STRENGTH OF MATERIALS

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3	**1**			Curri. Ref. No.: CIV 305
Total Contact hrs.:		**Total marks : 100**	**Theory :**	
Theory : 42			End Term Exam :80	
			I.A.: 20	

RATIONALE.:

Mechanics of Materials deals with the internal behaviour of variously loaded solid bodies, such as ; Shafts, bars, beams, plates and columns, as well as structures and machines that are assemblies of these Components. Mechanics of materials focuses primarily on mechanical properties of materials, analysis of stress, strain and evaluation of deformations. The subjects like structural analysis, design of structures as well as machines are based on adequate knowledge and understanding of Mechanics of Materials. Therefore, it is an important basic subject for Diploma students in Civil and Mechanical Engineering.

AIM :

The aim of the subject Mechanics of Materials is to develop background preparation of students for taking up Engineering subjects like Theory and Design of Structures, Design of Machines mostly through the followings:

- ► Describe the Mechanical properties of important Engineering materials.
- ► Determination stresses strains and deformations in elastic bodies of different shapes under different loading conditions for engineering applications.
- ► Determination load carrying capacity of different types of members.

1. Introduction **02 Hrs**

Elementary knowledge of stress & strain. Concept of Homogeneous, Isotropic & orthotropic material. Principle of superposition, St. Venant principle. Assumption in the analysis of solid material and their idealized behaviors: elastic, linearly elastic, ductile, brittle, viscous & viscoelastic such as creep & stress relaxation.

2. Stress and Strain : **12 Hrs**

2.1 Stress & strain and their types, complimentary shear stress. Tensile test of ductile & brittle material. Feature point on the curve. Factor of safety.

2.2 Hooke's law, poisson's ratio, Generalized Hooke's law, relation among the elastic constants for an isotropic material. Volumetric strain & their calculation for some common solid shapes.

2.3 Thin cylindrical & spherical shell. Hoop stress & strain. Change in dimension due to rise in pressure.

2.4 Deformations of Axially Loaded Members: Bars of varying section, tapering rod, bars of composite section, Deformation due to self weight, Thermal stress. (Simple problems on determination of stresses and shortening).

3. Centroid & Moment of Inertia. 05 hrs

Difference between c.g & centroid, Axis of symmetry. Centriod of simple common Figure by 1st principle, Calculation of centroid of composite section M.I. & their Calculation for simple plane shape by 1st principle perpendicular axis theorem. Polar Moment of interia. Parallel axis theorem and their use for calculation M.I. of composite section radius of gyration.

4. Analysis of beams : 8 hrs

Forces, Types, Resolution of forces, Equilibrium of forces Types of support, load and beam. Shear force and bending moment . Relation between Shear force, bending moment & uniformly distributed load. Shear force diagram and bending moment diagram of simply supported & cantilever beam with concentrated, UDL or combination of them.
Introduction of singularity function for calculation SFD & BMD.

5. Stresses in Beams: 9 hrs

5.1 Assumptions in the theory of pure bending, derivation of bending stress formula, concept of neutral axis, section modulus,, calculation of bending stresses for different types of loading and sections (in SS and Cantilever beam).

5.2 **Shear stresses in beams –** Formula for shear stress in rectangular cross section. Calculate shear stresses at different layers of a given Beam; draw the distribution of shear stress for different structural sections (only application of formula).

5.3 Torsional Stresses: Basic assumption for pure torsion, torsion of circular shafts (hollow and solid) – polar moment of inertia, torsional shearing stress, angle of twist, torsional rigidity. Determination of maximum shear stress and angle of twist in shafts transmitting given torque. Horse power transmitted by a shaft.

6 Columns and Struts : 06 hrs

Definition of columns and struts; Buckling load (critical or crippling load); Slenderness ratio, Classification of columns.
Euler's Theory – Basic assumptions made in Euler's theory for column buckling. Effective lengths for different end conditions. Factors affecting buckling strength of long column. Limitations of Euler's theory.
Other Formulae – Practical deviations from ideal column, Rankine's formula, factor of safety for different column materials, IS -800 latest edition.

Strength of Material Lab

Subject Code CIV 308

List of Experiment :-

1. Tension test on Tor /deformed steel bar using UTM.
2. Determination of support reaction of beam.
3. Testing of central deflection of a simply supported beam model (e.g., M.S. flat) with concentrated loading at the middle.
4. Determination of Young's Modulus for the material of beam model by load deflection method.
5. Determination of torsion and torque of steel.
6. Fleural test on Floor Tiles/Marble.
7. Transverse strength test on flooring Tiles.
8. Determination of compressive strength of concrete cube by CTM.
9. Determination of compressive strength of cast iron
10. Determination of critical Euler's load of column

REFEFENCE BOOKS :

1. Elements of Strength of materials – by S.P. Timoshenko, D.H. Young; Affiliated East – West
   Press Private Limited.
2. Engineering Mechanics and Strength of materials of materials – by R.K. Bansal; Laxmi Publication, New Delhi.
3. Strength of Materials – by Surendra Singh; Vikas Publication House Pvt. Ltd.
4. Strength of Materials – by Ferdinand L.Singer; Harper and Row and John Weatherbill.
5. Theory and Problems of Strength of Materials – by William A Nash; Shaum'm outline of Shaum's Outline Series, Mc. Graw Hill. Inc.
6. Engineering Mechanics of Solids – by Egor P. Popov; Prentice Hall of India Private Ltd.. New Delhi.
7. Strength of Materials – by R.S. Khurmi.
8. Strength of Materials –by Dr. Sadhu Singh; Khanna Publications, Delhi – 110 006.
9. Engineering Mechanics & Strength of Materials – by S. Ramamrutham; Dhanpat Rai Publication Co. Delhi – 110 006.
10. Mechanics of Materials through problems – by A.C. Ugural; Mc. Graw Hill. Inc.
11. Strength of Materials – by D.R. Malhotra and H.C. Gupta; Satya Prakashan , New Delhi - 110 005.
12. Strength of Materials through problems – by B.K. Sarkar; Allied Publishers Limited, NEW DELHI-110002
13. Strength of Material by Bhavikatti