1PT04: ENGINEERING MECHANICS AND MECHANICS OF SOLIDS
CREDITS - 4 (LTP:3,1,0)

Course Objective:
This course is to introduce the basic principles of engineering mechanics and Mechanics of deformable bodies with emphasis on their analysis and application to practical engineering problems.

Teaching and Assessment Scheme:

Teaching Scheme			Credits	Assessment Scheme				
L	T	P	C	Theory Marks		Practical Marks		Total Marks
				ESE	CE	ESE	CE	
3	1	0	4	60	40	20	30	150

Course Contents:

Unit No.	Topics	Teaching Hours
1	**Fundamentals of Statics**: **Coplanar concurrent and non-concurrent force system: Resultant, Equilibrant, Free body diagrams.** Coplanar concurrent forces: Resultant of coplanar concurrent force system by analytical and graphical method, Law of triangle of forces, Law of polygon of forces, Equilibrium conditions for coplanar concurrent forces, Lami's theorem. Coplanar non-concurrent forces: Moments & couples, Characteristics of moment and couple, Equivalent couples, Force couple system, Varignon's theorem, Resultant of non-concurrent forces by analytical method, Equilibrium conditions of coplanar non-concurrent force system	05
2	**Friction** Theory of friction, Types of friction, Static and kinetic friction, Cone of friction, Angle of repose, Coefficient of friction, Laws of friction, Application of theory of friction: Friction on inclined plane, ladder friction, wedge friction, belt and rope friction.	07
3	**Centroid and moment of inertia:** Centroid: Centroid of plane areas and volumes, Examples related to centroid of composite geometry, Pappus – Guldinus first and second theorems. Moment of inertia of planar cross-sections: Derivation of equation of moment of inertia of standard lamina using first principle, Parallel & perpendicular axes theorems, polar moment of inertia, and radius of gyration of areas. Examples related to moment of inertia of composite geometry,	07
4	**Columns and Struts:** Buckling of columns, different end conditions, effective length, least radius of gyration, Euler's and Rankine's formulae	05
5	**Simple stresses & strains:** Basics of stress and strain: Application of normal stress & strains: Homogeneous and composite bars having uniform & stepped sections subjected to axial loads and thermal loads, analysis of homogeneous prismatic bars under multidirectional stresses.	07

Unit No.	Topics	Teaching Hours
	Principle stresses: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress, ellipse of stress and their applications.	
6	**Bending stresses in Beams and curved bars:** Flexural stresses **:** Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I, T, Angle, channel sections. Bending stresses in curved bars: Pure bending of curved bars of I-section, circular section, crane hooks, stresses in curved bars of small initial curvature.	08
7	**Thin & Thick cylinders:** Thin seamless cylindrical shells, Riveted boiler shells, wire-bound thin pipes, and thick cylindrical shells.	06
	Total	**45**

List of References:

1. S. B. Junnarkar and H. J. Shah, "*Applied Mechanics*", Charotar Publishing House Pvt. Ltd.
2. S. B. Junnarkar and H. J. Shah, "*Mechanics of Structure Vol. I*", Charotar Publishing House Pvt. Ltd.
3. P. J. Shah, "*Mechanics of Solids*", S. Chand, New Delhi.
4. R. S. Khurmi, *"Engineering Mechanics*", S. Chand, New Delhi.
5. N. K. Arora, "*Mechanics of Solids*", Books India Publications, Ahmedabad.
6. M. N. Patel, P. V. Patel, C. S. Sanghvi, J. S. Thakur, "*Mechanics of Solids*", Mahajan Publishing House, Ahmedabad.

Course Outcome:

After learning the course the students should be able to:

1. Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering.
2. Know basics of friction and its importance through simple engineering applications.
3. Determine centroid and moment of inertia of a different geometrical shape and able to understand its importance.
4. Understand the different types of stresses and strains developed in the members subjected to axial, bending, shear.