ENGR 222 Dynamics **Fall Semester 2020**
3 Credit Hours

Course Syllabus

"I think that men (and women) of science as well as other men need to learn from Christ, and I think that Christians whose minds are scientific are bound to study science that this view of the glory of God may be as extensive as their being is capable of."

– James Clerk Maxwell, Letter to the Victoria Society, 1875, in L. Campbell and W. Garnett, The Life of James Clerk Maxwell, (Macmillan, London, 1882).

Instructor:	Dr. Mark Yuly		Rm. P106	567-9282
Office Hours:		MTWRF	Rm. P106	1:30-2:30 PM

Preferred means of contact: Please come talk to me whenever you feel like it. If I am in my office, I'm available to talk!

If that is not possible, please contact me at mark.yuly@houghton.edu to set up a zoom appointment.

Schedule:	Lecture	MWF	Rm. P207	8:50-9:40 AM

Nature and Nature's laws lay hid in night;
God said, "Let Newton be!" and all was light.
-- Alexander Pope

It did not last: the Devil howling "Ho!
Let Einstein be!" restored the status quo.
-- Sir John Collings Squire

Catalog Description: Development of classical Newtonian mechanics focusing on the dynamics of rigid bodies in one, two, and three dimensions. Topics include work and energy, central forces, collisions, non-inertial frames of reference, oscillations, vibrations. Prerequisites: MATH 181, PHYS 151

Objectives: In this course you will learn the methods by which motion may be analyzed in terms of kinematical quantities and forces. In addition to the theoretical treatments we discuss in class, as a practical application you will have a special orbital mechanics design project. You will use computer analysis tools to optimize your solution, and make an oral presentation to the class. My goal for all of this is to prepare you not just with a theoretical understanding of dynamics, but for the broad range of practical activities in which practicing engineers and scientists participate.

Learning outcomes:

These objectives will be evidenced by the following outcomes:

1. Ability to solve dynamic linear mechanical problems in two and three dimensions using… (P1, E1).
    a. … conservation of momentum and energy to solve classical collision problems.
    b. … rotating systems or reference frames.
    c. … simple harmonic oscillating systems that are damped or driven.
    d. … central forces, especially those of gravity and celestial mechanics.
2. Understanding of the elements of design in engineering, how they relate to the underlying science, and how to apply them as part of a team to a specific engineering problem (P1, P5, P7, E1, E2, E5, E7).
3. Ability to use computer software (for example, Octave, MATLAB, Mathematica or Mathcad) to closed and open-ended (i.e., design) problems (P1, E1).
4. The ability to give a professional oral presentation about a technical subject. (P3, E3)

Numbers in parentheses indicate the corresponding departmental learning objectives, available at

Engineering: TBD

Physics https://www.houghton.edu/academics/majors-programs/physics/physics-department-mission/

Text: Engineering Mechanics-Dynamics (Eighth Edition) by J.L. Meriam and L.G. Kraige, Wiley, 2015. ISBN 9781118885840

Class Attendance: This class is designed for synchronous in-person sessions in the classroom. If at all possible, you are encouraged to participate in-person. However, if you cannot be present in-person and must take the course through distance learning, you are still expected to be present and engaged remotely for each scheduled class session.

If you are unable to attend a class session for any reason, including quarantine, please make arrangements with me. If you miss a class session and do not contact me for instructions your grade for the course may be negatively affected.

Students participating in-person will need to sit in the same spot every day to facilitate taking attendance and keeping a seating chart.

Online students: This class is designed for synchronous in-person sessions in the classroom. Students taking the course online are expected to participate synchronously in the regularly scheduled sessions. However, in the event this is not possible, class sessions will be recorded and made available for review.

In the event campus classes are canceled: In the event on campus classes are canceled due to pandemic, the course will carry on remotely, synchronously, at the same meeting time as before. Attendance at online class sessions will be required. The format will be the same as for other remote learners in the class.

COVID-19 rules for in-person class sessions:

The following safety precautions must be scrupulously observed:

1. Everyone, teachers and learners, will wear a mask while moving to and from classes.
2. Students should not enter the classroom until five minutes before the scheduled start.
3. Students should leave the classroom within five minutes of the scheduled end.
4. Teachers should ensure that the class session ends promptly at the scheduled time.
5. Students will wear masks while in the classroom.
6. Students should clean their desks at the beginning of the class using materials provided. Teachers should clean podiums and other surfaces they routinely touch, including doorknobs. Please clean keyboards, computer hardware, and switches with disinfecting wipes.
7. Once everyone is seated, teachers may switch from a mask to a clear face shield. They should return to wearing a mask by the end of the class session.
8. Adequate social distancing will inform seating arrangements.
    a. Chairs, desks, and table spaces that should not be used will be labeled.
    b. Please do not rearrange any furniture.
    c. Student seating will be assigned, and careful attendance records will be kept, including where each student was located during class.
    d. Faculty will stay in the teaching area at the front of the room, at least six feet away from others people. If circumstances require the teacher to move outside the teaching area, a mask will be used.

