ME 274: Basic Mechanics II – Fall 2023
School of Mechanical Engineering, Purdue University, West Lafayette

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 schedule   A topical schedule for this course is on the last page of this document and can also be found on the course freeform website on the https://www.purdue.edu/freeform/me274/course-material/course-information/.

Course instructors

Instructor Section #	Lecture (MWF)	Lecture Room	Office	Office Hours	Email
Patricia Davies Section 002	12:30 - 1:20 pm	FRNY G124	HLAB 2004	MWF 1:30-2:30 pm	daviesp@purdue.edu
Luz Sotelo Section 001	2:30 - 3:20 pm	WALC B058	WANG 4179	MW 3:30-5:00pm	lsotelo@purdue.edu

Course TAs

Teaching Assistant	Email	Office Hours
Clark Addis	caddis@purdue.edu	TBD
Ruochen Wang	wang5745@purdue.edu	TBD

Course Textbook   The required course lecturebook: *Dynamics: A Lecturebook, 3rd Edition,* can be purchased from the University Bookstore.

Course Website All the course materials are all available at:
https://www.purdue.edu/freeform/me274/
Highlighted here are just a few of the features on the website/blog.

Homework and the course blog is accessed from the Homework/Discussion tab: https://www.purdue.edu/freeform/me274/blog/ and this page will be used for both threaded discussions and for the delivery of all course homework. More information on how to contribute to the Course Blog is given on page 6 of this document. Homework video solutions will be made available on the blog following the date of submission.

Animations and simulations are presented to assist you in visualizing motion and other concepts related to the topics of the course.   Under   the   Course material/Example soln videos tab, solutions to the problems in the Lecture Book are posted as multimedia video/audio files. Use these solutions to help you assess your ability to work problems like your homework problems.

All information related to exams will be made available under the Exams tab.

Class Meeting Times   Your attendance is expected at all lectures during the semester. If you are unable to attend a class, 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 this or any other virus, you should stay home and contact the Protect Purdue Health Center (496-INFO).

Homework   There will be a homework assignment for every regular class period of the semester. Two problems will be included in each assignment. The problem statements will be posted on the course blog on the date of the assignment. The homework is to be submitted on Gradescope by 11:59PM on the day of the next regular class period. Please see the pages on "*Homework guidelines*" and "*Homework format*" near the end of this document.

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%**
Two homework problems are assigned per lecture. Completed homework assignments are to the submitted on Gradescope by 11:59PM of the due date. *Late homework will not be accepted.* A sample format 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.

2.   ***Midterm and final exams*: 75%**
You will be given two, one-hour mid-term term examinations during the semester and a final two-hour exam during the scheduled University final exam period.   At the end of the semester, your performance in the two mid-terms will be compared with your performance in the final. The higher of these two (mid-terms or final) will be given a 50% weighting and the lower of these two will be given a 25% weighting in the computation of final course score, with the remaining 25% coming from the homework and quizzes scores.

3.   ***Bonus points*:**
There will be an opportunity to earn bonus points for HW and Quizzes. Officially there are 39 homework assignments, each marked out of 10, during the semester. At the end of the semester, your course homework score will be based on 36 homework assignments. That is, you are able to miss submissions for 3 homework sets without penalty to your grade, but the other 3 assignments, if submitted, provide bonus points.
In addition: participation in blog discussion can allow for up to 40 homework bonus points; and participation in mid and end of semester class surveys can allow for up to 20 bonus points (note that: 60 points is equivalent to 6 homeworks).

See page 6 detailing blog points for the course. Your instructor may also announce additional bonus points for your section. Note that your total combined HW/Quizzes/Bonus points will not exceed 25% of your final course score.

ME274 Fall 2023

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, and you can expect a quick turn-around on your questions during normal daytime hours. During the remaining time, we will continue to monitor the discussion and provide assistance when needed.

In addition, the course instructors and TAs will be providing interactive tutorial sessions/office hours. The times for these will be posted on the course website in an updated version of this Course Syllabus document, which is posted under various tabs on the freeform website including the Course material/Course information tab. You are free to attend any of the office hours/tutorial sessions, as you are not restricted to just the office hours of your own instructor.

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.

