIVALENT SYSTEMS OF FORCES
   24    26    28
   31                   EQUILIBRIUM OF RIGID BODIES
      February
          2     4
   [      ]    11
   14    16    18       DISTRIBUTED FORCES: CENTROIDS
   21 MID-T-E-R-M
   [
        March
                 ]
    7    []    11       ANALYSIS OF STRUCTURES
   14    16    18
   21    23    []       FORCES IN BEAMS AND CABLES
   28    30             FRICTION
        April
                 1
    4     6     8       DISTRIBUTED FORCES: MOMENTS OF INERTIA
   11    13    15       KINEMATICS OF PARTICLES (Most of this should be a review for you.)
   18    20    22       KINETICS OF PARTICLES
   25    27    F
         May
    I--N--A--L
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Dates of which you should be aware:

AAPT Winter 2005 Meeting (Mon, Jan 10 – Wed, Jan 12 **special arrangements will be made**)
Martin Luther King, Jr. Holiday (Mon, Jan 17 ** no class **)
Mardi Gras Holidays Labor Day (Mon, Feb 7 – Wed, Feb 9 ** no class **)
Midterm Period (Tue, Feb 22 – Fri, Feb 25) [Grades due Feb 28]
Spring Break (Mon, Feb 28 – Fri, Mar 4 ** no class **)
Academic Advising Day (Wed, Mar 9 ** no class **)
Easter Holiday (Fri, Mar 25 ** no class **)
Seniors: Last Day (Thu, Apr 14), Exam Period: (Mon, Apr 18 - Wed, Apr 20)
Last Day to Withdraw (Wed, Apr 20)
Last Day of Classes: (Wed, Apr 27)
Exam Period: (Fri, Apr 29 - Thu, May 5) [Grades due Mon, May 9] - the final will be given on the assigned date and time. No exceptions.

HOMEWORK NOTEBOOK:

Homework will be assigned periodically. The bulk of Exam and quiz problems are generally based on homework problems, textbook problems, and textbook examples.

Most of the learning you do in this course is done by **your doing homework problems outside of class!**

However, be sure that you can do the problems *by yourself* since you'll be working on many exams *by yourself*.

If you need help with your homework, please visit me (with your textbook and your notebooks and with proof that you have tried the problems) during Office Hours… the sooner the better.

** In addition to the regular notebook you use for this class, you must maintain a dedicated "**HOMEWORK NOTEBOOK**" for this class. (spiral-bound notebook with at least 180 sheets). It will be periodically collected, browsed over, graded-for-effort, and promptly returned. You must bring the notebook to each class and to office hours.

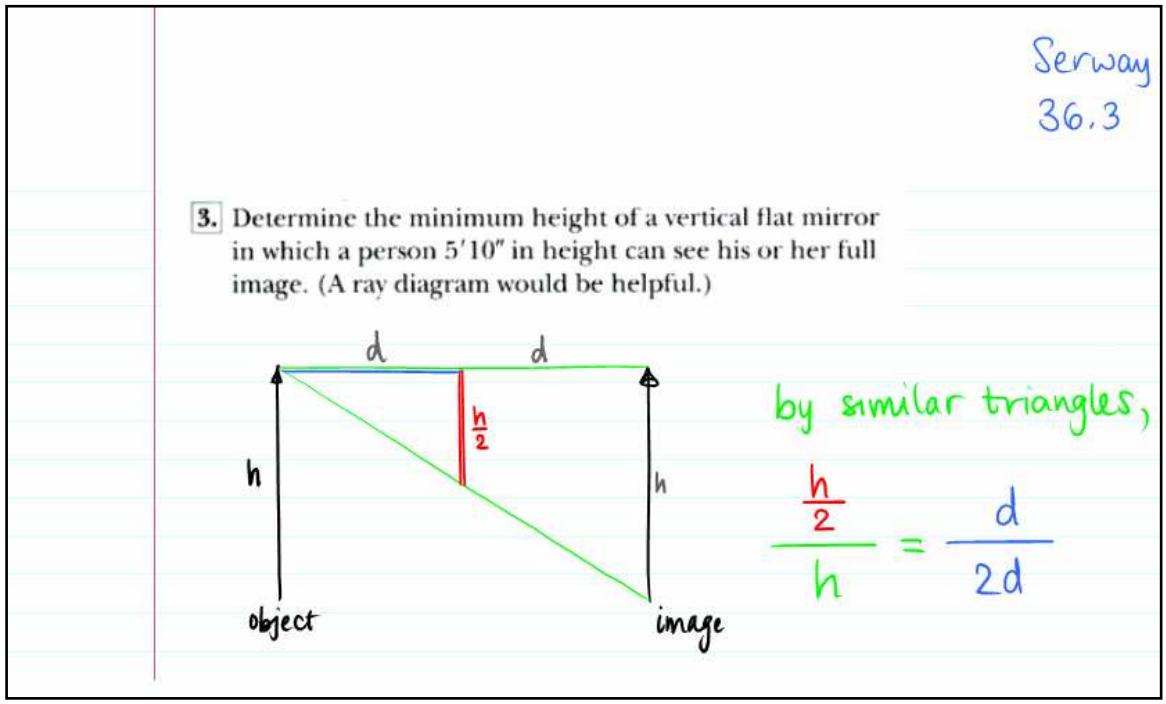
How you will use this: (the essential points---a detailed description will be provided on another sheet.)

- You are basically creating your own personal "solution manual" to the assigned homework problems.
- You should want to WRITE DOWN A CLEAR (i.e., logical and legible) AND COMPLETE SOLUTION that you really understand.
  - Start a new problem on a new sheet with the problem number in the upper-right corner…*for organizational purposes*.
  - Try your best to solve the problems by yourself *since this will be an indication of how well you understand the material*.
  - Write down your thoughts on the problem. *What is it really asking? What is it trying to get me to do? What is it trying to teach me?*
    It's okay if you don't understand at first, but you can understand it if you give it a good and honest try.
  - If you're stuck, work together with others in a group. *Don't blindly copy the work of others. Try to understand what you write down.*
    To help make this your work, add your own comments and fill in any missing steps to the group effort.
  - If you're still stuck, raise questions during class or office hours *then try again*.
- It is possible that you (with possibly the help of your group) were unable to solve the assigned problem by the due date. In that case, you should obtain a copy of my solutions (made available on the web). You must TRANSCRIBE [in your own handwriting] the solution *(adding your own comments and filling in any missing steps)* into your notebook.
- The notebook is expected to be in your handwriting. There should be no loose pages in your notebook.

How I will evaluate your notebook:

- I may or may not announce when I collect the notebooks. (It will be at least once every two weeks.)
- I will be looking to see that you are keeping the notebook up to date. I will only spot-check, not grade, your work.
- I will be looking to see that you are following the rules regarding organization. *(Again, start a new problem on a new sheet.)*
- I will assign a score (to form part of your final grade) and make comments on any deficiencies. You are expected to resolve any deficiencies (including rewriting, if necessary) to avoid further penalties. The original score will not be adjusted.
- Some examples of deficiencies: *missing problems, incomplete problems after solutions are made available, improper format (improper labeling, more than one problem on a sheet, etc.), illegibility, and inclusion of anything other than this course's homework problems*.

Comments will be written on the last sheet. Do not destroy that last sheet!



GRAPH PAPER:

You might want to equip yourself with graph paper. I can make some available on the web. However, the graph paper with the light-blue lines is much better since you can more easily erase on them. Graph paper will help you make an accurate drawing of what you are analyzing. You may want to crop out your drawing and paste it in your Homework Notebook. Use your PHY 112 skills, especially if you are in engineering!