Program : **Diploma in Architecture/ Automobile Engineering / Civil Engineering & allied programs / Mechanical Engineering & allied programs / Wood & Paper Technology / Environmental Engineering**	
Course Code : **2021**	Course Title: **Engineering Mechanics**
Semester : **2**	Credits: **3**
Course Category: **Engineering Science**	
Periods per week: **3 (L:2 T:1 P:0)**	Periods per semester: **45**

Course Objectives:

- To impart the knowledge and skills that enable the student to predict the effects of force and motion

Course Prerequisites:

Topic	Course Code	Course Name	Semester
Integration, Trigonometry		Mathematics I & II	1 & 2
Scalar, vector quantities, triangular and parallelogram law of forces		Applied Physics I	1

Course Outcomes:

On completion of the course, the student will be able to:

COn	Description	Duration (Hours)	Cognitive Level
CO1	Identify the force systems for given conditions by applying the basics of mechanics	10	Understanding
CO2	Apply conditions of static equilibrium to determine unknown force(s) of different structural elements.	12	Applying
CO3	Solve problems involving rigid bodies by applying the properties of distributed areas and masses.	11	Applying
CO4	Determine structural behavior of materials under various loading conditions.	10	Applying
	Series Test	2	

CO – PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2						
CO2	3	2					
CO3	3						
CO4	3						

3-Strongly mapped, 2-Moderately mapped, 1-Weakly mapped

Course Outline

Module Outcomes	Description	Duration (Hours)	Cognitive Level
CO1	**Identify the force systems for given conditions by applying the basics of mechanics**		
M1.01	Define different force systems.	2	Understanding
M1.02	To summarize basic ideas of units used in engineering	2	Understanding
M1.03	Resolve forces and find resultant of different force systems.	2	Understanding
M1.04	Compute moment of a force	2	Understanding
M1.05	Solve simple problems from free body concept and Lami's theorem	2	Understanding

Contents:

Basics of mechanics, force system

Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics.

Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units.

Resolution of a force - Orthogonal components of a force, principle of transmissibility. Composition of forces – Resultant, analytical method for determination of resultant for concurrent, Non-concurrent and parallel co-planar force systems. Moment of a force, Varignon's Theorem, torque.

Equilibrium and Equilibrant, Free body and Free body diagram (concept and purpose with simple numerical problems).

Lami's Theorem – statement and explanation, Application for various engineering problems,(simple problems only).

CO 2	**Apply conditions of static equilibrium to determine unknown force(s) of different structural elements.**

M2.01	Identify different types of beams, loads and supports.	1	Understanding
M2.02	Determine the reactions of simply supported and cantilever beams under point load, UD load and combination of point load & UD load	3	Applying
M2.03	Find out the unknown forces in simple truss using method of joints.	2	Applying
M2.04	Outline method of sections	4	Understanding
M2.05	Describe the principles of friction in various conditions.	2	Understanding
	Series Test – I	1	

Contents:

Types of beams, supports and simple truss

Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical and inclined point load, uniformly distributed load, couple,)

Beam reaction for cantilever, simply supported beam without overhang – subjected to Point load, uniformly distributed load, combination of Point load and uniformly distributed load.

Truss:- The magnitude and type of forces in various members of the truss due to vertical point loading only, using methods of joints:-simple problems (maximum 5 members). Introduction to method of sections.

Friction:-Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, relation between co-efficient of friction and angle of friction.

CO3	**Solve problems involving rigid bodies by applying the properties of distributed areas and masses.**		
M3.01	Recall formulae for finding centroid and centre of gravity of different geometrical plane figures and simple solids.	1	Remembering
M3.02	Locate centroid of composite figures composed of not more than three geometrical figures and Centre of Gravity of composite solids composed of not more than two simple solids.	3	Applying
M3.03	Outline moment of inertia of plane lamina and solid bodies	2	Understanding
M3.04	Determine moment of inertia of composite figures	3	Applying
M3.05	Outline polar moment of inertia.	2	Understanding

Contents:

Centroid centre of gravity and moment of inertia

Identify the centroid of geometrical plane figures such as square, rectangle, triangle, circle, semi-circle, quarter circle, and trapezoidal section (no derivation required).

Centroid of composite figures composed of not more than three geometrical figures, such as combinations of symmetrical sections such as T- I & channel sections and combinations of unsymmetrical sections such as L section. - Plane sections with cut out holes.

Identify centre of Gravity of simple solids (Cube, cuboid, cone, cylinder, sphere, hemisphere :– no derivation) Centre of Gravity of composite solids composed of not more than two simple solids.

Moment of inertia (M.I.): Definition, M.I. of plane lamina and solid bodies ,Radius of gyration, Parallel and Perpendicular axes theorems (without derivations) M.I. of rectangle, square, circle, semi-circle, quarter circle and triangle section (without derivations).

M.I. of symmetrical and unsymmetrical I-section, Channel section, T-section, Angle section, Hollow sections and about centroidal axes.

Polar Moment of Inertia of solid circular sections.

CO4	**Outline structural behavior of materials under various loading conditions**		
M4.01	Identify different types of stresses	2	Understanding
M4.02	Demonstrate stress- strain curve of mild steel and tor steel under tension	1	Understanding
M4.03	Determine stresses due to axial load	4	Applying
M4.05	Explain elastic constants.	3	Understanding
	Series Test – II	1	

Contents:

Simple stresses and strains

Definition of rigid, elastic and plastic bodies, deformation of elastic body under various forces, Definition of stress, strain, elasticity, Hook's law, Elastic limit, Modulus of elasticity- simple problems.

Type of Stresses-Direct, Bending, Shear and Torsion - nature of stresses.

Standard stress strain curve for mild steel bar under tension, Yield stress, Proof stress, Ultimate stress, Strain at various critical points, Percentage elongation.

Mechanical properties of materials - Elasticity, stiffness, plasticity, toughness, brittleness, ductility, Malleability and hardness.

Longitudinal and lateral strain, Modulus of Rigidity, Poisson's ratio, volumetric strain, change in volume, Bulk modulus (Introduction only with simple problems).

Relation between modulus of elasticity, modulus of rigidity and bulk modulus (without derivation and direct problems).

Text / Reference

T/R	Book Title/Author
T1	Khurmi, R.S., Applied Mechanics, S.Chand & Co. New Delhi.
T2	Bansal R K, A text book of Engineering Mechanics, Laxmi Publications.
T3	Ramamrutham, Engineering Mechanics, S.,S Chand & Co. New Delhi.
T4	Bedi D.S. , Strength of Materials, Khanna Publishing House, Delhi, Ed. 2018
T5	Khurmi, R.S., Strength of Materials, S Chand and Co. Ltd. New Delhi.
T6	Ramamurtham, S, Strength of Materials, Dhanpat Rai and sons, New Delhi.
T7	Punmia B C, Strength of Materials, Laxmi Publications (p) Ltd. New Delhi.
R1	Ram, H. D.; Chauhan, A. K. Foundations and Applications of Applied Mechanics, Cambridge University Press.
R2	Meriam, J. L., Kraige, L.G. , Engineering Mechanics- Statics, Vol. I, Wiley Publication, New Delhi.
R3	6. Rattan S.S., Strength of Materials, McGraw Hill Education; New Delhi.

Online Resources

Sl.No	Website Link
1	https://www.nptel.ac.in/courses/122104015/
2	https://nptel.ac.in/courses/112103109/