Diversity & Inclusion   Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdue's nondiscrimination policy can be found at: https://www.purdue.edu/purdue/ea_eou_statement.php

ME 274 – Emergency Information and University Resources

Emergency Preparedness

Though Purdue University is continuously preparing for natural disasters and human-caused incidents with the ultimate goal of maintaining a safe and secure campus, emergency preparedness is a personal responsibility. Please review the following items:

- To report an emergency, call 911.
- To obtain updates regarding an ongoing emergency, and to sign up for Purdue Alert text messages, view www.purdue.edu/ea
- There are nearly 300 Emergency Telephones outdoors across campus and in parking garages that connect directly to the Purdue Police Department (PUPD). If you ever feel threatened or need help, push the button, and you will be connected immediately.
- If we hear a fire alarm, we will immediately suspend class, evacuate the building, and proceed outdoors away from the building. Do not use the elevator. Go to the emergency assembly area.
    - Emergency assembly area (EAA) for Mechanical Engineering building occupants:
      Primary: Purdue Mall area outside MSEE,
      Secondary (inclement weather): Inside MSEE Atrium.
    - Emergency assembly area (EAA) for FRNY building occupants:
      Primary: near Awards Tower in the Engineering Mall,
      Secondary (inclement weather): Inside MSEE Atrium.
    - Emergency assembly area (EAA) for Wilmeth Active Learning Center (WALC) building occupants:
      Primary: Outside of the southeast corner of Potter Engineering Center which is behind WALC and near Dudley Hall (DUDL),
      Secondary (inclement weather): Inside southeast corner of Potter Engineering Center (POTR).
- If we are notified of a Shelter in Place requirement for a tornado warning, we will suspend class and shelter in the lowest level of the building away from windows and doors.
- If we are notified of a Shelter in Place requirement for a hazardous materials release, or a civil disturbance, including a shooting or other use of weapons, we will suspend class and shelter in our classroom, shutting any open doors or windows, locking or securing the door, and turning off the lights.

    If you are directed to shelter in place, but you are unaware of the specific reason, proceed to the lowest level of the building but continue to seek additional information by all possible means to determine the type of incident. Once you have determined the type of emergency, follow the chart shown on the next page:

Emergency	*Emergency Assembly Area (EAA)*
Weather-Related / Tornado Warning	Basement corridors, basement offices, basement restrooms or the lowest level of the building (stay away from windows and doors)
Hazardous Materials (HAZMAT) Release	Remain or find an unaffected office or work area and close windows and doors
Civil Disturbance / Active Shooter	Seek a safe location, preferably a room without windows that can be locked or secured by barriers

Please review the Emergency Preparedness website for additional information: https://www.purdue.edu/ehps/emergency-preparedness/

Emergency plans for the ME building and your class buildings:

ME Building Emergency Plan: https://www.purdue.edu/ehps/emergency-preparedness/emergency-plans/bep/building-beps/me-bep.html

FRNY Building Emergency Plan: https://www.purdue.edu/ehps/emergency-preparedness/emergency-plans/bep/building-beps/frny-bep.html

WALC Building Emergency Plan: https://www.purdue.edu/ehps/emergency-preparedness/emergency-plans/bep/building-beps/walc-bep.html

CAPS information

Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765) 494-6995 and https://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or by going to the CAPS office of the second floor of the Purdue University Student Health Center (PUSH) during business hours.

Accessibility

Purdue University strives to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, you are welcome to let me know so that we can discuss options.
You are also encouraged to contact Purdue Disability Resource Center (DRC): by visiting YONG Room 830, or by email drc@purdue.edu, or call: 765-494-1247. More information is on the DRC Website: https://www.purdue.edu/drc/

ME 274 – Course Blog Participation

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, up to *40 BONUS points* to your homework/quiz score are 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. For full blog credit there should be many (>6) <u>quality</u> comments throughout the semester. All *<u>blog activity prior to the last day of class will count toward your blog participation reward.</u>*

Your total combined HW/Quizzes/Bonus points will not exceed 25% of your final grade.

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.

ME274 Homework Guidelines

General Points

- If you use multiple sheets of paper to solve a problem repeat the *DATE PROBLEM NUMBER PAGE* and *NAME* header on each sheet (see format instructions on page 8).

- Each problem must start on <u>a new sheet of paper</u>.

- Your writing needs to be large enough so that when the problem is scanned, it does not require the grader to do high levels of magnification to be able to read your solution.

- If you are using a pencil to do your solution, you need to use a pencil that is on the soft side (HB at a minimum or 2B ideally) so that the writing is dark enough so that the scan works well. Make sure that the pencil is sharpened, too.

Vector Notation, Coordinate Systems, Unit Vectors, Diagrams and Free Body Diagrams

- You must use the unit vector and other notation used in this class. **Do NOT use** the "bracket notation" for vectors.
  For example, use $\vec{F} = \left(10\hat{i} + 20\hat{j}\right)lb$ instead of $\vec{F} = \left\langle 10,20 \right\rangle lb$.

- In your notation and final answers, you must clearly show that you understand the difference between a vector (e.g., velocity is a vector) and a scalar (e.g., speed is a scalar). Pay attention to what quantity you are being asked for.

