

MECHANICS OF SOLIDS
BE 1st SEMESTER (ME/IT/EE/ AE)
BE 2nd SEMESTER (EC/CE/ CIVIL)
SUB CODE: CC110 Teaching Scheme (Credits and Hours)

Teaching Scheme				Total Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		Midsem	CIA	Pract.	
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
3	00	02	5	4	3	70	30	20	30	150

LEARNING OBJECTIVES:

The educational objectives of this course are

- To understand the fundamentals of structural analysis that is essential for an economical dimensional proportioning of various civil engineering structures.
- To make students familiar with techniques to find analytical solution to a range of structural engineering problems.
- To prepare the students to give cost-effective, safe and durable structural solution to the society.

Outline of the Course:

Sr. No.	Title of the Unit	Hours Required
ENGINEERING MECHANICS		
1	UNIT : 1	02
2	UNIT : 2	08
3	UNIT : 3	03
4	UNIT : 4	08
5	UNIT : 5	05
STRENGTH OF MATERIALS		
6	UNIT : 6	01
7	UNIT : 7	07
8	UNIT : 8	08
9	UNIT : 9	03

Total hours (Theory): 45 Hours , Total hours (Lab) : 30 Hours , Total hours : 75 Hours

DETAILED SYLLABUS :

Unit No	Topics	Lectures (Hours)	Weight age (%)
ENGINEERING MECHANICS			
1	INTRODUCTION Introduction to Mechanics and its branches, Fundamental concepts Idealizations in mechanics , Fundamental Principles of mechanics S.I. system of unit, Scalar and vector quantity , Types of vectors	2	3
2	FUNDAMENTAL OF STATICS Force and force system and types of forces, Understanding of resultant, equilibrium, moment and couple , Solution of coplanar concurrent force system using a) Law parallelogram , b) Law of triangle, c) Resolution of force system d) Law of polygon , e) Lami's theorem Solution of coplanar non concurrent force system using a) Resolution of force system , b) Varignon's theorem	8	20
3	TRUSS Introduction, Assumptions made in analysis of truss, Classification of truss, Determination of member forces in truss using a) Method of joints , b) Method of sections	3	7

4	DISTRIBUTED FORCES, CENTER OF GRAVITY AND MOMENT OF INERTIA Introduction, , Basic definitions, Calculation of CG of simple shapes using integration, Calculation of CG of compound lines, planes, bodies, Concept of suspended bodies, Pappus- guldianus theorems, Basic understanding of moment of inertia and section modulus, Calculation of moment of inertia of simple shapes using integration, Calculation of moment of inertia compound planes	8	20
5	FRICTION Basic terms, Laws of friction , Block friction, Ladder friction , Wedge friction	5.	10
STRENGTH OF MATERIALS			
6	PHYSICAL AND MECHANICAL PROPERTIES OF STRUCTURAL MATERIALS Basic properties of material (Strength, Elasticity, Plasticity, Ductility, Brittleness, Malleability, Resilience, Hardness, Fatigue, Stiffness), Creep, Stress concentration, Static and dynamic and cyclic loading, Fatigue failure, Endurance limit	1	2
7	SIMPLE STRESS AND STRAIN <i>Simple stress and strain , Types of stress and strain,</i> Elastic limit, Hooke's law, Determination of stress in members due to external load, Stress-strain curve for mild steel in tension, Ultimate stress, Working stress, Factor of safety, Deformation of a body due to self weight, Stresses in members with varying cross section, Principle of super position, Extension of a tapered uniformly due to an axial force applied at each end, Stresses in composite members <i>Elastic constants</i> Introduction Longitudinal & lateral strain, Poisson's ratio, volumetric strain volumetric strain of different shape bars subjected to normal stresses on three mutually perpendicular planes. <i>Bulk modulus</i> Relation between Bulk modulus and Young's modulus, Shear stress and strain, Principle of complimentary shear stress, Normal stresses due to shear stress, Modulus of rigidity, Relation between Modulus of rigidity and Young's modulus <i>Thermal stress and strain</i> Introduction Thermal stresses and strain for yielding and non yielding supports, Thermal stresses and strain for Tapering and varying section , Thermal stresses and strain for composite bars	7	15
8	SUPPORT REACTION, SHEAR FORCE AND BENDING MOMENT Introduction Types of supports, Types of beams, Types of loads Relation between shear force-bending moment and rate of loading Calculation of shear force and bending moment in a) simply supported beam, b) overhanging beam c) cantilever beam, for point load, UDL and UVL, Shear force and bending moment diagrams, Point of contra flexure	8	20
9	BENDING STRESS AND SHEAR STRESS Theory of simple bending, Bending stresses and their distribution Moment of resistance, Modulus of sections, Introduction to shear stress Theory of shearing stress, Shear stress distribution in different sections	3	3
Total		45	100

