Engineering Mechanics II

Department of Mechanical Engineering
Boston University

Welcome to ENG ME 302: Engineering Mechanics II! This document will be your roadmap throughout the semester. It contains valuable information regarding the course's goals, resources, and expectations. Please read this document carefully and refer back to it often throughout this semester.

Description

Engineering Mechanics II investigates dynamics, which is the subfield of mechanics that deals with the motion of bodies, the forces causing their motion, and the forces caused by their motion. The main goal of this course is to provide an introduction to the science, skill, and art involved in modeling mechanical systems to predict their motion. The concepts studied in this course are necessary to understand, analyze, and design mechanisms and machines, and they are also fundamental to the study of biomechanics, robotics, and vehicles, along with many other interesting subjects.

This is the course that made Prof. Khurshid decide to major in mechanical engineering when she was an undergraduate student. She hopes you enjoy it as much as she did!

Teaching Team

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Graduate Teaching Fellows

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Course Website

ME302 will use Piazza to post announcements, handouts, and some lecture materials. We'll also use Piazza for extensive online Q & A.

Have any questions about the class? Post to Piazza! You may even post questions anonymously to your peers. If you send us a question relating to the course material via email, we'll ask you to repost it on Piazza. We also encourage you to answer posted questions and improve existing answers. Actively participating in Piazza will have a positive influence on your end-of-semester grade if your numerical score falls at the border between two grades.

Profs. Khurshid has already invited all enrolled students to join the ME 302 Piazza site. The link to sign up for Piazza is http://piazza.com/bu/spring2019/me302 and the link to the course homepage is http://piazza.com/bu/spring2019/me302/home.

Office Hours

Yuhe and I will hold office hours every week. Please fill out this when2meet form https://www.when2meet.com/?7448317-gN4Nk to help us schedule office hours that work well for your schedules. Please fill the poll out with your general availability, not just your availability for the week shown in the doodle poll. For example, if you have a meeting at 2pm next Wednesday, but will typically be free on Wednesdays at 2, please mark that time as available. We want you to come to office hours to ask questions and discuss course topics with us!

Credit

This class is four credit hours. It is required for all Mechanical Engineering students and is typically taken in the junior year. ME minors and students in other majors are welcome to take this class, provided they have satisfied the pre-requisites.

Pre-Requisites

To enroll in ME 302, you should have already taken ENG EK 301: Engineering Mechanics I or its equivalent. This means that you have also completed CAS PY 211, CAS MA 225, and ENG EK 127. ME 302 will build on each of these courses. If you have doubts about your preparedness for the course, please visit either professor's office hours.

Lectures

Each ME 302 will have lectures two times per week. Professor Khurshid will teach Section A1 on Mondays and Wednesdays from 8:00 am-9:45 am in the Photonics Building, Room 210.

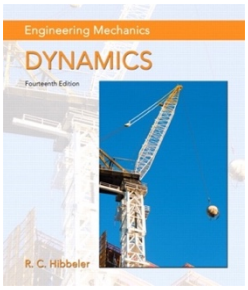
Lectures are intended to be interactive. If you have a question, there are likely others in the class with the same one, so please, speak up! If you think the professor has made a mistake in an explanation, which is sure to happen, please ask about it and help fix the mistake or explain the confusion. Participating constructively in these ways will help make this class better for everyone. Active participation will also have a positive influence on your end-of-semester grade if your numerical score falls at the border between two grades.

Discussions

Discussions are an important time for you to actively engage with the course material. They will be led by Yuhe Chang, the Graduate Teaching Fellow, and will focus on solving example problems, reviewing previously submitted homework, and answering questions that you might have about that week's lectures and assignment.

Yuhe will lead the discussion for Section B1 on Fridays from 3:35 pm - 4:25 pm in the Photonics Building, Room 210.

Textbook and Mastering Engineering



ME 302 will use the textbook **Engineering Mechanics: Dynamics, Fourteenth Edition** by R.C. Hibbeler, published by Pearson.

We have placed four copies of the textbook on course reserves at the Engineering Library. You may borrow one book for up the 2 hours at a time (we can change this window to 24 hours, based on your feedback).

Course Requirements and Evaluation

Your grade in this class will be determined as a weighted combination of your performance in the following areas. The weights may be altered as the semester progresses.

35% Homework, Laboratory Exercise, In-Class Assignments, Quizzes

There will be weekly homework assignments that include both written and programming problems. Answers to written problems will be checked

using Mastering Engineering. Students must also turn in the work that they did to reach their final answers in the Mechanical Engineering Office no later than 5pm on the business day following the deadline. Finally, Mastering Engineering will automatically assign an adaptive follow-up assignment based on your performance on the homework set. You will not have to complete the follow-up assignment if you score above a 95% on the homework. The follow-up assignment will be due 1 week after the assignment is due. Code for the MATLAB problems will be submitted using the course's Blackboard Learn website.

All stated deadlines are firm. Exceptions to these deadlines may be granted by Prof. Khurshid for cases such as severe illness and serious personal emergency. Ideally, you should request an extension well before the assignment's deadline. Unless you are ill or physically away from campus, extensions must be requested in person. You may meet with Prof. Khurshid during office hours or by scheduling an appointment. The professors will almost always grant your first extension request.

20% Midterm Exam 1

Tentatively either Tuesday, February 19 or Wednesday, February 20, in lecture

20% Midterm Exam 2

Tentatively on Wednesday, April 17, in lecture

25% Cumulative Final Exam

TBD

MATLAB

This class will help you learn to use MATLAB to analyze and simulate dynamic systems. Simulating and animating systems is an excellent way to learn more about why they behave the way they do: you can change the value of a parameter or the sign of a term, re-run your simulation, and quickly see the effects. Virtual experiments like this are much faster to run than real physical experiments, and they will significantly help you build your intuition for dynamics. Knowing MATLAB is also a useful skill for internships and jobs in engineering and other analytical fields.

