MASTER COURSE OUTLINE
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COURSE TITLE
Dynamics

GENERAL COURSE INFORMATION

Dept.: ENGR&	Course Num: 215	(Formerly: EGR 212)
CIP Code: 14.1901	Intent Code: 11	Program Code:
Credits: 5		
Total Contact Hrs Per Qtr.: 55		
Lecture Hrs: 55	Lab Hrs: 0	Other Hrs: 0
Distribution Designation: Natural Science NS		

COURSE DESCRIPTION (as it will appear in the catalog)
Dynamics is the study of the accelerated motion of particles and rigid bodies. The study of the motion in this course will deal with kinematics (the mathematical description of the motion) and kinetics (the analysis of the forces causing the motion). Vector notation and operations will be used extensively in this course, and calculus will be used regularly.

PREREQUISITES
ENGR& 214, PHYS& 221, and MATH& 152 with grades of 2.0 or higher

TEXTBOOK GUIDELINES
A college-level Statics textbook such as *Engineering Mechanics: Dynamics*, by Hibbeler, Vector *Mechanics for Engineers: Dynamics*, by Beer and Johnston, or *Engineering Mechanics: Dynamics*, by Pytel and Kiusalaas

COURSE LEARNING OUTCOMES
Upon successful completion of the course, students should be able to demonstrate the following knowledge or skills:

1. Solve problems involving the motion of particles traveling along straight and curved paths.
2. Solve problems involving the dependent motion of two particles, and examine the relative motion of two particles with translating axes.
3. Solve problems involving the acceleration of a particle using Newton's second law and the resulting equations of motion, employing different coordinate systems.
4. Solve problems involving the concepts of work, energy, conservative forces, and conservation of energy.
5. Solve problems involving the concepts of linear impulse and momentum for a particle.
6. Solve problems involving the concept of conservation of linear momentum for particles, including problems involving impacts.
7. Solve problems involving the concepts of angular impulse and momentum.
8. Solve problems involving the planar kinematics of a rigid body while employing force and acceleration, work and energy, and impulse and momentum.
9. Solve problems involving the three-dimensional kinematics and kinetics of a rigid body.

INSTITUTIONAL OUTCOMES

IO2 Quantitative Reasoning: Students will be able to reason mathematically.

COURSE CONTENT OUTLINE

I. Kinematics of a Particle
   A. Linear Motion with Constant Acceleration
   B. Motion with Non-Constant Acceleration
   C. Curvilinear Motion
      1. General motion
      2. Projectile motion
      3. Rectangular components
      4. Normal and tangential components
      5. Cylindrical components
   D. Absolute Dependent Motion of Two Particles
   E. Relative Motion of Two Particles using Translating Axes

II. Kinetics of a Particle: Force and Acceleration
   A. Newton's Second Law of Motion
   B. Equations of Motion
      1. System of particles
      2. Rectangular coordinates
      3. Normal and tangential coordinates
      4. Cylindrical coordinates

III. Kinetics of a Particle: Work and Energy
   A. Work Done by a Force
   B. Principle of Work and Energy
   C. Power and Efficiency
   D. Conservative Forces and Potential Energy
   E. Conservation of Energy

IV. Kinetics of a Particle: Impulse and Momentum
   A. Principle of Linear Impulse and Momentum for Single Particles and Systems of Particles
   B. Conservation of Linear Momentum
   C. Impact
   D. Angular Momentum and Relations with Forces
   E. Steady Flow of a Fluid Stream

V. Planar Kinematics of a Rigid Body
   A. Translation and Rotation of Rigid Bodies
   B. Relative Motion Analysis
      1. Velocity
      2. Instantaneous center of zero velocity
      3. Acceleration
      4. Use of rotating axes

VI. Planar Kinetics of a Rigid Body
   A. Mass Moment of Inertia
   B. Equations of Motion
      1. Translation
      2. Rotation about a fixed axis
      3. General plane motion

VII. Planar Kinetics of a Rigid Body: Work and Energy
   A. Kinetic Energy of a Rigid Body

B. The Work of Forces and Couple Moments
C. Principle of Work and Energy
D. Conservation of Energy

VIII. Planar Kinetics of a Rigid Body: Impulse and Momentum
A. Linear and Angular Momentum
B. Principle of Impulse and Momentum
C. Conservation of Momentum

IX. Three-Dimensional Kinematics and Kinetics of a Rigid Body
A. Rotation about a Fixed Point
B. General Motion
C. Angular Momentum
D. Kinetic Energy

DEPARTMENTAL GUIDELINES *(optional)*

PO5 should be assessed: Students will be able to solve problems by gathering, interpreting, combining and/or applying information from multiple sources.

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DIVISION CHAIR APPROVAL **DATE**