THE UNIVERSITY OF MICHIGAN
Department of Mechanical Engineering

ME 240 Introduction to Dynamics & Vibrations
Winter 2008, Section 002

Instructor 002: Professor Kathleen Sienko, sienko@umich.edu, 3116 G.G. Brown, 734-647-8249
Office hours: Monday 1:00-2:00, 3116 G.G. Brown
Wednesday 1:30-3:30, ME Learning Center (2281 G.G. Brown)

Section 002: Monday, 11:30 AM-1:00 PM, 220 Chrysler
Wednesday, 11:30 AM-1:00 PM, 220 Chrysler
Friday, 11:30-12:30 PM, 220 Chrysler

GSI 002: Adam Frischknecht, afrisch@umich.edu
Office hours: TBD, ME Learning Center (2281 G.G. Brown)

GSI 001: Joosup Lim, jooslim@umich.edu
GSI 003: Todd Lillian, tlillian@umich.edu

Tutoring Hours: ME Learning Center 2281 G.G. Brown, Areas A&B
Tentatively scheduled for Tuesday 3-7, Wednesday 9-5, Thursday 9-5 (hours subject to change)

Prerequisites: Physics 140 and Mathematics 216 (co-requisite)

Text: *Engineering Mechanics Dynamics*, 5th Ed.
Anthony Bedford & Wallace Fowler
Pearson Prentice Hall, Upper Saddle River, NJ, 2008.

Website: https://ctools.umich.edu/portal

Homework: Problem sets are an essential part of the course and they represent a key opportunity to learn the material. Problem sets will be assigned on Fridays and are due at the **beginning** of class on the following Friday[1]. Late problem sets will **not** be accepted. Your homework must show your work with the answers clearly marked. You may work in groups. However, the work you hand in must represent your own effort. Collaborators must be cited on each assignment to acknowledge those you worked with. Two computer assignments (CA) will be assigned during the term.

Examinations[2]: Dates and times are subject to change. All exams are closed book. Calculators and a hand-written formula sheet are allowed. Additional details will be provided at the time of the exam.

Examination #1:	2/11/08, 11:30-1:00 PM, 220 Chrysler
Examination #2:	3/31/08, 11:30-1:00 PM, 220 Chrysler
Final Examination:	4/22/08, 1:30-3:30 PM, 220 Chrysler

Quizzes: Unannounced quizzes will periodically (approximately weekly) be given in class to enable both the student and instructor to assess mastery of the material prior to the examination

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[1] All problem sets are due on the due date at the beginning of class. No extensions are possible unless caused by documented emergencies.
[2] No make-up exams will be given except in the case of documented emergencies.

setting. The quizzes will be graded on a 0-1-2 point scale. No make-up quizzes will be given. The lowest quiz score will be dropped.

Evaluation[3]:

Homework	15%
Computer assignments	5%
Weekly quizzes	5%
Exam #1	20%
Exam #2	20%
Final Exam	35%

Expectations on Attendance

You should expect that each class will start and end on time and that the clearest possible lecture will be given. In turn, I expect you to attend every lecture, to be on time, and to complete all of the required work in the course. I will periodically e-mail you if I note that you are not attending regularly and/or not turning in the required work. Material specific to class lectures may appear on exams.

Course Objectives

- To teach planar kinematics of rigid bodies, systems of rigid bodies and particles
- To teach problem formulation and solution methods for the dynamic equations of motions for planar motion of rigid bodies
- To develop simplified, rigid body models for systems of mechanical components
- To introduce the concepts and uses of work and kinetic energy
- To teach fundamental concepts and solution strategies for mechanical vibration problems

