



## Dynamics

Fall 2020

*Dynamics* introduces students to the motion of bodies subjected to forces. The course will give students the tools required to analyze the kinematics of systems of particles and rigid bodies. Students will determine the dynamic response of a system to applied loadings using Newton's Laws, the Principle of Work and Energy, and the Principle of Impulse and Momentum.

### Instructor

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### General Course Information

Course #: GENENG 20806233  
Section #: 32628  
Instruction Mode: Online ([information about instruction mode](#))  
Prerequisite: Statics, GENENG 20806232 (C or better)  
course web page: [madsioncollegephysics.net/233](http://madsioncollegephysics.net/233)



### What you will learn in this Course

A course in *Dynamics* is a fundamental component of many types of four-year engineering degree. It is a standard class taught in every Engineering school.

#### Course Outcomes

- Express dynamic quantities as vectors in terms of Cartesian components, polar coordinates, and normal-tangential coordinates.
- Solve kinematic problems involving rectilinear and curvilinear motion of particles.
- Solve kinetic problems involving a system of particles using Newton's Second Law.
- Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to the solution of engineering problems involving particles and systems of particles.
- Solve kinematic problems involving the translation and rotation of a rigid body.
- Compute mass moments of inertia for systems of particles and rigid bodies.
- Solve kinetic problems involving planar translation and rotation of rigid bodies.
- Apply the principles of work and energy, conservation of energy, impulse and momentum, and conservation of momentum to the solution of engineering problems involving rigid bodies in planar motion.

## **Course Format Information**

### **Textbook & Supplies Required**

- Engineering Mechanics: Dynamics, 14 th ed. (Pearson), R.C. Hibbeler
  - Available through the [College Textbook Rental program](#)
- Dynamics Workbook
  - Available at the bookstore, or free to print from the course web page
- Computer capabilities required
  - network connection and compatible browser
    - please visit the [Madison College Browser Check](#)
  - Course Blackboard access
  - Registration at [Mastering Engineering](#), an online homework website
- Calculator – should have at least the basic trigonometric functions

### **Communication Plan for Faculty and Students**

Check the Announcements on our course web page for class information.

I may be reached by email at [ampaulson@madisoncollege.edu](mailto:ampaulson@madisoncollege.edu). I will make every attempt to reply to your email within 24 hours on weekdays. I occasionally check email on the weekends. Your email is important to me but I get a great deal of email. To insure that I respond to your email within one workday please follow these protocols:

- Put the course name (Dynamics), your name, and your topic in the subject line. For example: Dynamics, Sam Smith, Observation question
- Sign your email with your first and last name

A primary mode of communication in this course will be email. It is your responsibility to check your email regularly for messages. At the beginning of the semester, check to be sure Blackboard emails are not collecting in your junk email folder. If this does happen, open the email and select the option to mark the sender as approved/safe.

Use your Madison College email account for all school correspondence as other accounts (Hotmail, Yahoo, etc.) often go directly to junk email in the College mail system.

### **Computer Use**

Computer or Internet problems are not an excuse for non-participation. Please have a back-up plan, and save your work on an external drive. Should Blackboard go down, email any assignments directly to your instructor to meet deadlines. Computer and technology help can be found at [Academic Support](#).

Students must exhibit proper online etiquette. Please visit [Netiquette](#) for more.

## Academic Integrity

As a Madison College student, it is important that you:

- Become familiar with the rules and consequences of academic misconduct.
- Approach your instructor if you are not sure what behaviors constitute academic misconduct (citing information from the web, for example).
- Inform your instructor if you believe you have witnessed an incident of academic misconduct. You may report your observations without fear of retaliation.
- Know that helping someone else cheat is a violation of the rules and may result in misconduct charges.

**Plagiarism** is when you seek to claim credit for the work or efforts of another without authorization or citation. For more information, see [Citing Sources and Avoiding Plagiarism](#). Any assignments or assessments that exhibit plagiarism or other forms of cheating will receive a grade of zero.

## Class Elements

Weekly course work consists of

- **Reading assignments.** There will be a short reading quiz posted every week. The quiz will cover the previous week's reading.
- **Homework assignments.** Homework assignments (except for HW0) are submitted through Mastering Engineering. The grades there will be used to update the grades on Blackboard.
- Weekly post in the course **Discussion Forum** on Blackboard. You are encouraged to participate by asking questions, answering questions, and participating in class activities and discussions.
- Every week there will be one hour for an online **video conference** for answering questions and working through problems.

Exams

- There will be three **Midterm Exams**. These will be posted on Blackboard and you will be given one week to complete and submit it. See the course schedule for when these will be given.
- There will be one **Final Exam**. This exam will be administered identically to the midterm exams.

## Preparation Expectations for Students

Students should expect to spend 5-8 hours on coursework per week. This may increase on days before an exam. Try not to spend more than a half-hour on a given homework problem if you are not getting it. If you are having trouble starting a problem, raise your question in class.

