MAE 130B / SE 101B
Mechanics II: Dynamics

Designation: Required course for ME, AE, and SE

Catalog Description:
MAE 130B/SE 101B: Mechanics II: Dynamics (4)
Kinematics and kinetics of particles in 2D and 3D motion. Newton's equations of motion. Energy and momentum methods. Impulsive motion and impact. Systems of particles. Kinematics and kinetics of rigid bodies in 2D. Introduction to 3D dynamics of rigid bodies.

Prerequisites:
Grades of C- or better in MATH 20D, and MAE 130A or SE 101A.

Textbooks, Required Material:
F.P. Beer and E.R. Johnston, Vector Mechanics for Engineers: Dynamics, 8th ed., McGraw-Hill (2007),
J.L. Meriam and L.G. Kraige, Engineering Mechanics: Dynamics, 5th ed., John Wiley & Sons (2003),
or equivalent.

Prerequisites by Topic:
Integral and differential calculus, differential equations, engineering statics.

Class/Laboratory Schedule: 4 lecture hours per week.

Course Topics:
1. Kinematics and kinetics of particles, energy and momentum methods
2. Central and oblique impact
3. System of particles
4. Kinematics of rigid bodies, Coriolis acceleration
5. Plane motion of rigid body, forces and accelerations
6. Energy methods for plane motion of rigid bodies and rigid body systems
7. Introduction to dynamics of rigid bodies in three dimensions.

Course Objectives:
(Numbers in parentheses refer to ME and AE Program Outcomes)

Objective 1: To teach students the basic principles underlying the dynamics of particles and rigid bodies (1a,5e)
Objective 2: To train students to identify, formulate and solve engineering problems in rigid body dynamics (1a,5e)
Objective 3: To introduce students to the concepts of work-energy and impulse-momentum for rigid bodies and body systems. (1a,5e)

Methods of evaluation:
1. Homework will be regularly assigned, collected and graded.
2. Midterms and Final exam.

Performance Criteria:
(Numbers in parentheses refer to the methods of evaluation used to assess student performance)

Objective 1
1.1 Students will demonstrate an understanding of Newtonian mechanics and basic equations underlying kinematics and kinetics of particles and rigid bodies (1, 2).

Objective 2
2.1 Students will demonstrate the ability to isolate rigid bodies and to draw their appropriate free body diagrams (1, 2).
2.2 Students will demonstrate an ability to identify known and unknown kinematic and kinetic variables (1, 2).
2.3 Students will demonstrate an ability to identify and effectively account for kinematic constraints such as rolling and/or sliding, and their kinetic consequences (1, 2).
2.4 Students will demonstrate that they can apply and combine the appropriate principles referred to in Objective 1 to the solution of problems (1, 2).

Objective 3
3.1 Students will demonstrate an understanding of work-energy principles as applied to moving particles and rigid bodies (1, 2).
3.2 Students will be able to evaluate the kinetic energy of rigid bodies as well as the potential energy associated with gravity and spring forces (1, 2).
3.3 Students will demonstrate an ability to apply impulse-momentum relations where appropriate (1, 2).
3.4 Students will demonstrate that they can use coefficient of restitution data in the solution of impact problems (1, 2).

Contribution of Course to Professional Component:
Fundamental course of engineering science for mechanical, aerospace, and structural engineers.

Prepared by: V. Nesterenko, February 2000
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