



ENGR 2030

Division: Natural Science and Mathematics

Department: Engineering and Computer Science

Course: ENGR 2030

Title: Dynamics

Catalog Description:

ENGR 2030 is designed for engineering majors in their preprofessional program. This course consists of an application of classical Newtonian theory to the analysis of moving mass systems in response to applied forces and moments. Topics included are the general motion of particles, particle systems, rigid bodies, and an introduction to the theory of vibrations.

General Education Requirements: N/A

Semesters Offered: Spring

Credit/Time Requirement: Credit: 3; Lecture: 3; Lab: 0

Clock/Hour Requirements: 0

Offered for Non-Credit: No

Prerequisites: Calculus II (MATH 1220), and Physics I (PHYS 2210)

Corequisites: N/A

Justification:

This course is designed as a component of the standard preprofessional curriculum in engineering, which enables the student to transfer with junior level status into a four year engineering program. Similar courses are offered in university engineering schools. ENGR 2030 is to be taken during the sophomore year of the preengineering curriculum and will prepare the student for subsequent course work.

Student Learning Outcomes:

Upon successful completion of this course, students will:

- have developed the ability to analyze systems of moving masses and applied forces
- be able to use three dimensional vector methods to solve dynamical problems
- demonstrate the ability to model dynamical systems with mathematical equations and apply methods of calculus to solve these equations
- have developed a perceptive insight and a creative imagination which will assist him or her in finding innovative solutions to engineering problems.

Content:

This course will include:

- a review of vector algebra
- kinematics of a particle

- a description of rectilinear and curvilinear motion
 - the use of rectangular, tangential normal, and cylindrical coordinate systems
- kinetics of a particle
 - equations of motion relating force and acceleration
 - work energy relations
 - impulse and momentum
 - central force motion
- kinematics of a rigid body
 - types of rigid body motion: translation versus rotation
 - angular velocity and angular acceleration
 - general planar motion of a rigid body, instantaneous center of zero velocity
 - motion of a rigid body relative to translating and/or rotating axes
- Kinetics of a rigid body
 - planar equations of motion for translation
 - equations of motion for rotation: moment of inertia
 - equations of motion relative to moving axis systems
 - kinetic energy of a rigid body in general motion
 - the work energy principle for rigid bodies
 - linear and angular momentum of a rigid body
 - conservation of momentum
- three dimensional kinematics and kinetics of a rigid body
 - rotation about a fixed point
 - general motion
 - moments and products of inertia
 - angular momentum
 - kinetic energy
 - equations of motion
 - gyroscopic motion
- vibrations
 - undamped free vibration
 - energy methods
 - undamped forced vibration
 - viscous damped free vibration
 - viscous damped forced vibration

General Education Outcomes:

6) Apply computational skills to a variety of contexts.

Mathematical and computational skills are essential to the success of an engineering student. The student must be able to perform calculations both manually and through the use of computational software.

7) Apply scientific reasoning to a variety of contexts.

Engineering consists of the application of scientific knowledge in order to design devices and systems with a practical purpose. Thus, students must be able to utilize the discoveries of science in the solution of engineering problems.

- Daily homework (15-20%), quizzes (5-8%), midterm tests (50-60%), and a final exam (15-20%) will be administered -- all related to the above outcomes. These will be evaluated and recorded.

Representative Text and/or Supplies:

- R. C. Hibbeler, *Engineering Mechanics, Dynamics*, current edition, Prentice-Hall.
- Beer, Johnston, Eisenberg, *Vector Mechanics for Engineers, Dynamics*, current edition, McGraw-Hill.

Optimum Class Size: 20

Maximum Class Size: 30

Signatures:

I hereby submit this course syllabus:

Garth O. Sorenson, MS, Associate Professor

I hereby find this course consistent with the goals and resources of the Engineering and Computer Science Department:

Garth O. Sorenson, MS, Associate Professor, Chair

I hereby find this course consistent with the goals and resources of the Natural Science and Mathematics Division:

Dan Black, EdD, Associate Professor, Dean

I have discussed the need for library resources related to this class with the person submitting the syllabus:

Lynn Anderson, MLIS, Technical Services Librarian (Main Campus)

Michelle Olsen, MLS, Campus Librarian (Richfield Campus)