COURSE TITLE & NUMBER: Dynamics: ENGR 2020
CREDITS: 3 (Lecture 3 / Lab 0)
PREREQUISITES: PHYS 2010: General Physics 1

CATALOG DESCRIPTION:
This course focuses on the application of principles of particle motion, conservation principles, dynamics of particle systems and plane rigid bodies, and technical applications. This course is intended for engineering majors and includes open-ended design.

OUTLINE OF MAJOR CONTENT AREAS:
1. Kinematics of a particle
   A. Rectilinear kinematics
   B. Graphical solutions
   C. General curvilinear motion
   D. Curvilinear motion: rectangular components
   E. Motion of a projectile
   F. Curvilinear motion: normal and tangential components
   G. Absolute-dependent-motion analysis of two particles
   H. Relative motion analysis of two particles using translating axes
2. Kinetics of a particle: force and acceleration
   A. Newton's laws of motion
   B. The Equation of Motion
   C. Equations of motion for a system of particles
   D. Equations of motion: rectangular coordinates
   E. Equations of motion: normal and tangential coordinates
3. Kinetics of a particle: work and energy
   A. The work of a force
   B. Principle of work and energy
   C. Principle of work and energy for a system of particles
   D. Power and efficiency
   E. Conservative forces and potential energy
   F. Conservation of Energy Theorem
4. Kinetics of a particle: impulse and momentum
   A. Principle of linear impulse and momentum
   B. Principle of linear impulse and momentum for a system of particles
   C. Conservation of linear momentum for a system of particles
   D. Impact
   E. Angular momentum
   F. Angular momentum of a system of particles
   G. Angular impulse and momentum principles
5. Planar kinematics of a rigid body
   A. Rigid body motion
B. Translation
C. Rotation about a fixed axis
D. Relative-motion analysis: velocity
E. Instantaneous center of zero velocity
F. Relative-motion analysis: acceleration

6. Planar kinetics of a rigid body: force and acceleration
   A. Moment of inertia
   B. Planar kinetic equations of motion
   C. Equations of motion: translation
   D. Equations of motion: rotation about a fixed axis
   E. Equations of motion: general plane motion

7. Planar kinetics of a rigid body: work and energy
   A. Kinetic energy
   B. The work of a force
   C. The work of a couple
   D. Principle of work and energy
   E. Conservation of energy

8. Planar kinetics of a rigid body: impulse and momentum
   A. Linear and angular momentum
   B. Principle of impulse and momentum
   C. Conservation of momentum
   D. Gyroscopic motion

**COURSE GOALS/OBJECTIVES/OUTCOMES:**
1. Students will analyze kinematics of a particle.
2. Students will utilize force-mass-acceleration to perform kinetic analysis of particles.
3. Students will utilize the method of work and energy to perform kinetic analysis of particles.
4. Students will utilize the method of impulse and momentum to perform kinetic analysis of linear systems.
5. Students will calculate the relationship between linear and rotational descriptions of kinetic systems.
6. Students will analyze kinematics of a rigid body in a plane.
7. Students will utilize force-mass-acceleration to perform kinetic analysis of rigid bodies.
8. Students will utilize the method of work and energy to perform kinetic analysis of rigid bodies.
9. Students will utilize the method of impulse and momentum to perform kinetic analysis of rigid bodies.
10. Students will communicate all written work in a professional manner utilizing spreadsheets and word processing applications.

**MNTC GOALS AND COMPETENCIES MET:**
N/A
HCC COMPETENCIES MET:
Communicating Clearly & Effectively

STUDENT CONTRIBUTIONS:
The student will attend class regularly, participate in class discussion, complete assignments, team design projects, and take a comprehensive final examination. The student will spend sufficient time to complete all assignments.

METHODS FOR EVALUATING STUDENT LEARNING:
The final grade is determined by grades earned on homework problems, periodic examinations, a comprehensive design project, and a comprehensive final examination.

ADDITIONAL INFORMATION:
All homework must be done on engineer's paper.
A scientific calculator with exponential and logarithmic capabilities is required for this course.

Curriculum Committee Approval Date: February 12, 2018

AASC APPROVAL DATE: February 21, 2018
REVIEW DATE: February 2023