Homework:

Problem Sets are generally to be turned in before 5:00 PM on the due date. They are at https://www.houghton.edu/academics/majors-programs/physics/course-websites/engr-222-dynamics/ .

Late homework will not be accepted.

I plan to be very particular about the format of the homework. Sloppy or disorganized work will not be accepted. I will expect the following rules to be followed:

1. Use only one side of your paper.
2. Each new problem is to begin on a new sheet.
3. Copy the problem, in its entirety, at the top of the page, before you begin the solution.
4. Use words to describe each step in the solution.
5. Leave space - do not crowd your work into a tiny area on the page.

I will show you some examples of the format I expect you to follow.

Working together:

I strongly encourage you to work together on your homework. We will discuss in class what that looks like. I hope small groups can still work together in person in the student office, as long as masks are worn and 6 feet distance is maintained. If not, you can still work together virtually. In that case, I would recommend using the video chat capability of MS Teams. To simulate writing on the chalkboard, I would recommend using either Invision freehand https://projects.invisionapp.com/d/main#/projects for

short things that you do not want to print out, or ConceptBoard https://app.conceptboard.com/.

Turning in Homework:

All handouts and assignments will be posted to the web, at: https://www.houghton.edu/academics/majors-programs/physics/course-websites/engr-222-dynamics/ . I may have one more update, so don't go there yet!

As an experiment, this semester we will be using Rocketbook for homework. Rocketbook allows you to write your homework on paper just like you always do, then quickly scan and upload it using a phone. It rotates everything, makes it the correct size, stiches the pages together and uploads a pdf.

1. To use this, you can download free paper templates at: https://getrocketbook.com/pages/rocketbook-for-free
2. Print some of these out, and then you can write your homework on them, just like always.
3. Download and install Rocketbook for android or iOS. See https://rocketbookhelp.zendesk.com/hc/en-us/categories/360000286633-Getting-Started
4. Set up Rocketbook to email the pdf files to yourself.
5. Finally, upload the pdf file to the proper assignment in MS Teams (or, alternatively, to the Homework section in MS OneNote).
6. Alternatively, if you have a tablet you could just use OneNote to write your homework directly into the OneNote section for homework.

Exams:

There will be a take-home midterm exam Oct. 5-9 and a take-home final examination Dec. 7-14. During the scheduled final exam period we will review the solutions to the final exam questions.

Design Project:

You will be required to participate in a design project as part of the course. The problem will be announced at a later date. You will be required to make a 10 minute (each student) oral presentation describing your proposal.

Grades:

Grades are assigned according to the Physics Department grading rubric at http://www.houghton.edu/physics/physics-grading-rubric/. The final grade will represent a weighted average of the scores on the homework (40%), the midterm exam (15%), the design project (15%) and the final exam (30%).

Technology Policy:

During class, please silence cell phones and do not use computers for taking notes without talking to me first.

College Support Services:

I want you to be aware of some of the services that the college provides that may be helpful for you (more information can be found online or by talking to me).

Academic Support and Accessibility Services
Writing Center
Counseling Services
Office of Vocation and Calling

Self-Reporting of Disabilities:

If you have an academic disability that requires special accommodations or modifications, it is up to you to self-report any such disability to the Academic Support and Accessibility Services office (585-567-9622). With appropriate documentation, you will be afforded the necessary accommodations and/or modifications. For more information , go to: http://www.houghton.edu/academics/academic-resources/center-for-academic-success-and-advising/ .

Academic Integrity:

From the course catalog: "Honesty is the foundation on which all intellectual endeavors rest. To use the ideas of others without acknowledging the authors of those ideas belies the nature and purpose of academic life. At Houghton, where we strive to live out Christian calling and commitment, personal integrity, including academic honesty, should be the hallmark of all our work and relationships.

Students are expected to exhibit extreme care relative to personal honesty in all academic work, including in-class and out-of-class learning experiences, such as exams, quizzes, journals, papers, research projects, etc. Dishonest work includes but is not limited to the following:

1. Obtaining aid or information without giving due recognition to the sources of such aid or information. Such dishonesty encompasses 1) asking to copy or copying other students' work to claim as one's own on an exam or assignment of any kind and 2) all forms of plagiarism. Plagiarism includes using ideas, words or phrases from any source without citing that source and downloading or purchasing papers or parts of papers from others or the Internet and claiming such work as one's own.
2. Giving aid or information when it is clearly inappropriate to do so, such as providing answers for an exam or writing a portion of a paper or an entire paper for someone, including selling one's work.

See the college catalog athttps://www.houghton.edu/academics/course-catalog/catalog-table-of-contents/ page 39 for the college statement on academic honesty.

Expected Minimum Time Required:

For each credit hour, the minimum amount of time expected for course-related work is 45 hours (3 hours per week per credit) giving 8,100 minutes minimum for this 3 credit hour class. A more realistic estimate for the time required to complete each task in this class is shown below.