## Late Assignment and Make-up Policies

Assignments are due on the date specified in the homework system (Mastering Engineering). If you need more time to complete an assignment, please make this request by email and include the date by which you will finish it.

## Equity and Inclusion

This class will be a safe and affirming learning space for all students, regardless of age, race, ethnicity, citizen status, gender, sex, sexual orientation, parental status, religion, ability, or socioeconomic status. As an instructor, I pledge to respect all students based upon these factors, including the use of preferred names and pronouns, and encourage open communication. Students are welcome and encouraged to share any/all viewpoints relevant to course material, and respectful, relevant debate is encouraged, provided all materials for the day can still be covered.

## Evaluation and Assessment

- Quizzes: Most weeks there will be a short quiz with questions from the reading.
- Discussion forum participation is required on Blackboard.
- Homework: One homework assignment per chapter will be posted to complete on-line.
- Exams: There will be three take-home midterm exams and a take-home final exam.

<i>Grading Criteria</i>	<i>Weight</i>
Reading Quizzes	5%
Discussions	5%
Homework Assignments	30%
Midterm Exams (3)	15%
Final Exam	15%

## Grading Calculations

Final grades at Madison College are recorded as follows:

<b>Grade</b>	A	AB	B	BC	C	D
<b>Score</b>	92-100	89-91	82-88	79-81	70-78	60-69

## Syllabus Changes

In the event that I modify the syllabus or schedule, I will provide reasonable notice to you. Look for an announcement in class and on the course web page.

## **Additional Resources**

### **Students with Disabilities (ADA Statement)**

Madison College welcomes students with disabilities into the College's educational programs. Every Madison College campus has Disability Resource Services available for students with disabilities. The Disability Resource Services website provides specific information related to accommodations for disability-related barriers. For further information, please visit [madisoncollege.edu/disability-resource-services](https://madisoncollege.edu/disability-resource-services), call 608-246-6716 (Students who are deaf should use relay) or email [DRSttransition@madisoncollege.edu](mailto:DRSttransition@madisoncollege.edu).

In order to receive consideration for reasonable accommodations for your disability, you must contact the Disability Resource Services office at the campus where you are officially enrolled. If approved for accommodations, Disability Resource Services will provide you with an accommodation plan.

Please share your accommodation plan with me and discuss your approved accommodations as early in my class as possible. If you feel your accommodation needs are not being met, please inform me or Disability Resource Services as soon as possible.

### **College Resources**

- Student Support Services <https://madisoncollege.edu/student-support>
- College Policies <https://madisoncollege.edu/policies-guidelines>
- College Resources <https://madisoncollege.edu/campus-resources>
- [Academic Support](#) including library spaces, computer and technology help, and Student Achievement Centers (with tutoring)
- [Student Support Services](#) including advising, counseling, financial literacy, etc
- [Disability Resource Services](#)
- [Academic Advising](#), [Fitness Center](#), [Health Clinic](#), [Madison College Shuttle Services](#)
- Health & Safety information: <https://madisoncollege.edu/covid>

### **Technology Access and Assistance**

You can borrow [laptop computers and wi-fi hot spots](#) for the semester, at no cost. Microsoft and antivirus software will be pre-loaded, and technology training and assistance is available for all currently registered students. Complete your [equipment loan request online](#) or call the Help Desk at 608-243-4444.

## Infectious Disease Reduction Efforts

COVID-19 and other infectious diseases are active in our local communities. While Madison College cannot guarantee that our campus is free of infectious disease, with everyone working together we can reduce the risk of transmission of these diseases within our community.

Madison College's COVID information is available at [madisoncollege.edu/covid](https://madisoncollege.edu/covid).

We have adopted rules that are designed to reduce the risk of transmission of these diseases and viruses on campus. The rules are based on guidance and recommendations from state and local health experts and authorities, including the Centers for Disease Control, and more. We expect that all students, staff and faculty will become familiar with the rules and comply with them as part of an overall effort to make our campus as safe as possible. We take the safety of our students, staff and faculty seriously.

Failure to comply with the rules may lead to disciplinary action up to and including exclusion from campus. Questions about the rules should be directed to Geraldo VilaCruz PhD., Dean of Students, 608-243-4555 / [deanofstudents@madisoncollege.edu](mailto:deanofstudents@madisoncollege.edu) (students and guests) OR [employeerelations@madisoncollege.edu](mailto:employeerelations@madisoncollege.edu).

