ME 302 A1: Engineering Mechanics II

Instructor

Prof. Mac Schwager
Office: 110 Cummington Mall, Rm 303
e-mail: schwager@bu.edu
Office hours: Tuesdays, 2–4pm

Teaching Fellow

Caity Bogdan
Office: 15 St Mary's Street, Rm 216
e-mail: cbogdan@bu.edu
Office hours: By appointment

Meeting Time and Place

Lecture: Mondays and Wednesday, 6–8pm, PHO 211
Discussion Section: Fridays, 3–4pm, PHO 203 (Subject to revision)

Description

In this course you will learn how to determine the equations of motion of realistic mechanical systems, and to analyze these equations to understand some basic properties of the motion of such systems. Specifically, this course deals with the dynamics of systems of particles and rigid bodies in three dimensional space. The course will cover kinematics, Newtonian (or momentum-based) dynamics, Lagrangian (or energy-based) dynamics, and vibrational motion. We will study the typical topics related to these areas including inertial and non-inertial reference frames, coordinate systems and coordinate transforms, Newton's laws, linear momentum and angular momentum, moments of inertia, Hamilton's principle, Lagrange's equations, generalized coordinates, virtual work, linearization of equations of motion, and analysis of frequencies, modes, and stability.

Prerequisites

All students should have taken EK 301: Engineering Mechanics I.

Structure and Expectations

The course will have four main components: lectures, problem sets, exams, and a lab.

Lectures Students will be expected to attend lectures and to have read the assigned reading prior to the lecture. Student participation will be encouraged in the lectures in the form of questions and interactive problem exercises.

Problem Sets Problem sets will be assigned approximately weekly (except when there is a midterm). You are welcome to discuss the problems with your fellow students, but the solutions that you hand in should contain your *own original work*. Copied solutions are not acceptable. Make your solutions neat, complete, and legible. The easier it is for the grader to read and understand your solutions, the more likely they will be to give you points. Problem sets should be handed in on the day they are due to the Mechanical Engineering front office on the first floor of ENG. They must be handed in before the front office closes at 5pm.

Exams We will have two midterms covering approximately the first and second thirds of the course, and a final covering all of the course material. The two midterm exams will be in class on the dates indicated on the schedule below. The final exam will be scheduled by the registrar during finals week.

Lab There will be a single lab that will involve modeling and analyzing a DC motor. You will form teams of three or four students to perform the lab, and each team will hand in one lab report.

Grading

The final course grade will be assigned according to the following weighting:

Problem Sets	10%
Lab	5%
Midterm 1	25%
Midterm 2	25%
Final exam	35%

Make-up and Extension Policy

No make-ups or extensions will be given. If you miss an exam without a valid excuse, you will get a zero. If you have to miss an exam with a valid excuse, you will be graded based upon the rest of your portfolio.

Course Website

All course materials will be disseminated on the blackboard course website. A link to blackboard can be found at `http://www.bu.edu/students/`.

Drop and Withdrawal Dates

The last day to *drop* the class (without a W appearing on your transcript) is February 24, 2015.
The last day to *withdraw* from the class (with a W appearing on your transcript) is April 3, 2015.

Textbook

J. H. Williams, *Fundamentals of Applied Dynamics*, John Wiley and Sons, Inc., 1996.

Planned Schedule

Date	Topic	Reading	Notes
1/21 W	Intro and particle kinematics	Chpt 1–2	PS1 out
1/26 M	Rigid body kinematics	Chpt 3	
1/28 W	Rigid body kinematics	Chpt 3	PS1 due, PS2 out
2/2 M	Rotating frames	Chpt 3	
2/4 W	Intermediate frames	Chpt 3	PS2 due, PS3 out
2/9 M	Newton's Laws	Chpt 4	
2/11 W	Linear/Angular momentum	Chpt 4	PS3 due, PS4 out
2/16 M	No class (Presidents' Day)		
2/17 T	Examples	Chpt 4	Mon schedule
2/18 W	Rigid bodies	Chpt 6	PS4 due, PS5 out
2/23 M	Linear/Angular Momentum	Chpt 6	
2/25 W	Moments of inertia	Chpt 6	PS5 due
3/2 M	Parallel axis theorem	Chpt 6	
3/4 W	Midterm exam 1	Chpt 6	PS6 out
3/9 M	No class (Spring Break)		
3/11 W	No class (Spring Break)		
3/16 M	Rigid body dynamics	Chpt 6	
3/18 W	Energy and work	Chpt 5	PS6 due, PS7 out
3/23 M	Generalized coordinates	Chpt 5	
3/25 W	Hamilton's principle	Chpt 5	PS7 due, PS8 out
3/30 M	Work and state functions	Chpt 5	
4/1 W	Hamilton's principle	Chpt 5	PS8 due, PS9 out
4/6 M	Lagrange's equations	Chpt 6	
4/8 W	Lagrange for rigid bodies	Chpt 6	PS9 due
4/13 M	Lagrange for rigid bodies	Chpt 6	
4/15 W	Midterm exam 2	Chpt 6	PS10 out
4/20 M	No class (Patriot's Day)		
4/22 W	Linearization (Mac traveling)	Chpt 8	PS10 due, PS11 out
4/27 M	Single degree of freedom vibs	Chpt 8	
4/29 W	Multi degree of freedom vibs	Chpt 8	PS11 due
5/5–5/9	Finals week, schedule to be determined		