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ZZU 101 ENGINEERING MECHANICS I—STATICS

MODULE 1

(12 hours)

Fundamentals of mechanics:

Introduction, basic dimensions and units of mechanics, secondary dimensional quantities, law of dimensional homogeneity, dimensional relations between force and mass, units of mass, idealisations of mechanics, vector and scalar quantities, equality and equivalence of vectors, laws of mechanics.

Important vector quantities:

Elements of vector algebra, position vector, moment of a force about a point, moment of a force about an axis, the couple and couple moment, couple moment as a free vector, addition and subtraction of couples, moment of a couple about a line.

Equivalent force systems:

Translation of a force to a parallel position, resultant of a force system, simplest resultant of special force systems, distributed force systems.

MODULE 2

(9 hours)

Equations of equilibrium:

Free body diagram, free bodies involving interior sections, general equations of equilibrium, problems of equilibrium, static indeterminacy.

MODULE 3

(9 hours)

Introduction to structural mechanics:

Trusses

The structural model, the simple truss, solution of simple trusses, method of joints, method of sections.

Section forces in beams:

Shear force, axial force and bending moment, differential relations for equilibrium, variety of problems.

Chains and cables:

Coplanar cables, parabolic and catenary cables.

MODULE 4

(12 hours)

Friction forces:

Laws of Coulomb friction, simple contact friction problems, belt friction, square screw thread, rolling resistance.

Properties of surfaces:

First moment of an area and the centroid, theorems of Pappus-Guldinus, second moments and the product of a plane area, transfer theorems, computations involving second moments and products of area, relation between second moments and products of area, polar moment of area, principal axes.

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 – Statics*, McGraw Hill Book Company, 2000.
2. J.L. Meriam and L.G. Kraige, *Engineering Mechanics – Statics*, John Wiley & Sons, 2002.