Engineering Mechanics: Dynamics

The University of Toledo
Department of Mechanical, Industrial, and Manufacturing Engineering
MIME 2300- 001 & 091 (CRN 11935 & 11935)

Instructor: Hamdy Ibrahim
Email: Hamdy.Ibrahim@utoledo.edu
Office Hours: M & W (3:30 – 5:30 PM)
Office Location: NI Hall, 4th floor, room 4040
Office Phone: TBA

Term: Spring 2018

Class Location: Palmer Hall 3020
Class Day/Time: MWF 2:30 PM - 3:25 PM
Lab Location: N/A
Lab Day/Time: N/A
Credit Hours: 3

COURSE/CATALOG DESCRIPTION

Kinematics of particles and rigid bodies. Through study of kinetics of particles and rigid bodies using Newton's laws of motion, work-energy methods, and impulse and momentum methods.

STUDENT LEARNING OUTCOMES

At the end of this course the student should have the knowledge and skills to:

- Solve constant and variable acceleration problems in particle kinematics.
- Draw free body diagram and apply Newton's second law of motion to solve kinetics problems associated with particles.
- Solve kinetics problems for particles involving statics and kinetic friction.
- Solve kinetics problems for particles using the principles of work and energy.
- Solve kinetics problems for particles using the principles of impulse and momentum.
- Solve kinetics problems involving collision of particles.
- Solve problems involving angular momentum of particles.
- Find the velocities and accelerations in linkages, gear trains and rigid body systems.
- Determine the mass moment of inertia for rigid bodies.
- Solve kinematics problems involving Coriolis components of acceleration.
- Understand the kinematics of a wheel rolling on a flat surface.
- Draw free body diagrams and apply Newton's second law of motion to solve kinetics problems associated with rigid body systems.
- Solve kinetics problems involving the rolling and/or sliding of cylinders.
- Solve kinetics problems for rigid bodies using the principle of work and energy.
- Solve kinetics problems involving principles of impulse and momentum.
- Understanding that the course is only basic and there is a need for life-long learning.

TEACHING STRATEGIES

Instruction includes lectures and discussions. Lecture notes will be posted on the Blackboard after the class. There are homework problems, quizzes, two midterm exams and a final examination. There will be a great deal of hands on and observed problem solving in the class. History has shown that regular attendance is necessary to be successful in the class. Quizzes will be short (10-15 minutes) during of class so always bring a calculator to class.

PREREQUISITES AND COREQUISITES
Prerequisite: CIVE 1150

REQUIRED TEXTS AND ANCILLARY MATERIALS
Engineering Mechanics: Dynamics, Fourteenth Edition, R. C. Hibbeler, @2017, Prentice Hall.

TECHNOLOGY REQUIREMENTS
Blackboard: the course syllabus, course schedule, lecture notes, announcements and other information will be available there.

UNIVERSITY POLICIES
Since passage of the Rehabilitation Act, The University of Toledo ("the university") has been committed to eliminating barriers to services, employment and educational opportunities for people with disabilities. Our commitment was renewed with the passage of the Americans with Disabilities Act ("ADA") in 1990. With the passage of the ADA Amendments Act of 2008 (ADAAA), we restate our goal of providing seamless access. The university does not discriminate on the basis of disability in violation of the ADA, or the Rehabilitation Act in admission or access to, or treatment or employment in, its programs or activities.

The University is an equal opportunity educational institution. Please read The University's Policy Statement on Nondiscrimination on the Basis of Disability Americans with Disability Act Compliance.

Academic Accommodations
The University of Toledo is committed to providing equal access to education for all students. If you have a documented disability or you believe you have a disability and would like information regarding academic accommodations/adjustments in this course please contact the Student Disability Services Office.

ACADEMIC POLICIES
University of Toledo academic policies for undergraduate students are found at http://www.utoledo.edu/policies/academic/undergraduate/index.html.

Homework:
Missed or late homework is accepted prior to examination covering the assigned material. There is a 5% per week late penalty assessed and the lowest you can get for a late homework is 50%. If homework is not submitted by the examination date, it will not be accepted without reasonable excuse.

Quizzes and Exams:
All quizzes and exams will be based on material that you have submitted homework for. There are no makeup quizzes. The lowest quiz grades will be dropped. Missed examinations must be made up as soon as practical.

Academic Dishonesty:
You are encouraged to work together in groups and discuss assignments. However, any written work you submit must be substantially your own. This means do not lift the homework solutions wholesale from the web and others. Work on examinations must be solely and entirely your own. Penalties range from an F on the assignment to suspension and expulsion.

