ENS214 Dynamics
Sabanci University 2023-24 (Spring)

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Schedule
- ENS 214
  Monday 12:40 pm-2:30 pm FENS L045
  Tuesday 11:40 am-12:30 pm FENS G035
- ENS 214R
  Thursday 2:40 pm-4:30 pm FENS L056

Credits
3 SU Credit / 6.00 ECTS / 42 Teaching Hours
Prerequisite: ENS 204 - Mechanics

Objectives
This course is designed for undergraduate students to (i) develop an understanding of particle and planar rigid body kinematics and kinetics (ii) obtain an understanding of Newton's Laws of Motion, and (iii) gain the ability to apply energy and momentum methods to particles and rigid bodies in planar motion.

Learning Outcomes
At the conclusion of this course, students should be able to:
1. Understand the basic kinematics concepts: displacement, velocity, and acceleration (and their angular counterparts)
2. Draw free-body diagram for a particle or a rigid body in motion
3. Understand the basic concepts of force, momentum, and energy
4. Understand and be able to apply Newton's laws of motion
5. Understand and be able to apply work-energy, impulse-momentum principle
6. Extend all of concepts of linear kinetics to systems in general plane motion

Course Content

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<td>Week 1 – 19.02.2024 – 23.02.2024</td>
<td>KINEMATICS OF A PARTICLE</td>
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| 3    | 04.03.2024 – 08.03.2024 | **(Quiz 1)** KINETICS OF A PARTICLE  
Force and Acceleration  
Newton’s Second Law of Motion, The Equation of Motion, Rectangular Coordinates, Normal and Tangential Coordinates, Cylindrical Coordinates, Central-Force Motion and Space Mechanics |
| 4    | 11.03.2024 – 15.03.2024 | Work and Energy  
| 5    | 18.03.2024 – 22.03.2024 | Impulse and Momentum  
Principle of Linear Impulse and Momentum, Conservation of Linear Momentum for a System of Particles, Impact, Angular Momentum, Principle of Angular Impulse and Momentum |
| 6    | 25.03.2024 – 29.03.2024 | **(Quiz 2)** PLANAR KINEMATICS OF A RIGID BODY  
Planar Rigid-Body Motion, Translation, Rotation about a Fixed Axis, Absolute and Relative Motion Analysis: Velocity, Instantaneous Center of Zero Velocity, Acceleration, Relative-Motion Analysis using Rotating Axes |
| 7    | 01.04.2024 – 05.04.2024 | **(Midterm 1)**  
Week 7 – 01.04.2024 – 05.04.2024  
Week 8 – 15.04.2024 – 19.04.2024 |
| 8    | 15.04.2024 – 19.04.2024 | PLANAR KINETICS OF A RIGID BODY  
Force and Acceleration  
Mass Moment of Inertia, Planar Kinetic Equations of Motion, Equations of Motion: Translation, Rotation about a Fixed Axis and General Plane Motion |
| 10   | 29.04.2024 – 03.05.2024 | Impulse and Momentum  
Linear and Angular Momentum, Principle of Impulse and Momentum, Conservation of Momentum, Impact |
| 11   | 06.05.2024 – 10.05.2024 | **(Quiz 3)**  
Week 10 – 29.04.2024 – 03.05.2024  
Week 11 – 06.05.2024 – 10.05.2024 |
| 12   | 13.05.2024 – 17.05.2024 | **(Quiz 4)** THREE-DIMENSIONAL KINEMATICS OF A RIGID BODY  
Rotation About a Fixed Point, The Time Derivative of a Vector Measured from Either a Fixed or Translating-Rotating System, General Motion, Relative-Motion Analysis Using Translating and Rotating Axes |
| 13   | 20.05.2024 – 24.05.2024 | **(Midterm 2)**  
Week 12 – 13.05.2024 – 17.05.2024  
Week 13 – 20.05.2024 – 24.05.2024 |
| 14   | 27.05.2024 – 31.05.2024 | THREE-DIMENSIONAL KINETICS OF A RIGID BODY  
Moments and Products of Inertia, Angular Momentum, Kinetic Energy, Equations of Motion, Gyroscopic Motion, Torque-Free Motion |
Main Textbook:

Other References:

Assessment Criteria
Quizzes (4×5%), Midterms (2×20%), Final (40%)
- Quizzes will be conducted during recitation sessions.

Course Material
The outline of lecture notes, project guidelines, and other course-related material will be posted at the SUCourse site (https://sucourse.sabanciuniv.edu/).