Spring
2025

SCUPI
Sichuan University - Pittsburgh Institute

ME1015 Rigid Body Dynamics

Instructor: Dr. Ruiqi DONG

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Office hours: Monday and Tuesday 9:00AM~12:00AM, S522

Any other days - by appointment only

Class time: Monday 13:50-16:25 PM

Class location: SCUPI new building 208

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

Course contributes to the following ABET Criterion 3 outcomes:

1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

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

Homework	10%
In-class quiz	20%
Mid-term exam	30%
Final exam	40%

While grades may be curved, there is no guarantee of any curve. However, in order to receive a grade of D or better and to be eligible to take Make-Up exam, a student will have to reach 50 % of the total possible points. If any student fails this course and takes Make-Up exam, the highest grade that student can receive is D.

Homework, Reading Assignment, In-Class Quiz and Exams

There will be homework problems assigned on weekly base, which will be graded as 10% of your grade. I strongly encourage for students to **work on homework on their own** since doing homework independently will reinforce and extend the knowledge of the material learned in class. Students are also encouraged to work with your classmates. Should you have any trouble with the homework, ask TA and instructors for help during designated office hours.

Students are expected to **read textbook before and after** each class period following the lecture schedule, which is the reading assignment. Remember lectures will be given assuming students read textbook before class.

In-Class Quiz will be given periodically during class hours, and there is **NO make-up** for quiz if you are absent from the class. You will work on and complete these problems as an individual within given time.

All the In-Class Quiz and homework should be submitted on BB. **If answer(s) is(are) required to submit to BB, the answer(s) of the question(s) must be handwritten otherwise NO credit will be given for that work**.

There will be **one mid-term exam** and **one final exam**. The final exam is comprehensive. The exams in this course will be closed book and closed note.

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 1 day after the any graded work including exams is returned and/or the grad of a work is posted on BB to dispute the grade.

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.

Office Hours:

Office hours are times I have specifically set aside to be available to students. During office hours, you can come to my office; you don't need an appointment. I may be available at other times; please email to schedule a time, or simply drop by, outside these times.

Be prepared to show me what work you have done and try to avoid asking vague questions

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 conservation 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.

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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	Ch. 3.8 ~ Ch. 3.10	Impulse & Momentum
7	Ch. 3.11 ~ Ch. 3.12	Impact and Chapter Review
8	Ch. 4.1 ~ Ch. 4.5	Generalized Newton's Law, Work-Energy Impulse-Momentum, Conservation of Energy and Momentum
9	Review	**Mid-Term Exam**
10	Ch. 5.1 ~ Ch. 5.4	Rotation, Absolute Motion and Relative Velocity
11	Ch. 5.5 ~ Ch. 5.6	Instantaneous Center of Velocity and Relative Acceleration
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
16	Review	Ch.1 ~ Ch. 6
17	**Final Exam**	