4032 - STRENGTH OF MATERIALS

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
4	2	6	25	25	3 Hrs	100	0	150

Pre-requisite	Source
2006	MEC

Semester	Theory	Test	Total	TW	PR	Gr Total
	75	25	100	25	–	125

RATIONALE:- In strength of Materials the main emphasis is on the understanding of how bodies respond to applied loads. The main objective of this course is to develop in the student the ability to analyse a given problem in a simple and logical manner and to apply to its solution a few fundamental and well-understood principles. Also for better understanding of machine design a thorough knowledge of strength of materials is a must. The practicals have been designed to consolidate the understanding of the concepts of strength of materials.

COURSE CONTENTS	Hrs	Mks
1. INTRODUCTION TO MATERIAL PROPERTIES 1. Definition of Elasticity, Plasticity, Brittleness, Malleability, Hardness, Toughness, Elastic bodies, Plastic bodies, Deformation. 2. Definition of stress and strain. 3. Definition and concept of tensile and compressive stresses and strains curve for ductile and brittle materials. Salient points on stress strain curve, factor of safety, safe stresses. 4. Stress and strain in composite section under axial loading. 5. Stress and strain due to temperature variation in homogeneous bars. 6. Shear load, shear stress and strain, modulus of rigidity, complementary shear stress, single shear & double shear. 7. Lateral strain, Poisson's ratio, Biaxial stress and Triaxial stresses, volumetric strain, change in volume, bulk Modulus. 8. Relation between Modulus of elasticity, Modulus of rigidity and bulk modulus.	10	16
2. PRINCIPAL PLANES AND STRESSES 1. State of stress at a point, normal and tangential stresses on oblique planes, Resultant stress. 2. Principal stresses and principal planes. (No derivation) 3. Problems to be solved by Mohr's circle method & Analytical method	4	8
3. STRAIN ENERGY 1. Definition and concept of Strain Energy 2. Stresses developed due to gradual, sudden and impact load. 3. Strain Energy stored due to gradual , sudden and impact load, Resilience, proof resilience, modulus of resilience	6	8
4. SHEAR FORCE AND BENDING MOMENT 1. Types of beams and support. 2. Concept and definition of shear force and bending moment, sign convention 3. Shear force and bending moment diagrams for simply supported and cantilever beams subjected to concentrated load and uniformly distributed load.	6	10
5. MOMENT OF INERTIA 1. Definition of moment of inertia, radius of gyration, parallel and perpendicular axis theorem. 2. Moment of inertia of rectangular, circular, semi circular, triangular, hollow-rectangular, 'I' section, channel, 'T' and angle sections about centroidal axes.	6	8

6. THEORY OF SIMPLE BENDING 1 Concept of pure bending, theory of simple bending, concept of Neutral axis. 2 Bending stress and their nature, bending stress distribution diagram, moment of resistance, derivation and application of flexure formula.	6	10
7. DIRECT AND BENDING STRESS 1. Concept of direct and Eccentric load. 2. Symmetrical columns with Eccentric loading about one Axis.	4	8
8. TORSION 1. Concept, theory of pure torsion. 2. Strength of circular shaft in pure torsion. 3. Power transmitted by a shaft.	6	8
9. THIN CYLINDERS 1. Definition of thin and thick cylinder. 2. Circumferential and longitudinal stresses in thin cylinders due to internal pressure.	4	8
10. COLUMNS AND STRUTS 1. Definition of columns and struts. 2. Definition of Buckling stress, Slenderness ratio, equivalent length of column. 3. Application of Euler's formula (No derivation), Rankine's Formula.	6	8
11. DEFLECTION 1. Concept of Deflection. 2. Deflection of simply supported beam and cantilever with a single point load, uniformly distributed load using double integration method.	6	8
Total	64	100

PRACTICAL:-

(Should form part of the progressive assessment and consist of at least four of the following.)

1. Tension test on mild steel specimen.
2. Impact test:- Charpy and Izod test
3. Torsion test on circular bar.
4. Shear test single, double shear.
5. Deflection test.
6. At least four problems on SF and BM diagram to be drawn to scale on half/full imperial size sheets.

REFERENCE BOOKS:-

1. Strength of materials - Singer F. L.Harper and Row
2. Schaum's outline of theory and problems of Strength of Materials: - William Nash.
3. Mechanics of materials, 2nd Edition: - Beer and Johnston. McGraw Hill.
4. Engineering Mechanics: - Timoshenko & Young. McGraw Hill.
5. Mechanics of Structures Vol. 1: - S. B. Junnarkar, Charotar Publishing House.
6. Strength of Materials: - R. S. Khurmi. – S. Chand & Company Ltd.
7. Strength of materials: - S. Ramamurtham - Dhanpat Rai & sons.