Applied Dynamics

Course Objectives:
The purpose of the course is to provide basic knowledge of engineering mechanics dynamics portion to the students such that they can understand the basics of kinematics and kinetics for both particles and rigid bodies and their motion.

1. Curvilinear Motion of Particles (4 hours)
    a. Position vector, velocity and acceleration
    b. Derivatives of vector functions
    c. Rectangular component of velocity and acceleration
    d. Motion relative to frame in translation
    e. Tangential and normal components
    f. Radial and transverse components

2. Kinetics of particles: Energy and Momentum Methods (5 hours)
    a. Work done b a force
    b. Potential and kinetic energy of particles
    c. Principles of work and energy: applications
    d. Power and efficiency
    e. Conservation of energy
    f. Principle of impulse and momentum
    g. Impulsive motion and impact
    h. Direct central and oblique impact

3. System of particles (5 hours)
    a. Newton's laws and a system of particles
    b. Linear and angular moment for a system of particles
    c. Motion of the mass centre
    d. Conservation of momentum
    e. Kinetic energy of system of particles
    f. Work energy principles; Conservation of energy for a system of particles
    g. Principles of impulse and momentum for a system of particles
    h. Steady stream of particles
    i. System with variable mass

4. Kinematics of Rigid Bodies (6 hours)
    a. Introduction
    b. Translation and rotation
    c. General plane motion
    d. Absolute and relative velocity in plane motion
    e. Instantaneous centre of rotation
    f. Absolute and relative frame; Coriolis acceleration in plane motion
    g. Rate of change of a general vector with respect to a rotating frame; Coriolis acceleration
    h. Motion about a fixed point
    i. General motion
    j. Three-dimensional motion of a particle relative to a rotating frame; coriolis acceleration

5. Plane Motion of Rigid Bodies: Forces, Moments, and Accelerations(4 hours)
    a. Definitions: rigid bodies
    b. Equation of motion for a rigid Body in plane motion
    c. Angular momentum of a rigid body in plane motion
    d. Plane motion of rigid body: D'Alembert's principle
    e. Application of rigid body motion in the plane
    f. Constrained motion in the plane

6. Plane motion of rigid bodies: energy and momentum methods (6 hours)
    a. Principle of work and energy for a rigid body
    b. Work done by external forces
    c. Kinetic energy for a system
    d. Conservative and non-conservative systems
    e. Work – energy applications
    f. Impulse and momentum for systems for rigid bodies
    g. Conservation of angular and linear momentum
    h. Impulsive motion and eccentric impact

Tutorials:
6 tutorials, 2 mini projects

References:

1. Hibbler, R.C. "Engineering Mechanics" (Statics and Dynamics)",
2. Beer F.P. and E.R. Johnson "Vector Mechanics for Engineers", , 2nd Edition, Tata McGraw Hill Publishing Co. Ltd., 1998
3. Shames, I.H "Engineering Mechanics – Statics and Dynamics"., 3rd Edition, New Delhi, Prentice Hall of India, 1990
4. Egor .P. Popov "Engineering Mechanics of Solids", , 2nd Edition, New Delhi, Prentice Hall of India, 1996

Evaluation Scheme:
The questions will cover all the chapters of the syllabus. The evaluation scheme will be as indicated in the table below:

Chapters	Hours	Marks Distribution*
1	4	4
2	5	8
3	5	8
4	6	8
5	4	4
6	6	8
Total	**30**	**40**

*Note: There may be minor deviation in marks distribution.