

ME1015 Rigid Body Dynamics

Instructor: Professor Yue Qiu
E-mail: qiuyue@wchscu.cn

Class time: Monday, 08:15 AM - 11:00 AM
Class location: 文科楼四区 Room #201
Teaching Assistant Zhanpeng Sun
E-mail: 1432446452@qq.com

Catalog Description: This is 3 credit hour course intended to introduce students to the motion of particles and rigid bodies. Students are expected to develop an understanding of the fundamental principles of applied kinematics for particles and rigid bodies in engineering dynamics and demonstrate an integrated understanding of engineering dynamics principles through applications involving problem solving and through creation of design solutions to engineering scenarios.

Course Objective At the end of the course, the student will be able to:

- Interpret the geometry and physical meaning of mechanical systems by drawing diagrams (free body diagrams and kinematic diagrams)
- Apply several governing methods (Newton laws, work-energy, impulse-momentum) to study mechanical systems
- Analyze and predict the kinematics and kinetics of a body using various reference frame

Prerequisites: MATH 0240 Analytic Geometry & Calculus 3
ENGR 0135 Statics & Mechanics of Materials I

Textbook: Engineering Mechanics Dynamics. 9th edition by *J. L. Meriam, L. G. Kraige, and J. N. Bolton*, John Wiley & Sons, Inc. New York, 2018.

Reference: Engineering Mechanics – Dynamics Any Edition by R. C. Hibbler, Prentice Hall.

Topics Covered:

1. Kinematics in Normal, Cylindrical & Tangential Coordinates
2. Absolute & Relative Motion
3. Kinetics: Equations of Motion
4. Principle of Work & Energy for Particles
5. Linear Impulse & Momentum
6. Angular Impulse & Momentum
7. Relative Velocity & Acceleration of Rigid Bodies
8. Moment of Inertia
9. Work and Energy for Rigid Bodies
10. Motion of a Rigid Body
11. Moments and Products of Inertia
12. Angular Momentum & Kinetic Energy

Grades

Attendance&Participation	20%
Two Term Exams	20%: Exam1 (Oct 16, 10%), Exam2 (Nov 20, 10%)
Homeworks	10%
One Final exam	50% (Jan 1)

While grades may be curved, there is no guarantee of any curve. However, a student will have to reach 50 % of the total number of possible points in order to receive a grade of D or better and to become eligible for make-up exam. If any student takes Make-Up exam, the highest grade that the student can receive is D. In the absence of a curve the grading scale is

	A > 90%	A ⁻ > 85%	
B ⁺ > 80%	B > 76%	B ⁻ > 73%	
C ⁺ > 70%	C > 66%	C ⁻ > 63%	
D ⁺ > 61%	D = 60%	F < 60%	

In & Out - Class Work and Exams

In each class, there will be the In-class work and the Out-class work. The In-class work will be given at the during class period to evaluate the understandings of the lecture. The Out-class work will be given after each class period and is to help you practice the learned material. You will work on and complete these problems as an individual within given time.

There will be **two term exams** and a **final exam**. The final exam is comprehensive. The exams in this course will be closed book and closed note. All the necessary formulas will be given to students by the instructor.

If you miss any exam, NO make-up will be given for the missing exam *without prior arrangement*. If you have a serious conflict with an exam time, you **MUST** discuss it with the INSTRUCTOR well ahead of the scheduled exam day to make an appropriate arrangement. Exams missed due to unpredictable events such as a family emergency and a traffic accident will be dealt with on a case-by-case basis if the student has a proper document(s) to prove it.

Students have one week after the any graded work of any kind including exams is returned or the grad is posted on BB to bring up any questions regarding the grading discrepancy.

It is important that you show the work in an organized manner clearly showing your thought process in solving the given question. Instructor cannot give credits for the answer(s)/work(s) that is(are) not readable and/or understandable.

Make sure that you use appropriate units for all your works such as homework, project and exam, or you will **be penalized** for any missed unit or wrong unit, and **be penalized** for using excessive number of significant figures

e.g., $\pi = 3.1415926535897932385$ instead of $\pi = 3.14$

Collaboration:

Collaboration between students is strongly encouraged for better understanding of the course material. Students are allowed to discuss homework problems and projects in terms of **methodologies**, but **not the solutions** of a problem, which means that each student **MUST** do the actual work independently. Inappropriate collaboration (also known as cheating) includes

- Using all or parts of homework, exams or projects from this year or any previous year
- Sharing of work such as graphs, equations, calculations or any other derived material that was not presented to the class
- Talking, passing information or using inappropriate materials during an exam Anyone found to be participating in inappropriate collaboration may be immediately failed from the course.

Attendance:

On-time attendance at all class activities is expected. Attendance itself will not be graded, but the student is responsible for any material that was covered, and any changes to the exam dates and homework assignments announced in class. Make-up work will only be accepted if prior arrangement has been made or if a valid emergency excuse (e.g., meteor strike) is accompanied by appropriate documentation.

Other Policies:

Please honor the following: do not come late; do not disturb the class by having conversation with others; turn off all cell phones and electronic gadgets; do not work on any other class materials.

Those students who fail to follow these policies may be asked to leave the class.

The instructor also reserves the right to extend credit for alternative assignments, projects, or presentations and to make changes to this syllabus as needed.

All changes will be announced via Blackboard and/or announced in class.

Class Week	Chapter	Topic
1	Ch. 1	Introduction - Basic Concepts, Newton's Law, Units
2	Ch. 2.1 ~ Ch. 2.5	Rectilinear & Curvilinear Motion in Rectangular and Normal & Tangential Coordinates
3	Ch. 2.6 ~ Ch. 2.8	Polar Coordinates, Space Curvilinear Motion and Relative Motion
4	Ch. 3.1 ~ Ch. 3.4	Kinetics - Equation of Motion and Rectilinear Motion
5	Ch. 3.5 ~ Ch. 3.7	Curvilinear Motion, Work & Kinetic Energy, and Potential Energy
6	Exam I (Oct 16)	
7	Ch. 3.8 ~ Ch. 3.12	Impulse & Momentum and Impact
8	Ch. 4.1 ~ Ch. 4.5	Generalized Newton's Law, Work-Energy Impulse-Momentum, Conservation of Energy and Momentum
9	Ch. 5.1 ~ Ch. 5.4	Rotation, Absolute Motion and Relative Velocity
10	Ch. 5.5 ~ Ch. 5.6	Instantaneous Center of Velocity and Relative Acceleration
11	Exam II (Nov 20)	
12	Ch. 5.7	Motion Relative to Rotating
13	Ch. 6.1 ~ Ch. 6.3	Force, Mass, and Acceleration I
14	Ch. 6.4 ~ Ch. 6.5	Force, Mass, and Acceleration II
15	Ch. 6.6 ~ Ch. 6.8	Work & Energy and Impulse & Momentum
17	Final Exam	