Physics 3200 Mechanics

Mechanics Physics 3200 Fall 2024 Section: 8064 TY2

Instructor: Raymond Tung
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Office & Hours: 1415NE New Ingersoll, 1:15-2 PM, Tuesday

Course Description:

The course covers the following topics: vector treatment of static equilibrium of rigid bodies, static analysis of trusses and other mechanical structures, vector treatment of kinematics of particles and rigid bodies, forces and motion, analysis of rotational motion, and moments of inertia.

Textbook: Beer, Johnston, Mazurek, Cornwell, Vector Mechanics for Engineers, 12th Ed., McGraw Hill

Course Website:

Course material: http://academic.brooklyn.cuny.edu/physics/tung/phys3200f24

Syllabus (Cont.)

Lectures: 2:15 – 3:30 PM Tuesday; 1:15 – 3:30 PM Thursday; Rm 431NE

Grades:
Classwork: 25%, Lecture Exams (2): 15%, 25%, Final Exam: 35%
You must show computation neatly and clearly on classwork and exams to receive credit.

Exams and Dates:

Exam #1 Ch. 2-4: **Oct. 1**; Exam #2 Ch. 5,6,9,14,15: **Dec. 5**;

Final Exam covers entire semester: **TBA Dec. 17 or 19**

No make-ups for exams. For absences in exam due to medical condition with doctor's note, 90% of the score from the student's following exam will be used as the score for the missed exam. Two missed exams: automatic fail.

Syllabus (Cont.)

Lecture Plan (Tentative):

Note: no classes on Oct. 3, 15, Nov. 28

Last day to drop WD: 9/17; last day to drop W: 11/6.

Ch. 2, Statics of Particles	**8/29, 9/3**
Ch. 3, Rigid Bodies: Equivalent Systems of Forces	**9/5, 10, 12**
Ch. 4, Equilibrium of Rigid Bodies	**9/17, 19, 24**
Ch. 5, Distributed Forces: Centroids and Centers of Gravity	**9/26, 10/8**
Ch. 6, Analysis of Structures	**10/10, 17, 22**
Ch. 9, Distributed Forces: Moment of Inertia	**10/24, 29**
Ch. 14, Systems of Particles	**10/31, 11/5, 7**
Ch. 15, Kinematics of Rigid Bodies	**11/12, 14, 19**
Ch. 16, Plane Motion of Rigid Bodies: Forces and ..	**11/21, 26, 12/3**
Ch. 17, Plane Motion: Energy and	**12/10, 12**

Items of Interest

Attendance:

Will be taken regularly. No deductions for poor attendance. There could be benefits for good attendance.

Exams:

Please bring your non-programmable calculator to exams. Relevant equations will be provided during all the exams. Do not arrive more than 10 minutes late for an exam. No bathroom breaks are allowed. All electronic devices (except non-prog. calculators) should be turned off during exams. Any cheating on exam results in a score of -50% for that exam. Graded lecture exams will be returned to the students, usually at the following lecture. Returned exams uncollected in one week will be discarded. The amount of points given in "partial credit" questions is not subject to discussion. The final exam will be archived at the physics department for record.

On Homework

Homework will be assigned but need not be submitted.

Exams will be largely based on assigned homework problems, sometimes with twists.

Working out as many textbook problems as possible is a tremendous help to grasping the concepts discussed in class and seeing how the equations and theories can be applied to actual situations.

Two suggestions:

(1) Before you see how a practice or example problem is solved in class, please try solving it yourself or thinking hard about it. Your ability to reason and follow rigorous procedures is essential to problem solving and is what you will gain/improve in this course.

(2) Try to define quantities clearly, add narratives between steps, have "sanity checks", etc. These will help you spot your own mistakes.

In-Class Exercises

There will be in-class exercises (usually during the second part of Thursday's lecture) to solve selected problems. These will be graded and will count toward 25% of your semester grade.

You can consult books or even discuss with fellow students during these exercises. When the strategy and the steps to solve a problem are clear, proceed on your own. Copying off of other people's work is strongly discouraged. Remember: if the idea to solve a problem did not come from you, it probably won't come to you at exam time.

What is Mechanics?

- Mechanics is the study of bodies under the action of forces.

- Categories of Mechanics:
  - Rigid bodies
    - *Statics* – bodies at rest or at constant velocity
    - Dynamics – accelerating bodies
  - Deformable bodies
  - Fluids – gas and/or liquid

- Mechanics is an applied science, closely related to physics, so many of the concepts will build on that prior knowledge.

- Mechanics is the foundation of many engineering topics and is an indispensable prerequisite to their study.

Systems of Units

- *Kinetic Units*: length, time, mass, and force.

- Three of the kinetic units, referred to as *basic units*, may be defined arbitrarily. The fourth unit, referred to as a *derived unit*, must have a definition compatible with Newton's 2nd Law,

$$\vec{F} = m\vec{a}$$

- *International System of Units* (SI): The basic units are length, time, and mass which are arbitrarily defined as the meter (m), second (s), and kilogram (kg). Force is the derived unit,

$$F = ma$$

$$1\,\text{N} = (1\,\text{kg})\left(1\,\frac{\text{m}}{\text{s}^2}\right)$$

- *U.S. Customary Units*: The basic units are length, time, and force which are arbitrarily defined as the foot (ft), second (s), and pound (lb). Mass is the derived unit,

$$m = \frac{F}{a}$$

$$1\,\text{slug} = \frac{1\,\text{lb}}{1\,\text{ft}/\text{s}^2}$$

Method of Problem Solution

- *Problem Statement*:
  Includes given data, specification of what is to be determined, and a figure showing all quantities involved.

- *Free-Body Diagrams*:
  Create separate diagrams for each of the bodies involved with a clear indication of all forces acting on each body.

- *Fundamental Principles*:
  The six fundamental principles are applied to express the conditions of rest or motion of each body. The rules of algebra are applied to solve the equations for the unknown quantities.

- *Solution Check*:
  - Test for errors in reasoning by verifying that the units of the computed results are correct,
  - test for errors in computation by substituting given data and computed results into previously unused equations based on the six principles,
  - **always** apply experience and physical intuition to assess whether results seem "reasonable"

Numerical Accuracy

- The accuracy of a solution depends on 1) accuracy of the given data, and 2) accuracy of the computations performed. The solution cannot be more accurate than the less accurate of these two.

- The use of hand calculators and computers generally makes the accuracy of the computations much greater than the accuracy of the data. Hence, the solution accuracy is usually limited by the data accuracy. That is, remember what you learned about *significant figures*.

- As a general rule for engineering problems, the data are seldom known with an accuracy greater than 0.2%. Therefore, it is usually appropriate to record parameters beginning with "1" with four digits and with three digits in all other cases, i.e., 40.2 lb and 15.58 lb.