- You must specify coordinate systems, associated references points, draw the unit vectors that you are using on the diagrams, and include units in your answers.

- For kinetics problems, you must include clear free-body diagrams.

Failure to do any of these things will result in a loss of points. Failure to do all of these things will result in a large loss of points.

Scanning and Uploading

- Before scanning, put the solution sheets in order for each problem, and then put the solution to the 1st assigned problem before the solution to the 2nd assigned problem.

- Scan the pages for the **two problems into one .pdf document**.
  We suggest, to make your record keeping easier, that you name the .pdf file "*ME274_Homework Numbers_Your Name*".

  Do **NOT** submit image files such as JPEG, PNG, TIFF, etc.
  You may use your mobile device to make a PDF scan the homework, e.g., with the scanning functionality of Dropbox, or apps such as Camscan or Scannable.

- Before uploading to Gradescope, check the quality of the scanned problems. You do not want to lose points because the grader is unable to read your solution. If it is hard to read, you need to rescan and make sure the result is better.

- Once uploaded, assign pages to the two problems in Gradescope.

Deadline for Uploading

- Due by 11:59PM on the day of your next class after the homework is assigned.

- While homework is due just before midnight (11:59PM), you should set yourself a goal of submitting it between 6 and 7PM at the latest, so that internet challenges can be identified soon enough to develop other strategies for uploading on time.

ME274 Homework Format

Please use **_white paper_** for your homework problem solutions in order to produce better scans.

DUE DATE (month, day, year) **PROBLEM NO.** (H#.#) **PAGE NO.** (# of #) **NAME** (last, first)

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

Some Common ME274 Questions at the Start of the Semester

Are homeworks and quizzes very important in the course?

To do well in this course, problem-solving practice (i.e., doing your homework and quizzes) is essential. 25% of your final grade in the course comes from your homework assignments, quizzes and additional extra credit opportunities.

Where can I find the homework assignments?

The homework assignement will be posted on the course blog:
https://www.purdue.edu/freeform/me274/blog/

Where can I get help with homework?

The blog can be used 24/7 for any questions regarding the course. Homework assistance is also available in the ME 274 tutorial room and instructor office hours. Staffed hours of operation will be announced in class and updated on the website.

What is the appropriate homework format?

Homework must be submitted in the correct format, as shown on page 8 of this handout. In particular, you must include statements of "Given" and "Find", and your sketch of the problem, when a figure is supplied in the problem statement.

How do I submit the homework?

Homework **must be in PDF format** and submitted via Gradescope.
Homework is due by 11:59PM on the day of the next regular class period after it is assigned.
Each problem should start on a new page.
The submission to Gradescope must be a *SINGLE* .pdf file that contains your answers to the two assigned problems, with problems and solution pages **in order**.
Once uploaded, pages must be assigned to the problems within Gradescope.

Is late homework accepted?

Late homework will **NOT** be accepted.

How is each homework set graded?

Each homework set assignment consists of 2 problems.
After submission is closed, one of the two problems is chosen to be graded.
The maximum possible score for each assignment is 10 points.

Are there extra credit (bonus points) opportunities?

Yes, there are a number of ways of receiving bonus points in the course.

• You are allowed to miss 3 of the 39 homework sets for the semester without a loss of points. If you submit more than 36 homeworks, scores on the extra submissions will count toward bonus points.
• You can receive up to 40 bonus points for course blog participation. Please see more on Blog Participation on page 6 of this handout.
• You can receive bonus points for participating in the mid-term and end-of-semester course evaluations. Contact your instructor for more information.
• The sum of Homework, Quizzes and Extra Credit Bonus Points is capped, and at most can contribute to 25% of your overrall score in the class.
  Scores on Mid-terms and Final exams make up the other 75%.

What is the format of the quizzes?

Quizzes will not be announced. The specific quiz policy for your course section will be explained by the instructors during class.

ME274 Schedule of Homework Assignments

Homework due on Gradescope by 11:59pm on the day of the next regular class period