Learning activity	Additional comments	Typical ***minimum*** time on task	Total time (in minutes)
Class time	Not including project and take home test days	50 minutes for 37 days	1850
Assigned reading *202 pages* (hand count, 6th ed.)	Textbook reading	8 minutes/page	1616
Homework assignments *8 Problem Sets*		7 hours per problem set	3360
Project Time	Meeting and working with team	15 hours	900
Exams *Midterm prep and Final*		Midterm: 10 hours Final: 15 hours	1500
TOTAL			**9,226**

Schedule of class sessions:

Online Sessions		
1. Monday, Aug. 31	Topic:	**Introduction and Math Review**
2. Wednesday, Sept. 2	Topic: Read: Assigned:	**Math Review -- Vectors** Chapter 1, Appendix C Problem Set #1
3. Friday, Sept. 4	Topic:	**Math Review – Differential Equations**
In-person Sessions		
4. Monday, Sept. 7	Topic: Read:	**Kinematics** Chapter 2-1 to 2-3, 2-8, 2-9
5. Wednesday, Sept. 9	Topic: Read: Due: Assigned:	**Coordinate Systems** Chapter 2-4 to 2-7 Problem Set #1 Problem Set #2
6. Friday, Sept. 11	Topic:	**Coordinate Systems**
7. Monday, Sept. 14	Topic:	**Coordinate Systems**
8. Wednesday, Sept. 16	Topic: Read:	**Newton's Laws** Chapter 3/1 to 3/5
9. Friday, Sept. 18	Topic: Due: Assigned:	**Examples** Problem Set #2 Problem Set #3
10. Monday, Sept. 21	Topic: Read:	**Work and Energy** Chapter 3-6, 3-7
11. Wednesday, Sept. 23	Topic:	**Examples**
12. Friday, Sept. 25	Topic: Read:	**Linear and Angular Momentum** Chapter 3-8, 3-9, 3-10
13. Monday, Sept. 28	Topic: Due: Assigned:	**Examples** Problem Set #3 Problem Set #4

14. Wednesday, Sept. 30	Topic: Read:	**Impact and Collisions** Chapter 3-12
15. Friday, Oct. 2	Topic:	**Impact and Collisions**
16. Monday, Oct. 5	Topic: Due: Assigned:	**Examples** Problem Set #4 Midterm Exam
17. Wednesday, Oct.7		**Reading Half Day (no class)**
18. Friday, Oct. 9	Topic: Read:	**Gravity and Orbits** Chapter 3-13
19. Monday, Oct. 12	Topic: Due: Assigned:	**Gravity and Orbits** Midterm Exam Problem Set #5
20. Wednesday, Oct. 14	Topic: Read:	**Examples**
21. Friday, Oct. 16	Topic: Read:	**Rockets** Chapter 4-6, 4-7
22. Monday, Oct. 19	Topic:	**Design Project: Introduction**
23. Wednesday, Oct. 21	Topic:	**Design Project: Introduction**
24. Friday, Oct. 23	Topic:	**Design Project: Example**
25. Monday, Oct. 26	Topic: Due:	**Design Project: Example** Problem Set #5
26. Wednesday, Oct. 28	Topic:	**Design Project: Example**
27. Friday, Oct. 30	Topic:	**Design Project**
28. Monday, Nov. 2	Topic:	**Design Project**
29. Wednesday, Nov. 4	Topic: Read:	**Simple Harmonic Oscillator** Chapter 8-1 to 8-3
30. Friday, Nov. 6	Topic:	**Damping and Resonance**

31. Monday, Nov. 9	Topic:	**Damping and Resonance**
32. Wednesday, Nov. 11	Topic: Due: Assigned:	**Design Project: Presentations** Project PowerPoints, SMath file at class time Problem Set #6
33. Friday, Nov. 13	Topic:	**Design Project: Presentations**
34. Monday, Nov. 16	Topic:	**Design Project: Presentations**
35. Wednesday, Nov. 18	Topic: Read:	**Systems of Particles** Chapter 4-1 to 4-5
36. Friday, Nov. 20		**Midterm Exam Retake (7:50 am to 9:50 am)**
37. Monday, Nov. 23	Topic: Due:	**Systems of particles (Continued)** Problem Set #6
Wednesday, Nov. 25		**THANKSGIVING BREAK**
Friday, Nov. 27		**THANKSGIVING BREAK**

Online Sessions

38. Monday, Nov. 30	Topic: Read: Assigned:	**Rigid Body Kinematics in a Plane** Chapter 5-1 to 5-3 Problem Set #7
39. Wednesday, Dec. 2	Topic:	**Examples**
40. Friday, Dec. 4	Topic: Read:	**Relative Motion for Rigid Bodies in a Plane** Chapter 5-4 to 5-6
41. Monday, Dec. 7	Topic: Due: Assigned:	**Examples** Problem Set #7 Take home final exam
42. Wednesday, Dec. 9		**Work on Final Exam**
43. Friday, Dec. 11		**Work on Final Exam**
Monday, Dec. 14	Due:	**Final Exam (9:00 AM)**

(class meets to answer questions about the test)