

Engineering Mechanics / College of Engineering

E M 345 – Dynamics Spring 2016 Syllabus

Part 1: Course Information

Instructor Information

Instructor: L.D. Sturges
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Course Description (from ISU Course Catalog, 2015 – 2016)

(3-0) Cr. 3. Particle and rigid body kinematics, Newton's laws of motion, kinetics of plane motion, rigid body problems using work-energy, linear, and angular impulse-momentum principles, vibrations.

Course Prerequisites (and previous knowledge expected)

Credit in E M 274 – Statics of Engineering

- Free-body diagrams
- Force components and resultants
- Moment of a force about a point and about a line
- Equivalent force-couple for a system of forces
- Center of mass and centroid of an area
- Mass moment of inertia

Credit or enrollment in Math 266 or 267 – Elementary Differential Equations).

- Differentiation (chain rule)
- Integration (standard functions)
- Differential equations (separation of variables; second order, linear, constant coefficient)

Textbook

Engineering Mechanics: Dynamics, 8th Edition, by J.L. Meriam, L.G. Kraige, and J.N. Bolton, John Wiley & Sons, Inc., New York. 2015.

The textbook itself is not required. However, a WileyPLUS access code is required to turn in homework. Full access to an electronic version of the textbook is available through WileyPLUS. Therefore, you may choose between 1) purchasing the package that includes the textbook with the WileyPLUS access code; 2) purchasing the textbook and WileyPLUS access card separately; or 3) purchasing only the WileyPLUS access card and accessing the textbook through WileyPLUS (<http://www.wileyplus.com>).

Homework

Homework will be turned in through WileyPLUS. Students will generally have about one week to complete each assignment. Although students are expected to complete assignments by themselves, students are encouraged to work together on problem solving strategies and techniques.

Exams

The three semester exams are **night exams – from 8:15 to 9:45 pm** – at locations to be announced. **Make-up exams** will be given only for unusual circumstances and/or approved medical excuses. For anticipated conflicts with a scheduled exam, you must contact your instructor **BEFORE** the exam to request and **attempt** to arrange an alternate exam. (**All requests for make-up exams must be submitted in writing** and must include the reason for the request and a copy of your schedule.)

Part 2: Course Learning Objectives

Enduring Understanding

The purpose of this course is to develop the thought process and discipline of students to enable them to systematically solve dynamics problems confidently and competently, regardless of difficulty.

Students will understand that:

- Forces are responsible for causing motion of bodies.
- Many problems that look very different from one another are in fact nearly identical and are solved with the same basic techniques.

Emphasis

This course is intended to familiarize students with basic concepts of particle and rigid body kinematics and kinetics as a basis for continued work in dynamics, machine design, mechanical vibrations, structural vibrations, and space flight dynamics.

Specific Course Learning Outcomes

By completion of the course, students should be able to:

- Calculate the velocity and acceleration of a particle in rectangular coordinates, in polar coordinates, in normal/tangential coordinates.
- Relate the velocity and acceleration of points in a rigid body using the absolute motion approach and using the relative motion approach.
- Solve particle kinetics problems using Newton's second law, work-energy, and/or impulse-momentum methods.
- Solve rigid-body planar motion problems using Euler's equations, work-energy, and/or impulse-momentum methods.
- Solve particle and rigid-body impact problems.
- Solve one-degree-of-freedom vibration problems of particles and rigid bodies in un-damped and damped free vibration.

Educational Outcomes

The course's learning objectives, assessment methods, and instructional techniques are formulated to address the following ABET Student Outcomes:

- (a) an ability to apply mathematics, science and engineering
- (e) an ability to identify, formulate and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Part 3: Topic Outline/Schedule