PERIOD		DATE	TOPIC	READ	HOMEWORK
			KINEMATICS		
1	M	8/21	Point Kinematics – Cartesian, Path and Polar/Cylindrical	1.A	H.1.A, H.1.B
2	W	8/23	Point Kinematics – Cartesian, Path and Polar/Cylindrical	1.A	H.1.C, H.1.D
3	F	8/25	Point Kinematics – Cartesian, Path and Polar/Cylindrical	1.A	H.1.E, H1.F
4	M	8/28	Point Kinematics – Joint Descriptions	1.C	H.1.G, H.1.H
5	W	8/30	Point Kinematics – Relative and Constrained Motion	1.D	H.1.I, H.1.J
6	F	9/1	Planar Kinematics – Rigid Bodies	2.A	H.2.A, H.2.B
	M	9/4	*No class due to University holiday*		
7	W	9/6	Planar Kinematics – Rigid Bodies	2.A	H.2.C, H.2.D
8	F	9/8	Planar Kinematics – Rigid Bodies	2.A	H.2.E, H.2.F
9	M	9/11	Planar Kinematics – Instant Centers	2.B	H.2.G, H.2.H
10	W	9/13	Planar Kinematics – Summary	2.C	H.2.I, H.2.J
11	F	9/15	Moving Reference Frame Kinematics – 2D	3.A	H.3.A, H.3.B
12	M	9/18	Moving Reference Frame Kinematics – 2D	3.A	H.3.C, H.3.D
13	W	9/20	Moving Reference Frame Kinematics – 3D	3.B	H.3.E, H.3.F
14	F	9/22	Moving Reference Frame Kinematics – 3D	3.B	H.3.G, H.3.H
15	M	9/25	Moving Reference Frame Kinematics – 3D	3.B	H.3.I, H.3.J
	Tu	9/26	***Exam 1 Covers Periods 1-12). 8:00 – 9:00 PM.*** ***All Sections: LILY 1105.***		(due 9/29)
	W	9/27	***No class due to evening exam on Tuesday***		
16	F	9/29	Particle Kinetics – Newton's Second Law	4.A	H.4.A, H.4.B
			KINETICS		
17	M	10/2	Particle Kinetics – Newton's Second Law	4.A	H.4.C, H.4.D
18	W	10/4	Particle Kinetics – Newton's Second Law	4.A	H.4.E, H.4.F
19	F	10/6	Particle Kinetics – Work/Energy	4.B	H.4.G, H.4.H
	M	10/9	*No class due to University holiday*		
20	W	10/11	Particle Kinetics – Work/Energy	4.B	H.4.I, H.4.J
21	F	10/13	Particle Kinetics – Linear Impulse/Momentum	4.C	H.4.K, H.4.L
22	M	10/16	Particle Kinetics – Linear Impulse/Momentum	4.C	H.4.M, H.4.N
23	W	10/18	Particle Kinetics – Central Impact	4.C	H.4.O, H.4.P
24	F	10/20	Particle Kinetics – Angular Impulse/Momentum	4.D	H.4.Q, H.4.R
25	M	10/23	Particle Kinetics – Angular Impulse/Momentum	4.D	H.4.S, H.4.T
26	W	10/25	Particle Kinetics – Summary	4.A-D	H.4.U, H.4.V
27	F	10/27	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.A, H.5.B
28	M	10/30	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.C, H.5.D
29	W	11/1	Planar Kinetics of Rigid Bodies – Newton/Euler Equations	5.A	H.5.E, H.5.F
30	F	11/3	Planar Kinetics of Rigid Bodies – Work/Energy	5.B	H.5.G, H.5.H
31	M	11/6	Planar Kinetics of Rigid Bodies – Work/Energy	5.B	H.5.I, H.5.J
32	W	11/8	Planar Kinetics of Rigid Bodies – Impulse/Momentum	5.C	H.5.K, H.5.L
	Th	11/9	***Exam 2 (Covers Period 13-29), 8:00 – 9:00 PM.*** ***S002-Davies: LILY G126. S001-Sotelo: SMTH 108.***		(due 11/13)
	F	11/10	***No class due to evening exam***		
33	M	11/13	Planar Kinetics of Rigid Bodies – Impulse/Momentum	5.C	H.5.M, H.5.N
34	W	11/14	Planar Kinetics of Rigid Bodies – Summary	5.A-D	H.5.O, H.5.P
			VIBRATIONS		
35	F	11/17	Vibrations – Equations of Motion	6.A	H.6.A, H.6.B
36	M	11/20	Vibrations – Free, Undamped Response	6.B	H.6.C, H.6.D
	W	11/22	*No class due to University holiday*		
	F	11/24	*No class due to University holiday*		
37	M	11/27	Vibrations – Free, Damped Response	6.B	H.6.E, H.6.F
38	W	11/29	Vibrations – Free, Damped Response	6.B	H.6.G, H.6.H
39	F	12/1	Vibrations – Harmonic Excitation	6.C	H.6.I*, H.6.J*
40	M	12/4	Vibrations – Harmonic Excitation	6.C	H.6.K**, H.6.L**
41	W	12/6	Vibrations – Harmonic Excitation	6.C	H.6.M**,H.6.N**
42	F	12/8	Course Overview		

* Due at 11:59PM on Sunday, 12/3/2023

** Will not be collected