

CC161: ENGINEERING MECHANICS

CREDITS = 5 (L=3, T=0, P=2)

Course Objective:

This course is to introduce the basic principles of engineering mechanics with emphasis on their analysis and application to practical engineering problems.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P		Theory		Practical		Total Marks
			ESE	CE	ESE	CE		
3	0	2	5	70	30	30	20	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	<u>Introduction & Fundamentals of Statics:</u> Scalar and Vector Quantities, composition and resolution of forces & Force system. Principles of statics, moments and couples & their properties, combination of coplanar couples and forces, equilibrant, equilibrium, free body diagrams, analytical conditions of equilibrium for coplanar force systems & related problems. Introduction to Vector Mechanics.	06
2	<u>Centroid, center of gravity and Moment of inertia:</u> Center of lines, plane areas, volumes, mass, gravity (combination of sphere, hemisphere, cone, cylinder), Pappus – Guildinus theorems, area and mass moment of inertia, radius of gyration of areas and mass, parallel & perpendicular axes theorems.	08
3	<u>Analysis of Simple Truss:</u> Types of Truss (Perfect, Imperfect, Redundant trusses), Methods of finding forces in truss members (Method of Joint, Method of Section, Graphical method).	05
4	<u>Friction:</u> Theory of friction, static and sliding friction, laws of friction, angle and coefficient of friction, inclined plane friction, ladder and wedge friction.	04

Unit No.	Topics	Teaching Hours
5	<u>Simple stresses & strains:</u> Elastic, plastic, brittle, ductile, homogeneous and isotropic materials; Behavior of material under axial and shear loads, Modulus of elasticity, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening. Basic definitions of stress: Linear, shear, bending, torsion, in-plane. Strains: Linear, shear, lateral, thermal and volumetric Poisson's ratio, Bulk Modulus, modulus of rigidity, relationship between various elastic constants Analysis of prismatic, tapered and composite sections under axial and thermal loads.	08
6	<u>Applications of fundamentals of statics to Statically determinate beams:</u> Types of loads, supports and beams; Determination of support reactions, Bending moment and shear force, Relationship between loading, shear force & bending moment, Bending moment and shear force diagrams for beams subjected to concentrated loads, uniformly Distributed loads, couples and their combinations; Point of Contra-flexure.	07
7	<u>Simple Lifting Machines:</u> Introduction to simple lifting machines: Simple screw jack, single purchase crab and differential wheel axle, Velocity ratio, mechanical advantage, efficiency and reversibility of machines. Law of Machine, Application of law of machine to simple machines.	03
8	<u>Uniform Flexible Suspension Cables:</u> Introduction to cables and loadings, cables subjected to concentrated load and UDL, Parabolic and catenary profile of cables.	04
TOTAL		45

List of References:

1. Beer and Johnston, "Engineering Mechanics (Statics)", McGraw-Hill Publications.
2. S. B. Junnarkar and H. J. Shah, "Applied Mechanics", Charotar Publishing House Pvt. Ltd.
3. S. B. Junnarkar and H. J. Shah, "Mechanics of Structure Vol. I", Charotar Publishing House Pvt. Ltd.
4. Beer and Johnston, "Mechanics of Materials", McGraw-Hill Publications.
5. P. J. Shah, "Mechanics of Solids", S. Chand, New Delhi.
6. R. S. Khurmi, "Engineering Mechanics", S. Chand, New Delhi.
7. A. K. Tayal, "Engineering Mechanics", Umesh Publications, New Delhi.
8. N. K. Arora, "Mechanics of Solids", Books India Publications, Ahmedabad.
9. M. N. Patel, P. V. Patel, C. S. Sanghvi, J. S. Thakur, "Mechanics of Solids", Mahajan Publishing House, Ahmedabad.

Course Outcomes (COs):

At the end of this course students will be able to ...

1. Solve practical problems of engineering by applying fundamental principles of mechanics & principles of equilibrium.
2. Determine the centroid and moment of inertia of different geometrical shapes.
3. Calculate stability of systems using fundamentals of friction and its importance through simple applications.
4. Determine stresses and strains under axial & thermal loads.
5. Apply principles of statics to analyze statically determinate beams, cables and trusses.
6. Solve machine parameters for simple machines and understand their working mechanism.