

ME 302 ENG Mechanics Sec. A1

Course Objective: to introduce juniors in Mechanical Engineering to the theory and application of engineering mechanics, with a focus on (1) Lagrangean approaches to systems of particles and rigid bodies and (2) vibrations of simple mechanical systems

Lectures:

Location: GCB 205

Time: Mon & Wed 4-6

Discussions (Sec. B1):

Location: GCB 209

Time: Fri 3-4

Instructor: Calin Belta

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Office hours: Mon 3-4, Wed 3-4

GTF / TA: TBA

Prerequisites: EK 301

Textbook: James H. Williams, Fundamentals of Applied Dynamics, 3rd edition, John Wiley & Sons, 1996, ISBN: 978-0-470-13385-9

Homework assignments, solutions, and lectures will be made available through the BU **Courseinfo**.

Grading:

Homework: 20%

Exams (3): 10%, 20%, 30%

Project: 20%

Topics and Tentative schedule:

Introduction and Motivation (1 class)

Direct vs. Indirect Approaches to Dynamics and Kinematics (2 classes, Ch. 2)

Kinematics and Dynamics via the Direct Approach (11 classes)

Particle velocity and acceleration; planar motion of a rigid body; angular velocity and acceleration; reference frame transformations) (3 classes, Ch. 3)

Newton's law; force and linear momentum; torque and angular momentum; equations of motion (2 classes, Ch. 4)

Models of rigid bodies, Newton-Euler equations, Inertia tensors, principal directions and inertial moments, dynamics of rigid bodies (5 classes, Ch. 6 .1-6.4)

Exam (1 class)

Kinematics and Dynamics via the Indirect Approach (9 classes)

Work and energy, degrees of freedom, generalized coordinates, velocities, and forces, holonomic and nonholonomic systems, Hamilton's principle, Lagrange's equations (5 classes, Ch. 5)

Potential energy, kinetic energy, and Lagrangian for rigid bodies; equations of motion of planar systems of rigid bodies (3 classes, Ch. 6.5, 6.6)

Exam (1 class)

Vibrations of Mechanical Systems (4 classes)

First order systems: free response, step response, ramp response, frequency response (1 class, Ch. 8.2)

Second order systems: free response, frequency response, natural frequency (2 classes, Ch. 8.3, 8.4)

Stability of Mechanical Systems (1 class)

Review for Final Exam (1 class)