1. Department, Course Number, and Course Title:

MECHANICAL ENGINEERING

CE/ME320 DYNAMICS I

2. Designation:

Required	☑	Elective	☐
Lower Division	☐	Upper Division	☑

3. Course Description: Kinematics and kinetics of rigid bodies; work, kinetic energy, impulse, momentum in two and three dimensions; applications to space mechanics.

4. Prerequisites: CE/ME 201 (Statics)

5. Text and Materials: Vector Mechanics for Engineers, Dynamics, Seventh Edition, F. P. Beer and E. R. Johnston, McGraw-Hill, 2004.

6. Course Objectives: The student will learn and understand the governing principles and methods of analysis of particle and rigid body dynamics. The student will apply these principles and methods of analysis to solving realistic engineering problems.

Course Outcomes

- Understanding of Newton's laws of motion for a particle and their generalization to systems of particles and rigid bodies.
- Understanding of the significance of an inertial frame.
- Ability to solve problems in particle motion in rectangular and polar coordinates.
- Ability to solve problems in particle motion in moving frames.
- Ability to apply relative velocity and relative acceleration equations in vector form.
- Understand and apply work-energy and impulse-momentum principles for systems of particles and rigid bodies.
- Ability to draw equivalent free-body and kinetic (mass-acceleration) diagrams for plane motion of rigid bodies.
- Ability to draw equivalent impulse and momentum diagrams for plane motion of rigid bodies.
- Ability to use calculus, vector algebra and vector notation to solve problems in dynamics.
- Ability to solve problems in a systematic rational manner, both in SI and USCU.

7. Topics Covered: (in Order of Presentation)

- Basic concepts and definitions, Newton's laws of motion, law of gravitation
- Kinematics of particles, rectilinear motion, dependent motions, angular motion of a line
- Vector algebra, curvilinear motion of a particle, rectangular components, motion relative to translating reference axes, normal and tangential components, radial and transverse components
- Kinetics of particles, force and acceleration, work and energy, potential energy, conservation of energy, impulse and momentum, conservation of momentum, impact
- Kinetics of systems of particles, equations of motion, work and energy, potential energy, linear and angular momentum, conservation of energy and momentum
- Kinematics of rigid bodies, angular velocity vector, absolute and relative velocity and acceleration in plane motion, derivative of a vector referenced to a rotating frame, plane motion of a particle relative to a rotating frame
- Plane kinetics of rigid bodies, translation, fixed-axis rotation, general plane motion, work and energy methods, impulse and momentum methods
- Kinematics of rigid bodies in three dimensions, kinetics, angular momentum, inertial properties.

8. Class Schedule:

Number of Sessions per week:	2
Duration of each session:	1 hour 40 minutes

9. Contribution of course to meeting the professional component:

This course is part of the 51 units of upper division major requirements in the mechanical engineering program.

Engineering Science	4 units

10. Relationship of course to program objectives:

This course relates to the program objectives by contributing to the following measurable outcomes at the level indicated for all engineering graduates:

Knowledge outcomes:

- an ability to apply knowledge of mathematics, science, and engineering (abet a)
- the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context (abet h)
- a knowledge of how mechanical engineering integrates into inter-disciplinary systems

Skill outcomes:

- an ability to communicate effectively (abet g)
- an ability to think in a logical sequential process

Attitudes Outcome:

11. Prepared by: Neda S. Fabris 05/2005