Period	Date	Reading	Topics	Problems
1	M 1/11	2/ 1,2,3	Position, velocity, acceleration	2/ 3, 10, 13
2	W 1/13	2/ 1,2,3	Rectilinear motion	2/ 16, 26, 28
3	F 1/15	2/ 4	Rectangular coordinates	2/ 64, 72, 74, 85
M 1/18 Martin Luther King Holiday — No Classes				
4	W 1/20	2/ 5	Normal and tangential coordinates	2/ 98, 100, 112, 122
5	F 1/22	2/ 6	Polar coordinates	2/ 135, 137, 142, 151
6	M 1/25	2/ 8,9	Relative/constrained motion	2/ 191, 203, 209, 215
7	W 1/27	3/ 1-5	Particle kinetics	3/ 2, 13, 18, 28
8	F 1/29	3/ 1-5	Particle kinetics	3/ 48, 51, 55, 57
9	M 2/1	3/ 6,7	Work and energy method	3/ 104, 109, 111, 112
10	W 2/3	3/ 6,7	Work and energy method	3/ 139, 142, 147, 151
11	F 2/5		Review	2/ 204; 3/ 39, 84
12 M 2/8 NIGHT EXAM 1 — Through Period 10				
13	W 2/10	3/ 8,9	Linear impulse and momentum	3/ 177, 182, 188, 195
14	F 2/12	3/ 10	Angular impulse and momentum	3/ 215, 220, 223, 225
15	M 2/15	3/ 11,12	Direct central impact	3/ 241, 242, 243, 255
16	W 2/17	3/ 12	Oblique central impact	3/ 253, 254, 258, 261
17	F 2/19	5/ 1,2,3	Plane kinematics of rigid bodies	5/ 2, 11, 13, 16
18	M 2/22	5/ 3	Absolute motion analysis	5/ 30, 37, 38, 42
19	W 2/24	5/ 4	Relative velocity analysis	5/ 65, 71, 72, 73
20	F 2/26	5/ 4	Relative velocity analysis	5/ 74, 76, 78, 80
21	M 2/29	5/ 5	Instantaneous center of zero velocity	5/ 95, 99, 101, 104
22	W 3/2	5/ 6	Relative acceleration analysis	5/ 127, 134, 139, 140
23	F 3/4		Review	3/ 131, 211; 5/ 75
24 M 3/7 NIGHT EXAM 2 — Through Period 21				
25	W 3/9	5/ 6	Relative acceleration analysis	5/ 144, 145, 147, 148
26	F 3/11	4/ 1,2,3	Systems of particles, Moments of Inertia	
M 3/14 – F 3/18 Spring Break				
27	M 3/21	6/ 1,2,3	General equations of motion, Translation	6/ 3, 6, 11, 14
28	W 3/23	6/ 3	Translation, Fixed axis rotation	6/ 17, 22, 34, 36
29	F 3/25	6/ 4	Fixed axis rotation	6/ 39, 44, 46, 51
30	M 3/28	6/ 5	General plane motion	6/ 71, 73, 79, 80
31	W 3/30	6/ 5	General plane motion	6/ 86, 88, 91, 92
32	F 4/1	6/ 5	General plane motion	6/ 94, 95, 98, 102
33	M 4/4	6/ 6	Work – energy of rigid bodies	6/ 111, 115, 117, 118
34	W 4/6	6/ 6	Work – energy of rigid bodies	6/ 120, 124, 127, 133
35	F 4/8	6/ 6	Work – energy of rigid bodies	6/ 134, 139, 141, 144
36	M 4/11	6/ 8	Impact of rigid bodies	6/ 178, 183, 203, 205
37	W 4/13	6/ 8	Impulse – momentum of rigid bodies	6/ 172, 177, 187, 189
38	F 4/15		Review	5/ 53; 6/ 90, 101
39 M 4/18 NIGHT EXAM 3 — Through period 37				
40	W 4/20	8/ 1,2	Vibrations, simple harmonic motion	8/ 2, 4, 5, 7
41	F 4/22	8/ 2,4	Un-damped free vibrations	8/ 9, 18, 21, 23
42	M 4/25	8/ 2,4	Damped free vibrations	8/ 33, 39, 42, 43
43	W 4/27	8/ 2,4	Rigid body vibrations	8/ 72, 81, 89, 126
44	F 4/29		Review	

The assigned homework problems should be considered a minimum assignment. Students should do as many additional problems as is necessary to thoroughly understand the basic principles.

Night Exams:

Place: _____

Final Exam: Time: _____, Day: _____, Date: _____, Place: _____

Part 4: Grading Policy

Graded Course Activities

Percentage	Description
88%	Exams 1 – 3 and Final Exam; 22% each
12%	Homework

Late Work Policy

Be sure to pay close attention to deadlines – there will be no make-up exams or late homework accepted without a serious and compelling reason and instructor approval.

