# Course Syllabus

**Department:** Science & Technology

**Date:** 02-02-2015

**I. Course Prefix and Number**: ESC 212

**Course Name**: Dynamics

**Credit Hours and Contact Hours**: 3 credit hrs (3 lec hrs, 0 lab hr)

**Catalog Description including pre- and co-requisites:** *supporting data required for grade prerequisite of 'C' or higher.*

This course is the second semester of a two-semester sequence in Engineering Mechanics. It presents the fundamental laws of Newtonian dynamics for particles and rigid bodies, provides a rigorous methodology for solution of problems, and presents a wide variety of examples of application. The course relies heavily on the use of vectors and vector algebra. Subject areas discussed are kinematics of particles including rectilinear, relative and curvilinear motion; kinetics of particles including Newton's Laws, dynamic equilibrium, angular momentum, work, energy principle, conservation of energy, and impulse-momentum; kinematics of rigid bodies including Newton's Laws, angular momentum, plane motion, work and energy; introduction to vibrations (time permitting). *Pre-requisite:* ESC 211.

**Relationship to Academic Programs and Curriculum including SUNY Gen Ed designation if applicable:**
This course is primarily a technical elective course for the A.S. in Engineering Science program. It is designed for the students who wish to pursue a baccalaureate degree in Aeorspace, Mechanical, Civil, Environmental, or Electrical Engineering. Other students from other programs may also take the course if they have the appropriate background.

**II. Course Student Learning Outcomes:** *State the student learning outcome(s) for the course (e.g. Student will be able to identify…)*
Upon completion of the course the student will be able to:

1. Calculate the velocity and acceleration of a particle from a given initial condition using the rectangular, polar, or the local orthogonal coordinate sytems.
2. Determine the complete motion of a particle resulting from an application of a system of forces, using the Newton's Laws of motion, or the energy and/or momentum principles.

3. Calculate the velocity and acceleration of a point on a rigid body exhibiting either a translational, rotational, or general plane motion.
4. Determine the complete motion of a rigid body resulting from an application of a system of forces, using the Newton's Laws of motion, or the energy and/or momentum principles.
5. Determine the orbit equation for a sattelite from the knowledge of the burnout position and velocity.

**College Learning Outcomes Addressed by the Course:** *(check each College Learning Outcome addressed by the Student Learning Outcomes)*

| | |
|---|---|
| ☐ writing | ☐ computer literacy |
| ☐ oral communications | ☐ ethics/values |
| ☐ reading | ☐ citizenship |
| ☒ mathematics | ☐ global concerns |
| ☒ critical thinking | ☐ information resources |

## III. Assessment Measures (Summarize how the college and student learning outcomes will be assessed): *For each identified outcome checked, please provide the specific assessment measure.*

| List identified College Learning Outcomes(s) | Specific assessment measure(s) |
|---|---|
| *eg: writing* | *eg: student will complete a research paper* |
| Mathematics | Student will answer specific test questions correctly |
| Critical Thinking | Student will answer specific test questions correctly |

## IV. Instructional Materials and Methods

### Types of Course Materials:

Current edition of Beer and Johnston, "Vector Mechanics for Engineers - Statics and Dynamics" is used as the textbook.
Instructor notes are used as the supplemental source of information for the course content.
Each student is required to have a scientific calculator (a minimum of TI-83 or equivalent).
A course website is maintained on the internet for lecture schedule, test solutions, and other supplemental learning material.

### Methods of Instruction (e.g. Lecture, Lab, Seminar …):

Main avenue used to convey knowledge to the student are lectures. They are presented in the traditional way, using either whiteboard

or smartboard, supplemented with models, material samples, or power point presentations.
Plenty of example problems are solved in class and the students are allowed to practice the problem solutions through various homework assignments.

## V. General Outline of Topics Covered:

Introduction, rectilinear motion of particles,
Position,velocity,acceleration
Uniform and uniformly accelerated rectilinear motions, dependent motions
Curvilinear motion of particle, derivatives of vector functions,
Rectangular components of velocity and acceleration, projectile motion
Tangential and normal components of curvilinear motion
Radial and transverse components of curvilinear motion
Newton's second law
Linear momentum
Equations of motion
Angular momentum
Newton's law of gravity
Trajectory of a particle under central force, application to space mechanics
Energy method, work of a force, kinetic energy of a particle, work & energy principle
Potential energy, conservative forces, conservation of energy
Momentum method, principle of impulse and momentum
Impact, direct and oblique central impact, problems involving energy and momentum
Translation, rotation about a fixed axis
General plane motion, absolute and relative velocity in plane motion
Instantaneous center of rotation in plane motion
Absolute and relative acceleration in plane motion
Plane motion of a particle relative to a rotating frame, Coriolis acceleration
Equations of motion for a rigid body in plane motion
Principle of work and energy for the plane motion of a rigid body
Principle of impulse and momentum for the plane motion of a rigid body

7/12