While the teaching team all value strong programming skills, they recognize that the difficulties that arise during learning process. You will have the option to use the software development technique called pair programming to complete all assignments. In pair programming, two programmers work together on a single computer. One programmer 'drives' and the other 'navigates'. The programmers switch roles frequently. Pair programming has proven to be effective in reducing errors in the produced code. Pair programming is also an effective learning technique. For more information on the pair programming technique see "All I really need to know about pair programming I learned in kindergarten," by Williams and Kessler, *Communications of*

the ACM, May 2000.

Every student may install MATLAB on their computer for free. The following website gives instructions for obtaining the license and the software:
http://www.bu.edu/tech/services/cccs/desktop/distribution/mathsci/matlab/

The teaching team is indebted to Prof. Katherine J Kuchenbecker of the Max Planck Institute for Intelligent Systems and the University of Pennsylvania for generously sharing the MATLAB assignments she developed while teaching dynamics at Penn.

Academic Ethics

> "Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of the public health, safety, and welfare. Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct."
>
> - *National Society of Professional Engineers*

All students are expected to act with civility, personal integrity, respect other students' dignity, rights and property; and help create and maintain an environment in which all can succeed through the fruits of their own efforts. An environment of academic integrity is requisite to respect for self and others and a civil community.

All students in this course must follow Boston University's Academic Conduct Code (https://www.bu.edu/academics/policies/academic-conduct-code/). Sanctions for breaches in academic integrity may range, depending on the severity of the offense, from an "F" grade on an assignment or test to an "F" in the course. Severe cases and/or repeat offenses of academic dishonesty may also result in more severe disciplinary sanctions up to and including suspension or expulsion.

To help you understand the meaning of academic integrity in this class, the teaching team will attempt to provide very clear explanations of what types of activities are allowed and disallowed on each assignment. You also need to ask questions whenever you encounter or observe potentially ambiguous situations. As far as practicable, we will also try to avoid academic procedures that create temptations to violate the Code of Academic Conduct.

The teaching team understands that solution manuals and individual problem solutions are freely available online and from peers. Students sometimes use these resources to expedite or circumvent the completion of take-home assignments, which is not fair to the rest of the class. Simultaneously, we believe that homework problems offer a

fundamentally important learning opportunity for students: you can learn to solve challenging dynamics problems only by grappling with new problems that you haven't already seen worked out. The teaching team is committed to helping your through the sometimes-frustrating process of learning new and difficult material. It is always better to come to office hours, as opposed to checking the solutions manual for the next step, when you get stuck. You will demonstrate your ability to independently solve problems on the course's three exams.

Disability Accommodation

If you have a physical or learning disability that we should be aware of, please arrange for individual consultation with the professor of your section to discuss accommodation. Students entitled to additional time and/or an alternative location during in-class exams need to coordinate with the BU Disability Services to make these arrangements.

Statement of Student Wellbeing

Diminished mental health, including significant stress, mood changes, excessive worry, or problems with eating and/or sleeping can interfere with optimal academic performance. The source of symptoms might be strictly related to your course work; if so, please speak with us. However, health issues, problems with relationships, family worries, loss, or a personal crisis can also contribute to decreased academic performance.

Boston University provides mental health services to support the academic success of students. BU offers a variety of resources that you should be aware of in the event that you or a friend need additional support. Those seeking free, confidential mental health counseling can contact Student Health Services Behavioral Medicine (p: 617-353-3569, w: http://www.bu.edu/shs/behavioral-medicine). Behavioral Medicine can help to support both better general mental wellness, as well as during psychiatric emergencies 617-353-3549. Students should as note that Center for Psychiatric Rehabilitation offers a variety of free and paid programs, including LEAD BU, a free course focused on developing well-being, academic, and interpersonal skills. (p: 617-353-3549, w: http://www.cpr.bu.edu). Other BU resources include the Danielsen Institute (617-353-3047), and the Center for Anxiety & Related Disorders (617-353-9610).

In the event we suspect you need additional support, we will express our concerns and the reasons for them, and remind you of resources that might be helpful to you. It is not our intention to know the details of what might be bothering you, but simply to let you know we are concerned and that help, if needed, is available.

Getting help is a smart and courageous thing to do -- for yourself *and* for those who care about you.

Schedule

The tentative course schedule is listed below.

Week	Course Meetings	Topics	Reading
1	January 23	Particle Kinematics	12.1—12.5, 12.8
2	January 28, 30	Particle Kinematics, Particle kinetics: Newton's second law for a particle and system of particles	12.7, 12.9-10, 13.1—13.7, 12.6
3	February 4, 6	Particle kinetics: work and energy for a particle and system of particles	14.1—14.6
4	February 11, 13	Particle kinetics: impulse and momentum for a particle and system of particles	15.1—15.7
5	February 19, 20	Flex week with exam (likely Feb 20)	
6	February 25, 27	Planar kinematics of rigid bodies	16.1—16.8
7	March 4, 6	Rigid body kinetics: Newton's second law	17.1—17.5
8	SPRING BREAK		
9	March 18, 20	Rigid body kinetics: Newton's second law	17.1—17.5
10	March 25, 27	Rigid body kinetics: work and energy	18.1—18.5
11	April 1, 3	Rigid body kinetics: work and energy Rigid body kinetics: impulse and momentum	18.1—18.5, 19.1—19.4
12	April 8, 10	Rigid body kinetics: impulse and momentum	19.1—19.4
13	April 17	Exam 2	
14	April 22, 24	Mechanical vibrations	22.1-22.3
15	April 29, May 1	Mechanical vibrations	22.4-22.6