Viewing Grades on Blackboard Learn

Points you receive for graded activities will be posted to the Blackboard Learn Grade Book page. Click on the My Grades link on the left navigation to view your points. Your instructor will update the online grades after each exam is graded.

Letter Grade Assignment

Letter grades will be given only for the final course grade and will be no lower than the following grade scale

A > 91%	B- > 78%	D+ > 65%
A- > 88%	C+ > 75%	D > 60%
B+ > 85%	C > 70%	D- > 56%
B > 80%	C- > 68%	F < 56%

Part 5: Course Policies

Class Participation and Miscellany

- Attendance will not be taken or recorded, but your attendance and class participation is strongly encouraged
- Students should take their own notes. At the instructor's discretion, supplemental notes, EOL recorded lectures, and supplementary modules may be provided through the course Blackboard Learn page.
- This course does not offer extra credit.
- Please turn off or silence your cell phone during class. Please respect your classmates and do not use your cell phone during class.
- Use of laptops/tablets is strongly discouraged.

Build Rapport

If you find that you have any trouble keeping up with homework or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that we can help you find a solution.

Understand When You may Drop This Course

It is the student's responsibility to understand when they need to consider dis-enrolling from the course. Refer to ISU's policy for dates and deadlines for registration. After this period, a serious and compelling reason is required to drop from the course. Serious and compelling reasons includes: (1) documented and significant change in work hours, leaving student unable to attend class, or (2) documented and severe physical/mental illness/injury to the student or student's family.

Disability Accommodation

Iowa State University complies with the Americans with Disabilities Act and Sect 504 of the Rehabilitation Act. If you have a disability and anticipate needing accommodations in this course, please contact the instructor to set up a meeting within the first two weeks of the semester or as soon as you become aware of your need. Before meeting with your instructor, you will need to obtain a SAAR form with recommendations for accommodations from the Disability Resources Office (<http://www.dso.iastate.edu/dr/student>), located in Room 1076 on the main floor of the Student Services Building. Contact by phone at 515-294-7220 or email disabilityresources@iastate.edu. Retroactive requests for accommodations will not be honored.

Academic Dishonesty

"The academic work of all students must comply with all university policies on academic honesty. Examples of academic misconduct are:

- Attempting to use unauthorized information in the taking of an exam;
- Submitting as one's own work, themes, reports, drawings, laboratory notes, computer programs, or other products prepared by another person;
- Knowingly assisting another student in obtaining or using unauthorized materials; or
- Plagiarism."

ISU Dean of Students Office
Academic Misconduct

<http://www.dso.iastate.edu/ja/academic/misconduct.html>

This class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office (<http://www.dso.iastate.edu/ja/academic/misconduct.html>).

Dead Week

This class follows the Iowa State University Dead Week Policy as noted in section 10.6.4 of the Faculty Handbook (<http://www.provost.iastate.edu/resources/faculty-handbook>).

Harassment and Discrimination

Iowa State University strives to maintain our campus as a place of work and study for faculty, staff, and students that is free of all forms of prohibited discrimination and harassment based upon race, ethnicity, sex (including sexual assault), pregnancy, color, religion, national origin, physical or mental disability, age, marital status, sexual orientation, gender identity, genetic information, or status as a U.S. veteran. Any student who has concerns about such behavior should contact his/her instructor, Student Assistance at 515-294-1020 or email dso-sas@iastate.edu (<http://www.dso.iastate.edu/sa>), or the Office of Equal Opportunity and Compliance at 515-294-7612 (<http://www.eoc.iastate.edu/>).

Religious Accommodation

If an academic or work requirement conflicts with your religious practices and/or observances, you may request reasonable accommodations. Your request must be in writing, and your instructor or supervisor will review the request. You or your instructor may also seek assistance from the Dean of Students Office (<http://www.dso.iastate.edu>) or the Office of Equal Opportunity and Compliance (<http://www.eoc.iastate.edu/>).

Course policies are subject to change. It is the student's responsibility to check Blackboard Learn for corrections or updates to the syllabus. Any changes will be posted in Blackboard Learn.