Anti-Bullying Policy

Every University of Toledo student deserves to enjoy our school equally, and feel safe, secure and accepted regardless of race, sex, religious beliefs, sexual orientation, size, academic ability, athletic ability, cultural beliefs, physical appearance, disability, or any other characteristic. Any form of bullying will not be tolerated in this course. Bullying is defined as intentionally persistent, hostile behavior that is aimed at harming another individual. Bullying can take many forms including verbal (e.g., name-calling, insults), physical (e.g., pushing, shoving), and relational (e.g., eye rolling when a classmate enters the room, mimicking a classmate, ostracizing or attempting to get others to consistently ignore a classmate). Please note, you can anonymously report bullying incidents to The University of Toledo's Anti-Bullying Task Force www.utoledo.edu/tlc/bully

Missed class policy.

Regular attendance is key to learning. Your attendance should be regular and punctual. Attendance is also recorded during midterm grading to meet state and federal laws regarding financial aid disbursement. Students who decide not to attend the class further, must formally withdraw (drop) from the course. For more information about add/drop dates please visit the Registrar's Office online at: http://www.utoledo.edu/offices/registrar/registration_dates.html.

Honors:

I am happy to accommodate students who wish to take the course for honors credit. It requires execution of an honors contract and completion of a project of approximately hours duration. The project can involve any application of the principles of this course. Both experimental and theoretical projects are possible. Included in the project requirements will be preparation of a short report or presentation on your work. If you wish to take the course for honors credit, see or e-mail me before the end of the second week of class.

GRADING

There is no grading curve in the course. You are not competing against the other students. You will receive whatever grade you meet the standard for regardless of how many other students have that grade.

Weighting	
Homework and quizzes	20%
Midterms	50%
Final	30%
	100%

Grading Scale				
A 93+	B+ 87-89	C+ 75-79	D+ 63-66	F < 57
A- 90-92	B 83-86	C 70-74	D 60-62	
	B- 80-82	C- 67-69	D- 57-59	

COURSE SCHEDULE

Week #	Week of	Subject
1	Jan. 15	Course introduction, Chapter 12: Kinematics of a particle • Rectilinear kinematics: continuous Motion • Rectilinear kinematics: erratic motion
2	Jan. 22	Chapter 12: Kinematics of a particle • General curvilinear motion • Curvilinear motion: rectangular components • Motion of a projectile • Curvilinear motion: normal and tangential components
3	Jan. 29	Chapter 12: Kinematics of a particle • Curvilinear motion: normal and tangential components (cont.) • Curvilinear motion: cylindrical components • Dependent motion of two particles
4	Feb. 05	Chapter 12: Kinematics of a particle • Relative motion of two particles using translating axes. Chapter 13: Kinematics of a particle: force and acceleration • Newton's laws of motion • Equation of motion • Equation of motion for a system of particles • Equation of motion: rectangular coordinates
5	Feb. 12	Chapter 13: Kinematics of a particle: force and acceleration • Equation of motion: normal and tangential coordinates • Equation of motion: cylindrical coordinates
6	Feb. 19	**Problem session (Monday) and midterm 1 (Wednesday)** Chapter 14: Kinetics of a particle: work and energy • The work of a force • Principle of work and energy
7	Feb. 26	Chapter 14: Kinetics of a particle: work and energy • Principle of work and energy for a system of particles • Power and efficiency • Conservative forces and potential energy • Conservation of energy
8	March 05	**No Class - Spring Break**
9	March 12	Chapter 15: Kinetics of a particle: impulse and momentum • Principle of linear impulse and momentum for a sys. of particles • Conservation of linear momentum for a sys. of particles • Impact
10	March 19	Chapter 15: Kinetics of a particle: impulse and momentum • Angular momentum • Relation between moment of a force and angular momentum • Principle of angular impulse and momentum. Chapter 16: Planar kinematics of a rigid body • Planar rigid body motion • Translation • Rotation about a fixed axis
11	March 26	Chapter 16: Planar kinematics of a rigid body • Relative motion analysis: velocity • Instantaneous center of zero velocity • Relative motion analysis: acceleration • Relative motion analysis using rotating axes

Week #	Week of	Subject
12	April 02	**Problem session (Monday) and midterm 2 (Wednesday)** Chapter 17: Planar kinetics of a rigid body: Force and acceleration • Mass moment of inertia • Planar kinetic equation of motion • Equation of motion: translation
13	April 09	Chapter 17: Planar kinetics of a rigid body: Force and acceleration • Equation of motion: rotation about a fixed axis • Equation of motion: general plane motion Chapter 18: Planar Kinetics of a rigid body: work and energy • Kinetic energy • Work of a force and a couple
14	April 16	Chapter 18: Planar Kinetics of a rigid body: work and energy • Principle of work and energy • Conservation of energy
15	April 23	Chapter 19: Planar kinetics of a rigid body: impulse and momentum • Linear and angular momentum • Principle of impulse and momentum • Conservation of momentum **Problem session (Friday)**
16	April 30	**Final exam (Wednesday, May 2, 2018, 2:45-4:45 PM)**