INSTRUCTIONAL METHOD AND PEDAGOGY (Continuous Internal Assessment (CIA) Scheme) :

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.

- Attendance is compulsory in lectures, Practicals and Tutorials which carries 05 Marks.
- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in Tutorial rooms carries 05 Marks.
- Viva Voce will be conducted at the end of the semester of 05 Marks.
- One internal exam of 30 marks is conducted as a part of Mid semester evaluation.
- Experiments shall be performed in the laboratory related to course contents.

STUDENTS LEARNING OUTCOME:

On successful completion of the course

- Students will be able to understand the fundamentals of solids and various methods of Analysis.
- The course gives students an understanding of the importance of Mechanics Of Solids

TEXT AND REFERENCE BOOKS:

- Mechanics of solids by Sanju Unadkat & Indrajeet Jain (Tech-Max Publication)
- Mechanics of solids by Prof. C.S. Sanghavi (Mahajan Publication)
- Mechanics of solids by Dr. A.K. Arora (Books India Publication)
- Mechanics of solids by Prof. P.J. shah (S. Chand Publication)
- Mechanics of solids by H.J. Sawant (Technical Publication)
- Mechanics of solids by Gajjar & Shah (Tata McGraw-Hill's Publication)
- Mechanics of solids by Dr. R.P. Rethaliya (atul Prakashan)
- Engineering Mechanics by S. Ramamrutham (Dhanpat Rai Publication)
- Engineering Mechanics by M. Chakraborti (S.K. Kataria & son's Publication)
- A Text Book of Engineering Graphics By P.J.Shah, S.Chand & Company Ltd., New Delhi
- Strength of Materials by S. Ramamrutham (Dhanpat Rai Publication)

WEB MATERIALS:

- <http://www.wikipedia.org>
- [http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT delhi/Mechanics%20of%20Solids/index.htm](http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT%20delhi/Mechanics%20of%20Solids/index.htm)
- <http://nptel.iitm.ac.in/video.php?subjectId=105106116>

LIST OF EXPERIMENTS:

Sr. No.	Name of the Experiments
1.	Law of Polygon of Forces
2.	Equilibrium of Coplanar, Non-concurrent and Non-Parallel Forces
3.	Equilibrium of Coplanar Concurrent Force System : Lami's Theorem
4.	Co-efficient of Static Friction
5.	Forces in Determinate Trusses
6.	Equilibrium of Coplanar Parallel Forces : Simply Supported Beam
7.	Izod Impact Test
8.	Shear Test on Mild Steel
9.	Compressive Test on Timber
10.	Tensile in M.S. and C.I. and Compression Test on Metals

List of Tutorials:

Sr. No.	Name of Tutorials
1.	Introduction
2.	Fundamental Of Statics
3.	Truss
4.	Distributed Forces, Center Of Gravity And Moment Of Inertia
5.	Friction
6.	Physical And Mechanical Properties Of Structural Materials
7.	Simple Stress And Strain
8.	Support Reaction, Shear Force And Bending Moment
9.	Bending Stress And Shear Stress