

Branch Name:	Mechanical Engineering
Program Code:	ET101
Course Name:	Engineering Mechanics
Course Code:	2ET1010303T
Pre-requisite Course:	Basic understanding of Physics and Mathematics

Course Objectives:

1. To understand the concepts of stress, strain and principle stresses
2. To learn about coplanar concurrent and non-concurrent force system
3. To understand the fundamentals of shear force and bending moment
4. To apply the laws/concepts mechanics to simple machines.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
04	03	01	-	04	24	60	16	40	-	-	-	-	100

Course Contents:

Sr. No	Topic	Total Hours	Weightage (%)
1	Introduction: Definition of space, time, particle, rigid body, deformable body. Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces. Fundamental Principles of mechanics: Principle of transmissibility, Principle of superposition, Law of gravitation, Law of parallelogram of forces, Newton's Laws of Motion.	04	10
2	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. Application of these principles. 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 and graphical method, Equilibrium conditions of coplanar non-concurrent force system, Application of these principles. Concept of statically determinate and indeterminate problems.	08	20
3	Shear force and Bending moment: Types of loads, Types of supports, Types of beams; Determination of support reactions, Relationship between loading, shear force & bending moment, Bending moment and shear force diagrams for beams subjected to only three types of loads :i) concentrated loads ii) uniformly distributed loads iii) couples and their combinations; Point of contra flexure, point & magnitude of maximum bending moment, maximum shear force.	08	20

4	Centroid and moment of inertia and mass moment of inertia: Centroid: Centroid of lines, 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, radius of gyration of areas, section modulus. Examples related to moment of inertia of composite geometry	08	15
5	Torsion: Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity	04	10
6	Simple Machines: Basics of Machines, Definitions: Velocity ratio, mechanical advantage, efficiency, reversibility of machines. Law of Machines, Application of law of machine to simple machines such as levers, pulley and pulley blocks, wheel and differential axle, Single purchase, double purchase crab, screw jacks. Relevant problems.	08	20
7	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	02	05

List of Tutorials:

The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.

Mechanics of rigid body

1. Equilibrium of coplanar concurrent forces
2. Equilibrium of coplanar non-concurrent forces
3. Equilibrium of coplanar parallel forces: Determination of reactions of simply supported beam
4. Verification of principle of moment: Any rigid body
5. Determination of shear force and bending moment
6. Determination of parameters of machines (Any two)
 - (a) Wheel and differential axles
 - (b) Single purchase crab
 - (c) Double purchase crab
 - (d) System of pulleys

Reference Books:

1. Engineering Mechanics by S. Ramamurtham, Dhanpat Rai & Co. Ltd. 2017.
2. Introduction to Mechanics by MK Verma. CRC Press.
3. Engineering Mechanics by S. S. Bhavikatti, Kavi Rajashekkarappa, New Edge International (P).
4. Engineering Mechanics by Bhattacharya Basu Deb, Oxford University Press, 2009.
5. Engineering Mechanics by M N Patel, C S Sanghvi, J S Thakur, Mahajan Publishing House.
6. Engineering Mechanics by P J Shah; S. Chand & Company Ltd, 2011.

E-Resources:

1. <https://nptel.ac.in/courses/122104015>

Course Learning Outcomes (CLO):

CLO	Description	Bloom's Taxonomy Level
CLO1	Understand and apply the fundamental principles of engineering mechanics, including the concepts of force, moment, and equilibrium.	1 Remembering 2 Understanding
CLO2	Understand the concepts of stress and strain in mechanics of solids and structures and material properties	3 Applying 4 Analyze
CLO3	Analyze the concurrent and non-concurrent force system and its response	2 Understanding 4 Analyze
CLO4	Determine centroid and moment of inertia of a different geometrical shape and its use in engineering problem.	2 Understanding 4 Analyze
CLO5	Determine principal stresses and strains for two dimensional system using analytical and graphical methods.	4 Analyze 5 Evaluating
CLO6	Apply the basics of simple machines and their working mechanism	6 Creating

Mapping of CLOs with POs & PSOs:

Course Learning Outcomes	Program Outcomes (POs)												Program Specific Outcomes(PSOs)	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CLO1	M		M			M						L	M	M
CLO2		H	M			M	M					L	M	L
CLO3	M	H	M	M		M	M					L	M	L
CLO4	H	M	M	M	M								M	
CLO5	H	L	M										L	
CLO6	M			M	H	M					L		H	

H: High, M: Medium, L: Low