Madison College understands that while it is required that all individuals on campus wear a mask/facial covering, not all individuals are able to do so. Madison College will provide accommodations, whenever possible, to meet the needs of these individuals. These individuals should be referred to Disability Resource Services (DRS) for further assistance: (608) 246-6716 or email [drstransition@madisoncollege.edu](mailto:drstransition@madisoncollege.edu)

## Madison College is a Safe Space for All

Madison College is committed to providing a safe space for all students, employees and staff. Negative attitudes and fear during the COVID-19 pandemic can lead to [discrimination against people and communities](#). Prejudiced behavior violates our values and our policies and should be reported. If you experience or observe harassment or discrimination, Madison College's [Harassment and Discrimination Policy](#) outlines the procedure for filing a complaint. Madison College does not tolerate discrimination of any type. We strive to provide an educational environment free from harassment.

## Course Schedule – see the [course web page](#) for exam date and changes

- Week 1:
- **Ch 12: Kinematics of a Particle**
  - 12.1 Introduction
  - 12.2 Rectilinear Kinematics: Continuous Motion
  - 12.3 Rectilinear Kinematics: Erratic Motion
- Week 2:
- 12.4 General Curvilinear Motion
  - 12.5 Curvilinear Motion: Rectangular Components
  - 12.6 Motion of a Projectile
  - 12.7 Curvilinear Motion: Normal and Tangential Components
  - 12.8 Curvilinear Motion: Cylindrical Components
- Week 3:
- 12.9 Absolute Dependent Motion Analysis of Two Particles
  - 12.10 Relative-Motion of Two Particles Using Translating Axes
  - **Ch 13: Kinetics of a Particle: Force and Acceleration**
  - 13.1 Newton's Second Law of Motion
  - 13.2 The Equation of Motion
  - 13.3 Equation of Motion for a System of Particles
  - 13.4 Equations of Motion: Rectangular Coordinates
- Week 4:
- 13.5 Equations of Motion: Normal and Tangential Coordinates
  - 13.6 Equations of Motion: Cylindrical Coordinates
- Week 5:
- **Ch 14: Kinetics of a Particle: Work and Energy**
  - 14.1 The Work of a Force
  - 14.2 Principle of Work and Energy
  - 14.3 Principle of Work and Energy for a System of Particles
  - 14.4 Power and Efficiency
  - 14.5 Conservative Forces and Potential Energy
  - 14.6 Conservation of Energy
- Week 6:
- **Ch 15: Kinetics of a Particle: Impulse and Momentum**
  - 15.1 Principle of Linear impulse and Momentum
  - 15.2 Principle of Linear impulse and Momentum for a System of Particles
  - 15.3 Conservation of Linear Momentum for a System of Particles
  - 15.4 Impact
- Week 7:
- 15.5 Angular Momentum
  - 15.6 Relation Between Moment of a Force and Angular Momentum
- 15.7 Principle of Angular Impulse and Momentum
  - 15.8 Steady Flow of a Fluid Stream
- Week 8:
- 15.9 Propulsion with Variable Mass
- Week 9:
- **Ch 16: Planar Kinematics of a Rigid Body**
  - 16.1 Planar Rigid-Body Motion
  - 16.2 Translation
  - 16.3 Rotation about a Fixed Axis
  - 16.4 Absolute Motion Analysis
  - 16.5 Relative-Motion Analysis: Velocity
- Week 10:
- 16.6 Instantaneous Center of Zero Velocity
  - 16.7 Relative-Motion Analysis: Acceleration
  - 16.8 Relative-Motion Analysis using Rotating Axes
- Week 11:
- **Ch 17: Planar Kinetics of a Rigid Body: Force and Acceleration**
  - 17.1 Mass Moment of Inertia
  - 17.2 Planar Kinetic Equations of Motion
  - 17.3 Equations of Motion: Translation
  - 17.4 Equations of Motion: Rotation about a Fixed Axis
  - 17.5 Equations of Motion: General Plane Motion
- Week 12:
- **Ch 18: Planar Kinetics of a Rigid Body: Work and Energy**
  - 18.1 Kinetic Energy
  - 18.2 The Work of a Force
  - 18.3 The Work of a Couple Moment
  - 18.4 Principle of Work and Energy
- Week 13:
- 18.5 Conservation of Energy
  - **Ch 19: Planar Kinetics of a Rigid Body: Impulse and Momentum**
  - 19.1 Linear and Angular Momentum
  - 19.2 Principle of Impulse and Momentum
  - 19.3 Conservation of Momentum
  - 19.4 Eccentric Impact
- Week 14:
- **Ch 20: Three-Dimensional Kinematics of a Rigid Body**
  - 20.1 Rotation About a Fixed Point
  - 20.2 The Time Derivative of a Vector Measured from Either a Fixed or Translating-Rotating System
  - 20.3 General Motion
- Week 15:
- **Ch 21: Three-Dimensional Kinetics of a Rigid Body**
  - 21.1 Moments and Products of Inertia \*
  - 21.2 Angular Momentum
  - 21.3 Kinetic Energy
- Week 16:
- **Final Exam**