Text: *Vector Mechanics for Engineers - Dynamics* (11^{th} Edition); Ferdinand Beer; Phillip Cornwell; E. Russell Johnston; Brian Self; McGraw-Hill Education; 2015

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Grading policies: *Homework*

- There will be weekly homework assignments.
- The assignments may vary in length, but all problems will be equally weighted.
- You are encouraged to form study groups and teach one together. Piazza has been enabled for this course so you may discuss problems and share ideas asynchronously.
- Helping one another does not extend to copying someone else's work or allowing someone else to copy your work.
- Late homework loses 50% of its value per day that it is late. After two days, graders will mark errors and then assign a grade of 0.

Quizzes

- There will be weekly quizzes about both the reading assignments and the problem assignments.
- Quizzes on the reading assignment will be administered via BlackBoard and primarily consist of True/False and Multiple Choice style questions. All questions will be weighted equally.
- Quizzes on the problem assignments will be administered via BlackBoard after each assignment due date. Such quizzes will typically pose one or two problems similar to the homework followed by a set of Multiple Choice and Fill-in-the-Blank style questions about the problem(s). You will submit work supporting your quiz answers in class after the quiz is administered.
- USC's Academic Integrity policy will be strictly enforced and the *slightest* hint that the work you submit is not entirely your own will result in a report to SJACS proposing an F on the quiz for all those involved.

Exams

- There will be two equally weighted exams — the first approximately midway through the term and the second on the day and time scheduled for the final.

Final grade calculation

- Each exam will count toward 12.5% of your grade.
- Your average quiz score will count toward 50% of your grade.
- Your homework average will count toward 25% of your grade if your homework average is higher than your quiz average. Under such conditions, your final grade will be determined by a weighted score based on your homework average (1/4), your quiz average (1/2), and your exam average (1/4).
- The homework will not effect your grade if your homework average is lower than your quiz average. Under such circumstances, your final grade will be based entirely on your quiz average (2/3) and exam average (1/3).

Comments: The reading assignment should be completed before class so you'll understand the discussion in class.
Multiple short homework problems may appear on the same page provided the problems are clearly separated.
Longer homework problems should each start at the top of a new page.
Final answers should be neatly boxed or otherwise clearly marked at the end of each problem.
Spiral bound note paper will not be accepted unless the fringe has been neatly removed.
Neatness counts! Sloppy papers will incur an inherent penalty — if we can't read 'em, we won't grade 'em.

Background

If you are looking for someone to blame for this course, look no further than Isaac Newton. Everything in this course was laid out in his seminal work, *Philosophiæ Naturalis Principia Mathematica* (often referred to as simply *The Principia*). Not coincidentally, Newton is responsible (along with Gottfried Wilhelm von Leibniz) for the branch of mathematics known as calculus. This entire course is based upon Newton's observation of the relation between the force applied to a particle and the change in the linear momentum of the particle. Simple mathematical operations (like addition and multiplication), basic geometry, some algebra, and straight-forward applications of differential and integral calculus lead directly to everything else covered in the course.

Learning objectives

By the end of this course, you will have learned how to:

- solve certain types of differential equation problems involving the kinematics of single particles;
- relate the force applied to a particle to the rate of change of the linear momentum of a particle;
- use that relation to analyze the motion of a particle and the forces acting upon it in one or more directions;
- relate linear and angular impulse to changes in the linear and angular momentum of a particle;
- relate the work done by one or more forces to changes in the kinetic energy of a particle;
- extend the concepts of force/acceleration, impulse/momentum, and work/energy to closed systems of particles;
- relate the motion of one location on a rigid body to that of another; and
- extend the concepts of force/acceleration, impulse/momentum, and work/energy to one or more rigid bodies.

Course outline

This section contains a weekly plan for the semester. While not fixed in stone, this roughly illustrates what we'll be discussing each week and the work you'll be expected to complete. We will not follow the exact sequence of topics in the text — we may jump ahead at some points; we may return to earlier material at other points, and we may skip some material altogether. In general, we'll first cover all the material that applies to single particles — kinematics, Newton's Laws, the relation between work and energy, and the relations between impulse and momentum. Next, we'll look at the same material as applied to multiple particles. Finally, we'll see the same material as it is applied to rigid bodies.

Week-by-week schedule

It should be noted that the number of class meetings per week is not constant due to various holidays. For Fall 2017, Labor Day and Thanksgiving both affect the schedule so Week 3 contains only two class meetings (September 6 and 8) while Week 14 has but one meeting (November 20). These lost lecture days may affect what we can cover on those weeks — if so, we'll make appropriate adjustments as we go.

In the table that follows: Column 1 contains the week of the term; Column 2 contains the reading assignment for the week; Column 3 briefly describes the topics that will be discussed in class that week; and Column 4 contains the problems problem assignment. The reading assignments come from the textbook supplemented by occasional additional reading material distributed via BlackBoard.

Many end-of-section problem sets in the Beer/Johnston/Cornwell/Self text are preceded by a group of "Concept Questions". Although these questions will not typically be assigned as homework problems, you should get in the habit of answering all the concept questions before tackling the homework problems for the week.

Week	Reading assignment	Topics	Problem set
1	Text: Ch. 11 (§1, 2ab, 3) Bb: vector review handout Bb: separation of variables handout	Nomenclature; rectilinear motion; $\ddot{s} = \ddot{s}(t), \ddot{s}(s), \ddot{s}(\dot{s})$	Problem set #1
2	Text: Ch. 11 (§4abc, 5) Bb: coordinate systems handout	Curvilinear motion; Cartesian, intrinsic, cylindric, and spherical coordinate systems	Problem set #2
3	Text: Ch. 11 (§2c, 4d)	Relative and constrained motion	Problem set #3
4	Text: Ch. 12 (§1) Bb: systems of particles handout (§1-2)	$\mathbf{F} = m\mathbf{a}$ for single particles	Problem set #4
5	Text: Ch. 13 (§1-2) Bb: conservative forces handout	Work/energy; power; conservative forces; potential energy	Problem set #5
6	Text: Ch. 13 (§3-4) Bb: particle collision handout	Linear impulse/momentum; impact	Problem set #6
7	Text: Ch. 12 (§2)	Angular impulse/momentum; central force motion	Problem set #7
8	Text: Ch. 14 (§1-2) Bb: systems of particles handout (§3) Bb: centers and centroids handout	Closed systems of particles; force, energy, and momentum	Problem set #8
9	Text: Ch. 15 (§1-2)	Rigid body planar kinematics; abs. and rel. vel./acc.; Joints/contact conditions	Problem set #9
10	Text: Ch. 15 (§3-7)	Rotating frames	Problem set #10
11	Text: Ch. 16 (§1-2) Bb: rigid body motion handout (§1-3)	$\mathbf{F} = \dot{\mathbf{L}}$ and $\mathbf{M}_O = \dot{\mathbf{H}}_O$ for rigid bodies in planar motion; 2-D constrained motion	Problem set #11

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Week	**Reading assignment**	**Topics**	**Problem set**
12	Text: Ch. 17 (§1) Bb: rigid body work/energy handout	Work/Energy for rigid bodies in planar motion	Problem set #12
13	Text: Ch. 17 (§2) Bb: rigid body motion handout (§4)	Impulse/Momentum for rigid bodies in planar motion	Problem set #13
14	Text: Ch. 17 (§3)	Rigid body impact	Problem set #14
15	Catch up, review, etc.		
16	Study days and Final exam		