ME 274 – FALL 2022

School of Mechanical Engineering
Purdue University, West Lafayette

Course Title

ME 274 – Basic Mechanics II

Course instructor

Yangfan Liu
Lecture time: MWF, 4:30 pm to 5:20 pm, WALC 2087
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Office Hours:

- Monday and Friday, 3:00 pm to 4:00 pm, ME 2142
- Wednesday, 3:00 pm to 4:00 pm, ME 3061K

Tina (Tianhong) Han
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Course TAs

Clark C Addis
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TA tutorial hours:

- Wednesday, 2:30 pm to 4:30 pm, ME 2142
- Tuesday and Thursday, 1:30 pm to 4:30 pm, ME 2142

Course Textbook

The *required* course lecturebook: *Dynamics: A Lecturebook* can be purchased from the University Bookstore.

Course website

https://www.purdue.edu/freeform/me274/
The course website will be used for both threaded discussions and for the delivery of important course material. (*Note that Brightspace will NOT be used in this course.)* Example problems from the lecturebook are posted as multimedia video/audio files on the course blog. Use these solutions to help assess your ability to work the homework problems for that day. Homework video solutions will be made available on the blog following the date of submission. Animations and simulations are presented on the blog to assist you in visualizing motion and other concepts related to the topics of the course. All information related to homeworks and exams is available on the blog. Note that all material on this website is accessible without logging in; you need to log in only when you post comments in the discussion thread. Please see the homepage of the website for login instructions.

Class meeting time

Your attendance is expected for all meetings during the semester. If you are unable to attend a class meeting, you are expected to contact your instructor prior to the start of the class period. If you feel ill, or have any symptoms associated with COVID-19, or suspect that you have been exposed to the virus, you should stay home and contact the Protect Purdue Health Center (496-INFO).

Course prerequisites

ME 270 – Basic Mechanics I
MA 262 – Linear Algebra and Differential Equations (co-requisite)

Course description

Particle kinematics (both 2D and 3D motion, including moving reference frame descriptions for each). Particle kinetics including Newton's laws, work/energy and impulse/momentum. Planar kinetics of rigid bodies. Kinetics for planar motion of rigid bodies including equations of motion and principles of energy and momentum. Introduction to linear vibrations with emphasis on single-degree-of-freedom systems.

Course objectives

The learning objectives for this course are:

1. to develop an understanding of Newton's Laws of Motion and how these are applied to engineering systems;
2. to develop an understanding of conservation principles (work-energy, impulse-momentum and angular impulse-momentum) and how these are applied to engineering systems;
3. to develop skills in the modeling and evaluation of the response of 2nd order linear mechanical systems; and
4. to develop a mastery of a systematic approach to problem solving.

Course schedule

A topical schedule for the course is attached at the end of this syllabus.

Homework

Two homework problems are assigned per lecture. Homework problem statements will be released on the course website (see the "*Homework*" link) at 10:00AM on the day of their assignment. A sample format for your homework is attached. Your work needs to be presented with a logical thought process and in a neat, easy-to-read style. Failure to do so can result in a loss of points in your homework grade.

Homework submission and grading: Each homework submission will be submitted and graded twice. Late homework will not be accepted.

- The first submission is to be submitted on Gradescope by 11:59pm of the due date. Full grade allocated to this submission will be given, if serious effort is shown in the attempt. There are two problems in each homework assignment, each problem is worth 1.5 points in the first submission.

- The second submission is to be submitted after the solution is released but before the due time of the next homework assignment. Students should check the released solutions and correct mistakes in the first attempt. In this submission, the work in the first attempt should be included with additional corrections or rework clearly marked with a different color. Students need to clearly mark which part of work in the second submission is the correction or rework of which part of work in the first submission. Correctness in both steps and answers are considered in grading. A correct final answer is worth 1 point and correct method is worth 6 points.

- If there is no second submission, the grading of the second submission will be based on the work in the first submission.

- Points will be given to the second submission, only if the first submission receives full points (i.e., serious effort is shown in the first submission).

Quizzes

Quizzes will be unannounced and will take place during the regular class period. The instructor of each session can decide the number of quizzes and how the quizzes are graded.

Course grading

Your course grade will be based on a straight grading scale: 97-100% A+; 93-97% A; 90-93% A-; 87-90% B+; 83-87% B; 80-83% B-; 77-80% C+; 73-77% C; 70-73% C-; 67-70% D+; 63-67% D; 60-63% D-; <60% F. The percentage breakdown for the components of your course grade are the following:

1. *Homework and quizzes*: 25%
   Homeworks and quizzes will account for a total of 25% of your course grade. Two homeworks will be dropped in the calculation of your course grade. No quiz scores will be dropped.
2. *Midterm and final exams*: 75%
   You will be given two, one-hour midterm term exams during the term and a final exam during the scheduled university final exam period. At the end of the term, the average of the two midterm exams will be compared against your final exam score. The higher of these two will be given a 50% weighting and the lower of these two will be given a 25% weighting in the computation of your course average from which your course grade is determined.
3. *Bonus points (to be added to homeworks/quizzes)*:
   There will be several opportunities during the term to receive bonus points in the course. In addition, as mentioned above, two homeworks will be dropped in the calculation of your course grade.

