ENGR 0230 - DYNAMICS

Catalog Description

Prerequisite: Completion of ENGR 130 with grade of "C" or better
Advisory: Completion of ENGR 151 with grade of "C" or better
Hours: 54 lecture
Description: Fundamentals of kinematics and kinetics of particles and rigid bodies. Topics include kinematics of particle motion; Newton's second law, work-energy and momentum methods; kinematics of planar motions of rigid bodies; work-energy and momentum principles for rigid body motion; Introduction to mechanical vibrations (optional). (C-ID ENGR 230) (CSU, UC)

Course Student Learning Outcomes

- CSLO #1: Analyze and solve problems including the relationships between position, velocity, and acceleration of a particle in rectilinear and curvilinear motion with and without forces.
- CSLO #2: Analyze and solve engineering problems modeled as a single particle, as system of particles, or a rigid body in plane motion using the concepts of impulse and momentum.
- CSLO #3: Analyze and solve engineering problems modeled as a single particle, a system of particles, or a rigid body in plane motion using the concepts of work and energy.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

54

Outside of Class Hours

108

Total Student Learning Hours

162

Course Objectives

1. Derive and apply the relationships between position, velocity, and acceleration of a particle in rectilinear and curvilinear motion.
2. Derive relations defining the velocity and acceleration of any particle on a rigid body for translation, rotation and general plane motion.
3. Apply Newton's second law to analyze the motion of both a particle in rectilinear or curvilinear translation acted upon by forces and a rigid body in plane motion acted upon by forces and moments.
4. Apply the method of work and energy to engineering problems modeled as a single particle, a system of particles, or a rigid body in plane motion.
5. Apply the method of impulse and momentum to engineering problems modeled as a single particle, as system of particles, or a rigid body in plane motion.
6. Select the method of analysis that is best suited for the solution of a given problem. (Newton's Law, Work and Energy, Impulse and Momentum, or a combination of these methods.)
7. Describe and analyze the plane motion of a particle relative to a rotating frame. Determine the Coriolis acceleration in plane motion.
8. Apply the principle of impulse and momentum to problems of direct and oblique central impact, as well as eccentric impact.
9. Effectively communicate legible engineering solutions to be understood by engineers both in and out of their specific disciplines.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

Methods of Evaluation

- Problem Solving Examinations
  - Example: Exams are given to evaluate the engineering concepts in the Student Learning Outcomes. These are graded to determine the proficiency gained regarding the presented material. Examples would be: 1. Given a diagram of a 3D force, acceleration and mass, determine the unknown acceleration on the body. 2. Using the kinematic equations, solve for the final velocity of a rigid body given the initial velocity, time and acceleration. 3. Using the concepts of conservation of energy, solve for the velocity of a swinging pendulum with know mass and changing radius. Rubric grading. Homework sets are collected and graded to determine the students ability to perform a solution and communicate the correctness of that solution to the reader. Examples: 1. Set up and solve the necessary system of equations for unknown accelerations and final velocity (after a known time) of a particle in plane curvilinear motion. 2. Calculate the final, horizontal distance (location) give the initial velocity, mass, and angle of projectile departure. 3. Given the mass of a frictionless glider moving up an incline with an attached spring of known stiffness and displacement, and with a known force acting upon it, calculate the velocity at a known distance for the initial position.

Repeatable

No

Methods of Instruction

- Lecture/Discussion
- Distance Learning

Lecture:

1. Instructor demonstrates how to draw and then analyze 2- and 3-dimensional force-body dynamics problems; including appropriate solution development of a free body diagram. Students will draw a model based on a given graphic.

Distance Learning

1. Instructor illustrates/demonstrates via live/recorded video and then posts an online discussion on the concept of work and energy. These concepts are then used to solve problem sets in dynamics for unknown variables (example velocity) given known system parameters (example mass, angle, force, height, etc.).

Typical Out of Class Assignments
Reading Assignments

1. Read through the theory and examples regarding the solution of problems to find acceleration in bodies with imposed known forces. Be prepared to discuss in class. 2. Read the textbook explanation regarding the engineering definition of work and energy. Be prepared to solve problems involving work and energy. 3. Read through chapter in the text; the theory and procedure for solving vibration problems related to natural frequency. Be prepared to discuss and solve problems involving vibration.

Writing, Problem Solving or Performance

1. Complete a homework problem set from the textbook on the principles of bodies subject to forces that cause acceleration of that body. Create a free body diagram to declare and analyze the system (this is the model). Perform mathematical analysis to accompany the model created above and solve the system for acceleration of the body. 2. Given a body with known mass and velocity which impacts another body at rest, solve for the velocity of both bodies after the impact using the engineering principals of impulse/impact/momentum.

Other (Term projects, research papers, portfolios, etc.)
Required Materials

- Engineering Mechanics - Dynamics
  - Author: Russell Hibbeler
  - Publisher: Pearson
  - Publication Date: 2016
  - Text Edition: 14th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Engineering Mechanics: Dynamics
  - Author: Meriam, Kraige, Bolton
  - Publisher: Wiley
  - Publication Date: 2018
  - Text Edition: 9th
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.

Calculator