**ESSEX COUNTY COLLEGE**

**Engineering Technologies and Computer Sciences Division**

**ENR 212 – Engineering Mechanics II – Dynamics**

**Course Outline**

**Course Number & Name:**  ENR 212 Engineering Mechanics II – Dynamics

**Credit Hours:**  3.0 **Contact Hours:**  3.0 **Lecture:** 3.0 **Lab:**  N/A **Other:**  N/A

**Prerequisites**:  Grade of “C” or better in ENR 211

**Co-requisites:** None **Concurrent Courses:** None

**Course Outline Revision Date:**  Fall 2010

**Course Description**: This is a course in kinematics and kinetics using vector analysis. Topics covered include curvilinear motion with respect to fixed and rotating axes of particles and rigid bodies, work, energy, impulse, and momentum.

**Course Goals:** Upon successful completion of this course, students should be able to do the following:

1. apply the concepts and principles of kinematics and kinetics of a particle including force and acceleration, work and energy, and impulse and momentum to solve engineering problems;

2. apply the concepts and principles of planar kinematics and kinetics of a rigid body including force and acceleration, work and energy, and impulse and momentum to solve engineering problems; and

3. determine the kinematic and kinetic properties of a rigid body in three dimensions.

**Measurable Course Performance Objectives (MPOs)**: Upon successful completion of this course, students should specifically be able to do the following:

1. Apply the concepts and principles of kinematics and kinetics of a particle including force and acceleration, work and energy, and impulse and momentum to solve engineering problems:

* 1. *express particle motion along a straight line and a curved path;*
  2. *analyze dependent motion of two particles;*
  3. *analyze relative motion of two particles by using translating axes;*
  4. *analyze the accelerated motion of a particle by applying Newton’s Second Law of Motion in appropriate coordinate systems;*
  5. *apply the principles of work and energy to solve problems involving force, velocity, and displacement;*
  6. *solve problems involving power and efficiency;*
  7. *apply the principles of linear impulse and momentum to solve problems involving force, velocity, and time;*
  8. *analyze the mechanics of impact;* and
  9. *solve angular impulse and momentum problems*

**Measurable Course Performance Objectives (MPOs)** (continued):

2. Apply the concepts and principles of planar kinematics and kinetics of a rigid body including force and acceleration, work and energy, and impulse and momentum to solve engineering problems:

2.1 *analyze rigid body planar motion (both translation and angular motion);*

2.2 *analyze relative motion of velocity and acceleration by using translating and rotating frames of reference;*

2.3 *determine the velocity of a point on a body using the instantaneous center of zero velocity;*

2.4 *apply the planar kinetic equations of motion to rigid bodies undergoing translation, rotation, and general plan motion;*

2.5 *apply the principles of work and energy to solve rigid-body planar kinetic problems involving force, velocity, and displacement;*

2.6 *apply conservation of energy to solve rigid-body planar kinetic problems;*

2.7 *apply the principles of linear and angular impulse and momentum to solve rigid-body planar kinetic problems involving force, velocity, and time;*

2.8 *apply conservation of momentum;* and

2.9 *analyze the mechanics of eccentric impact*

1. Determine the kinematic and kinetic properties of a rigid body in three dimensions:
   1. *analyze the kinematics of a rigid body in 3D motion;*
   2. *analyze the moments of inertia and products of inertia of a rigid body about various axes;* and
   3. *apply the principles of work and energy and linear and angular momentum to a rigid body in 3D motion*

**Methods of Instruction**: Instruction will consist of lectures including demonstrations, discussions, and solutions to engineering problems.

**Outcomes Assessment:** Selected homework, quiz, test, and exam questions are blueprinted to course objectives. Data is collected and analyzed to determine the level of student performance on these assessment instruments in regards to meeting course objectives. The results of this data analysis are used to guide necessary pedagogical and/or curricular revisions.

**Course Requirements:** All students are required to:

1. Maintain regular attendance and participate in classroom discussions.

2. Read all assigned textbook pages.

3. Complete homework assignments on time.

4. Take all quizzes, tests and exams as scheduled.

**Methods of Evaluation:** Final course grades will be computed as follows:

**% of**

**Grading Components final course grade**

* **Homework, quizzes and class participation**  **10 – 30%**

A perusal of homework and quiz questions and analysis of class discussion will indicate the extent to which students master course objectives.

* **3 or more Tests** (dates specified by the instructor) **30 – 50%**

Tests will show evidence of the extent to which students meet course objectives, including but not limited to identifying and applying concepts, analyzing and solving problems, estimating and interpreting results and stating appropriate conclusions using correct terminology.

* **Final Exam** (comprehensive)  **20 – 30%**

The same objectives apply as with tests, but it is anticipated that students will provide increased evidence of synthesizing a combination of concepts.

Note: The instructor will provide specific weights, which lie in the above-given ranges, for each of the grading components at the beginning of the semester.

**Academic Integrity:** Dishonesty disrupts the search for truth that is inherent in the learning process and so devalues the purpose and the mission of the College. Academic dishonesty includes, but is not limited to, the following:

* plagiarism – the failure to acknowledge another writer’s words or ideas or to give proper credit to sources of information;
* cheating – knowingly obtaining or giving unauthorized information on any test/exam or any other academic assignment;
* interference – any interruption of the academic process that prevents others from the proper engagement in learning or teaching; and
* fraud – any act or instance of willful deceit or trickery.

Violations of academic integrity will be dealt with by imposing appropriate sanctions. Sanctions for acts of academic dishonesty could include the resubmission of an assignment, failure of the test/exam, failure in the course, probation, suspension from the College, and even expulsion from the College.

**Student Code of Conduct:** All students are expected to conduct themselves as responsible and considerate adults who respect the rights of others. Disruptive behavior will not be tolerated. All students are also expected to attend and be on time for all class meetings. No cell phones or similar electronic devices are permitted in class. Please refer to the Essex County College student handbook, *Lifeline*, for more specific information about the College’s Code of Conduct and attendance requirements.

**Course Content Outline:** based on the text **Engineering Mechanics – Dynamics,** 12th edition, by R C Hibbeler; published by Prentice Hall, 2010; ISBN #: 0-13-609200-4

**Week**

**(2 meetings**

**@80 minutes) Topic/Content**

1 – 2 Kinematics of a Particle

3 – 4 Kinetics of a Particle: Force and Acceleration

**Test 1**

5 Kinetics of a Particle: Work and Energy

6 Kinetics of a Particle: Work and Energy (continued) & Kinetics of a Particle: Impulse and Momentum

7 Kinetics of a Particle: Impulse and Momentum (continued)

**Test 2**

8 Planar Kinematics of a Rigid Body

9 Planar Kinematics of a Rigid Body: Force and Acceleration

10 Planar Kinematics of a Rigid Body: Work and Energy

11 Planar Kinematics of a Rigid Body: Impulse and Momentum

**Test 3**

12 3D Kinematics of a Rigid Body

13 3D Kinematics of a Rigid Body (continued) & 3D Kinetics of a Rigid Body

14 3D Kinetics of a Rigid Body (continued)

15 Review & **Comprehensive Final Exam**