Tutorial assistance

The discussion thread of the course blog will be open 24/7 throughout the course. We will be closely monitoring this discussion thread throughout usual business hours. During the remaining time in the week, we will continue to monitor the discussion and provide assistance when needed. In addition, the course instructor and TAs will be providing interactive tutorial sessions (each instructor: 3 hours per week, TA: 8 hours per week).

Collaboration

You are encouraged to work together in learning the course material (including homework). However, your submitted homework solutions should be YOUR work and not copied from other sources. Copying solutions from other sources will be considered to be a serious offense in this course. Please see your instructor if you are uncertain about the difference between collaborating and copying.

Usage of services such as Chegg, Course Hero, Quizlet, etc. for unauthorized help (including, but not limited to, accessing online cheating services) is a violation of class policy. The consequences of not following the course policy on this include a lowering of your course grade up through possible expulsion from the University. Suspect use cases will be submitted to the Office of the Dean of Students and, if copyright infringement is involved, to appropriate legal counsel.

Academic Integrity

Your instructor is a strong believer that the mission of the University can only be fulfilled in an environment of high academic integrity. Students are encouraged to review the University's policies on academic integrity, which is located at: https://www.purdue.edu/odos/academic-integrity/
In addition, the Purdue University Honor Pledge is located at:
https://www.purdue.edu/provost/teachinglearning/honor-pledge.html
Suspected cases of academic integrity violations will be reported to the Dean of Students.

Never forget:

As a Boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.

Assignment Schedule – Fall 2022

ME 274 - BASIC MECHANICS II

School of Mechanical Engineering - Purdue University

	PERIOD	DATE	TOPIC	READING	HOMEWORK
			KINEMATICS		
1	M	8/22	Point Kinematics – Cartesian description	1.A	H.1.A, H.1.B
2	W	8/24	Point Kinematics – Path description	1.A	H.1.C, H.1.D
3	F	8/26	Point Kinematics – Polar description	1.A	H.1.E, H1.F
4	M	8/29	Point Kinematics – Joint description	1.C	H.1.G, H.1.H
5	W	8/31	Point Kinematics – Relative and Constrained Motion	1.D	H.1.I, H.1.J
6	F	9/2	Planar Kinematics – Rigid Bodies	2.A	H.2.A, H.2.B
	M	9/5	**No Class - Labor Day**		
7	W	9/7	Planar Kinematics – Rigid Bodies	2.A	H.2.C, H.2.D
8	F	9/9	Planar Kinematics – Rigid Bodies	2.A	H.2.E, H.2.F
9	M	9/12	Planar Kinematics – Instant Centers	2.B	H.2.G, H.2.H
10	W	9/14	Planar Kinematics – Rigid Body Summary	2.C	H.2.I, H.2.J
11	F	9/16	Moving Reference Frame Kinematics – 2D	3.A	H.3.A, H.3.B
12	M	9/19	Moving Reference Frame Kinematics – 2D	3.A	H.3.C, H.3.D
	W	9/21	**No class meeting due to evening exam**		
	W	**9/21**	**Exam 1: Wed 9/21, 8:00p - 9:00p, SMTH 108**		
13	F	9/23	Moving Reference Frame Kinematics – 3D	3.B	H.3.E, H.3.F
14	M	9/26	Moving Reference Frame Kinematics – 3D	3.B	H.3.G, H.3.H
15	W	9/28	Moving Reference Frame Kinematics – 3D	3.B	H.3.I, H.3.J
			KINETICS		
16	F	9/30	Particle Kinetics – Newton's Second Law	4.A	H.4.A, H.4.B
17	M	10/3	Particle Kinetics – Newton's Second Law	4.A	H.4.C, H.4.D
18	W	10/5	Particle Kinetics – Newton's Second Law	4.A	H.4.E, H.4.F
19	F	10/7	Particle Kinetics – Work/Energy	4.B	H.4.G, H.4.H
	M	10/10	**No Class - October Break**		
20	W	10/12	Particle Kinetics – Work/Energy	4.B	H.4.I, H.4.J
21	F	10/14	Particle Kinetics – Linear Impulse/Momentum	4.C	H.4.K, H.4.L
22	M	10/17	Particle Kinetics – Linear Impulse/Momentum	4.C	H.4.M, H.4.N
	W	10/19	**No class meeting due to evening exam**		
	W	**10/19**	**Exam 2: Wed 10/19, 8:00p - 9:00p, SMTH 108**		
23	F	10/21	Particle Kinetics – Central Impact	4.C	H.4.O, H.4.P
24	M	10/24	Particle Kinetics – Angular Impulse/Momentum	4.D	H.4.Q, H.4.R
25	W	10/26	Particle Kinetics – Angular Impulse/Momentum	4.D	H.4.S, H.4.T
26	F	10/28	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.A, H.5.B
27	M	10/31	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.C, H.5.D
28	W	11/2	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.E, H.5.F
29	F	11/4	Planar Kinetics of Rigid Bodies – Work/Energy	5.B	H.5.G, H.5.H
30	M	11/7	Planar Kinetics of Rigid Bodies – Work/Energy	5.B	H.5.I, H.5.J
31	W	11/9	Planar Kinetics of Rigid Bodies – Impulse/Momentum	5.C	H.5.K, H.5.L
32	F	11/11	Planar Kinetics of Rigid Bodies – Impulse/Momentum	5.C	H.5.M, H.5.N
33	M	11/14	Planar Kinetics of Rigid Bodies – Summary	5.A-D	H.5.O, H.5.P
	T	**11/15**	**Exam 3: Tue 11/15, 8:00p - 9:00p, MTHW 210**		
	W	11/16	**No class meeting due to evening exam**		
			VIBRATION		
34	F	11/18	Vibrations – Equations of Motion	6.A	H.6.A, H.6.B
35	M	11/21	Vibrations – Free, Undamped Response	6.B	H.6.C, H.6.D
	W	11/23	**No Class - Thanksgiving Vacation**		
	F	11/25	**No Class - Thanksgiving Vacation**		
36	M	11/28	Vibrations – Free, Damped Response	6.B	H.6.E, H.6.F
37	W	11/30	Vibrations – Free, Damped Response	6.B	H.6.G, H.6.H
38	F	12/2	Vibrations – Harmonic Excitation	6.C	H.6.I*, H.6.J*
39	M	12/5	Vibrations – Harmonic Excitation	6.C	H.6.K**, H.6.L**
40	W	12/7	Vibrations – Harmonic Excitation	6.C	H.6.M**, H.6.N**
41	F	12/9	Course Overview		
			Final exam: Time and location TBD		

