

**Department of Mechanical Engineering**  
**ENSC 306**  
**Dynamics**  
 **Required**       **Elective**



AY	Revision History: Changes and Rationale	Progress Exam Affected?
07/08	Syllabus Created	N

**Coordinator:** Dr. K. Akbar Ansari, Professor, Mechanical Engineering.

**Catalog Description:** A vector treatment of kinematics and kinetics. General motion of a particle; energy and momentum methods for particles and rigid bodies. Prerequisite: ENSC 205.

**Prerequisites by Topic:** Statics of particles and rigid bodies.

**Textbook(s) / Require Mat'l:** Engineering Mechanics- Dynamics- by R. C. Hibbeler, Eleventh Edition, Pearson Prentice Hall, 2007

**Course Topics:**

1. Kinematics of a particle (15%)
2. Kinetics of a particle- force and acceleration methods (10%)
3. Kinetics of a particle - work and energy methods (10%)
4. Kinetics of a particle- impulse and momentum methods. (10%)
5. Planar kinematics of a rigid body (15%)
6. Planar kinetics of a rigid body- force and acceleration methods (10%)
7. Planar kinetics of a rigid body- work and energy methods ( 10 %)
8. Planar kinetics of a rigid body- impulse and momentum methods (10%)
9. Exams (10%)

**Course Objectives:**

1. Gain knowledge and understanding of the fundamental methods and principles of engineering dynamic analysis
2. Apply the techniques learned to the dynamic analysis of engineering systems

**Professional Components/  
Course Outcomes:**

By the end of this course the student will be able to:

- 1.1. Determine the velocity and acceleration of a particle from a given displacement
- 1.2. Determine the motion of a particle, given its acceleration as a function of position, time or velocity.
- 1.3. Investigate the motion of a projectile
- 1.4. Solve problems on curvilinear motion of a particle
- 1.5. Conduct a dependent motion analysis of two particles connected by inextensible cables.
- 1.6. Conduct a relative motion analysis of two particles
- 1.7. Write down the equations of motion of a particle or a system of particles subjected to external forces using rectangular coordinates and solve for unknowns.
- 1.8. Write down equations of motion of a particle using tangential and normal coordinates or cylindrical coordinates and solve for unknowns.
- 1.9. Solve problems in particle dynamics involving force, velocity and displacement using work and energy methods
- 1.10. Solve problems in particle dynamics involving power and efficiency.
- 1.11. Solve problems in particle dynamics using impulse and momentum techniques.
- 1.12. Analyze the mechanics of impact.
- 1.13. Analyze planar motion of a rigid body
- 1.14. Locate the instantaneous center and determine the velocity of a point on a rigid body.
- 1.15. Conduct a relative motion analysis of two points on a rigid body.
- 1.16. Write down the kinetic equations of motion of a rigid body doing plane motion using force and acceleration methods
- 1.17. Develop formulations involving planar rigid body motion with the help of work - energy methods.
- 1.18. Develop formulations involving planar rigid body motion with the help of impulse-momentum techniques.
- 1.19. Distinguish between the various methods of dynamic analysis taught and their applications.
- 1.20. Distinguish between the various problem formulations demonstrated as they apply to particle models and to rigid-body math models.

2.1. Apply the techniques learned in the course to the dynamic analysis of engineering systems

**Class/Lab Schedule:**

3 sessions per week, 50 minutes per session,  
3 credits

**Relation to Program Outcomes:**

<input checked="" type="checkbox"/> (a) Fundamental math, science, or engineering	<input type="checkbox"/> (b) Experimentation
<input type="checkbox"/> (c) Design	<input type="checkbox"/> (d) Teamwork
<input type="checkbox"/> (f) Professional ethics	<input checked="" type="checkbox"/> (e) Problem solving
<input type="checkbox"/> (i) Life-long learning	<input type="checkbox"/> (g) Communication
<input type="checkbox"/> (j) Contemporary issues	<input type="checkbox"/> (h) Global awareness
	<input type="checkbox"/> (k) Modern tools

**Computer Tools:**

None

**Laboratory Content:**

None

**Design Content:**

none