Course Outcomes

- Describe the planar motion of a particles and rigid bodies
- Describe planar motion of a system of connected rigid bodies including pinned, rolling and sliding connections
- Draw free body diagrams for particles, rigid bodies and systems of rigid bodies along with their components
- Apply the laws of motion to relate forces obtained from free body diagrams and accelerations from kinematics to derive the equations of motion for particles and rigid bodies in planar motion
- Develop simplified models and dynamic equations of motion for connected mechanical systems including rigid links, rigid inextensible cords, sliding and rolling contact conditions, springs and masses
- Develop closed form solutions for single degree of freedom free and harmonically driven vibratory systems
- Design to avoid or achieve resonance in single degree of freedom mechanical models
- Understand definitions of work, potential energy and kinetic energy
- Learn that work and energy principles may be more appropriate for problem solution when forces are not a primary quantity of interest and to use these principles to obtain velocity, position and the work done by external forces
- Obtain a basic level of understanding of how to apply modern computational software for solving and animating dynamics problems
- Obtain numerical results for the dynamic equations of motion using algebraic manipulation, solution of differential equations or computational methods

[3] Historically, the average grade in ME240 is a B-.

Date[4]	Topic	Reading	Homework
1/4	Review Syllabus & Introduction	13.1-13.2	**Hw. 1 Assigned**
1/7	Particle Kinematics	13.3-13.4	
1/9	Particle Kinematics	13.6	
1/11	Particle Kinematics	13.7	**Hw. 1 Due, Hw. 2 Assigned**
1/14	Particle Kinetics: Newton's Laws	14.1-14.2	
1/16	Particle Kinetics: Newton's Laws	14.2-14.3	
1/18	Particle Kinetics: Newton's Laws	14.3-14.4	**Hw. 2 Due, Hw. 3 Assigned**
1/21	**Martin Luther King, Jr. Day (no class)**		
1/23	Particle Kinetics: Newton's Laws	14.4-15.1	
1/25	Particle Kinetics: Work & Energy	15.1-15.2	**Hw 3 Due, Hw. 4 & CA#1 Assigned**
1/28	Particle Kinetics: Work & Energy	15.2	
1/30	Particle Kinetics: Work & Energy	15.3	
2/1	Particle Kinetics: Work & Energy	15.3	**Hw. 4 Due, Hw. 5 Assigned**
2/4	Particle Kinetics: Impulse & Momentum	16.1	
2/6	Particle Kinetics: Impulse & Momentum	16.2	
2/8	Particle Kinetics: Impulse & Momentum	16.2	**Hw. 5 Due, CA#1 Due**
2/11	**Examination #1 (in class)**		
2/13	Rigid Body Kinematics	17.1-17.2	
2/15	Rigid Body Kinematics	17.2	**Hw. 6 Assigned**
2/18	Rigid Body Kinematics	17.3-17.4	
2/20	Rigid Body Kinematics	17.3-17.4	
2/22	Rigid Body Kinematics	17.4	**Hw. 6 Due, Hw. 7 Assigned**
	Spring Break		
3/3	Rigid Body Kinematics	17.5	
3/5	Rigid Body Kinematics	17.6-17.7	
3/7	Rigid Body Kinematics	17.6-17.7	**Hw. 7 Due, Hw. 8 Assigned**
3/10	Rigid Body Kinetics: Newton's Laws	18.1	
3/12	Rigid Body Kinetics: Newton's Laws	18.2	
3/14	Rigid Body Kinetics: Newton's Laws	18.2	**Hw. 8 Due, Hw. 9 & CA#2 Assigned**
3/17	Rigid Body Kinetics: Newton's Laws	18.2	
3/19	Rigid Body Kinetics: Work & Energy	19.1	
3/21	Rigid Body Kinetics: Work & Energy	19.1	**Hw. 9 Due, Hw. 10 Assigned**
3/24	Rigid Body Kinetics: Impulse & Momentum	19.2	
3/26	Rigid Body Kinetics: Impacts	19.3	
3/28	Review for Exam #2		**Hw. 10 Due, CA#2 Due, Hw. 11 Assigned**
3/31	**Examination #2 (in class)**		
4/2	Mechanical Vibrations	21.1	
4/4	Mechanical Vibrations	21.1	**Hw. 11 Due, Hw. 12 Assigned**
4/7	Mechanical Vibrations	21.2	
4/9	Mechanical Vibrations	21.2	
4/11	Mechanical Vibrations	21.3	**Hw. 12 Due**
4/14	Mechanical Vibrations	21.3	

[4] Tentative schedule for all sections