ZZU102 ENGINEERING MECHANICS II—DYNAMICS

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3	1	0	3

MODULE 1 (12 hours)

Kinematics of a particle – simple relative motion:
Introduction, general notions, differentiation of a vector with respect to time, velocity and acceleration calculations, rectangular components, velocity and acceleration in terms of path variables, cylindrical coordinates, simple kinematical relations and applications, simple relative motion, motion of a particle relative to a pair of translating axes.

Particle dynamics:
Introduction, rectangular coordinates, rectilinear translation, Newton's law for rectangular coordinates, rectilinear translation, cylindrical coordinates, Newton's law for cylindrical coordinates, path variables, Newton's law for path variables, a system of particles, the general motion of a system of particles.

MODULE 2 (12 hours)

Energy methods for particles
Analysis for a single particle, power considerations, conservative force field, conservation of mechanical energy, alternative form of work-energy equation, systems of particles, work-energy equations, kinetic energy expression based on centre of mass, work-kinetic energy expressions based on centre of mass.

Methods of momentum for particles
Linear momentum, impulse and momentum relations for a particle, linear momentum considerations for a system of particles, impulsive forces, impact, moment of momentum, moment of momentum equation for a single particle and for a system of particles.

MODULE 3 (9 hours)

Kinematics of rigid bodies: Relative motion
Introduction, translation and rotation of rigid bodies, Chasles' theorem, derivative of a vector fixed in a moving reference, applications of the fixed-vector concept, general relationship between time derivatives of a vector for different references, the relationship between velocities of a particle for different references, acceleration of a particle for different references.

MODULE 4 (9 hours)

Moments and products of inertia:
Formal definition of inertia quantities, relation between mass-inertia and area-inertia terms, translation of axes.

Kinetics of rigid bodies
Moment-of-momentum equations for general motion of rigid bodies, Plane motions, Pure rotation of a body of revolution about its axis of revolution, General plane motion concept of a slablike body, Pure rotation of an arbitrary rigid body.

Text Book
I. H. Shames, Engineering Mechanics – Statics and Dynamics, 4th Edition, Prentice Hall of India, 1996.

Reference Books
1. F.P. Beer and E.R. Johnston, Vector Mechanics for Engineers – Dynamics, McGraw Hill Book Company, 2003.
2. J.L. Meriam and L.G. Kraige, Engineering Mechanics – Dynamics, John Wiley & Sons, 2002.