*: H.6.I and H.6.J are due at 11:59 pm on Sunday, 12/4

**: Homework assignments for the last week of the semester will NOT be collected

Final Examination: During the final examination period (12/12-12/17). Date, time, and location TBA during the semester.

Homework Assignments: Homework problems are due on Gradescope by 11:59 pm on the day of the next class period after they are assigned.

Solution Videos: Solution videos are provided for the assigned problems above on the course blog after the due date.

HOMEWORK FORMAT - *USE ENGINEERING PAPER*

DATE ***PROBLEM NUMBER*** ***NAME***

***Given*:** A concise statement (in your own words) of the information given.

***Find*:** A concise statement (in your own words) of the information sought.

***Solution*:** **Sketch the system** to be studied. USE A STRAIGHT EDGE for drawing lines. Always draw in the UNIT VECTORS for the coordinate systems that you use in your solution.

For kinetics problems, follow the four-step plan:

1. Draw FBD's
2. Write down the fundamental kinetics equations (Newton/Euler, work/energy, linear impulse/momentum, angular impulse momentum equations)
3. Kinematics
4. Solve

Work the problem symbolically.
At the end convert all quantities to a consistent set of units and substitute into the equations to obtain the answers.

Check your answers for correctness and feasibility.

Check your vector notation and units. In particular, check that you are not equating vector quantities to scalar quantities. It is important that you demonstrate that you know the difference between scalars and vectors. So pay attention to your notation.

Label the answers._____ANSWER

ME 274 – Course Blog

Fall 2022

The blog discussion threads for this course are intended to provide a forum for the exchange of ideas among the students in the class and between the students and the instructor. From this blog, you can get/provide assistance from/to other people in the class. We have found that you can often learn as much from helping others as from getting help for yourself.

REWARD:

To reward your involvement in the blog, *two percentage points* of your course grade is available based on the following:

> *Asking questions and providing assistance to others.* For this, you ask/answer questions of others on a comment or post. A minimum of six quality comments will count as full credit toward your blog point bonus. *Only blog activity prior to the last day of class will count toward your blog participation reward.*

ANONYMITY IN POSTING:

When you first log onto the course blog and are approved by your instructor, your default *User Name* is set to that of your Purdue Career Account. This *User Name* will appear with each comment that you post on the blog. If you would like to post anonymously, you are able to choose a new "*Nickname*" that will be displayed instead of your *User Name* on the comments. To do so:

1. Go to your "**Edit my profile**" in the upper right of the Admin Bar under "**Howdy**".
2. Add a nickname in the "**Nickname**" (*required*)" box.
3. In the "**Display name publicly as**", choose the desired nickname from the drop-down list.
4. Click "**Update Profile**" at the bottom of the page.

You may add additional *Nicknames*, and switch among these for different displays throughout the semester. If being anonymous to your colleagues is important to you for your postings, choose nicknames that will help you maintain your anonymity.