4232 – MATERIALS AND STRUCTURES

Teaching Schedule Per Week			Progressive Assessment		Examination Schedule (Marks)			
					Theory		Practical Ex.	Total
Lectures	Practical	Credits						
3	2	5	25	25	3Hrs	100	--	150

Pre-requisite	Source
2006	FAB

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

RATIONALE: - The course contents comprises of the study of fundamentals of theory of elasticity and the response of the structural components when subjected to service loads of tension, compression, shear and transverse loading. The knowledge of the relationship between the applied loading and the resulting effects in the structural components shall assist in the realistic analysis and leading to economic and safe design of structures. Furthermore, the course content comprises of the study of the theory of bending, determination of moment of inertia of single and built up sections and shear due to bending. The laboratory exercises have been designed to study the properties of the basic structural materials and their behaviour under different types and stages of loading.

COURSE CONTENTS	Hrs	Mks
1. STRESSES AND STRAINS	15	30
Definitions of rigid, elastic and plastic bodies, deformation, internal resistance, stress and strain, gradually applied axial loading, tension, compression, tensile and compressive stresses and strains, stress distribution, stress-strain relationship, Hook's law, modulus of elasticity, behaviour of mild steel under axial, tensile load, stress-strain curve, elastic limit, limit of proportionality, yield point, maximum stress, breaking stress, percentage elongation, percentage reduction in area, factor of safety and working stress, concept of shear loading and deformation, shear stress, shear strain, modulus of rigidity, longitudinal strain, lateral strain, Poisson's ratio, concept of Bi-axial and Tri-axial stress systems (without numerical problems on this concept), Tri-axial state of stress, volumetric strain bulk modulus, relation between modulus of rigidity and young's modulus, state of simple shear, complimentary shear stress, induced tension and compression, stress on a oblique plane, stresses and strains in composite sections subjected to axial loading, temperature stresses and strains in homogenous section.		
2. STRAIN ENERGY	3	6
Concept and definition of strain energy. Strain energy stored due to gradual, sudden and impact loading, graphical representation. Resilience, proof resilience and modulus of resilience.		
3. SHEAR FORCE AND BENDING MOMENT	10	20
Definition of beam. Types of beams, cantilever, simply supported, simply supported with overhang, fixed and continuous beams. Effects of transverse loading on a beam, shear force and bending moment, definition of shear force and bending moment, sign convention. Definition of S.F. and B.M. diagrams, S.F. and B. M. diagrams for cantilevers, simply supported and overhanging beams subjected to point loads and uniformly distributed loads, point of contra-flexure. (Analytical method only). S.F. and B.M. diagrams for cantilever, simply supported and overhanging beams subjected to couples and uniformly varying loading. (Analytical method only). Relation between bending moment, shear force, rate of loading, graphical representation.		
4. MOMENT OF INERTIA	6	12
Definition of moment of intertia of plane area, radius of gyration, parallel axes and perpendicular axes theorems, derivation of moment of inertia of rectangular, triangular and circular sections about centroidal axes, polar moment of inertia, modulus of section, moment of inertia of different structural steel shapes like angle section, I sections channel section, T section about centroidal axes, moment of inertia of built up sections consisting of angle, channel and I sections with and without flange plates		
5. BENDING STRESSES IN BEAMS	9	20
Theory of simple bending, definition of pure bending, neutral plane, neutral axis, bending plane and bending axis, stress and strain due to bending, assumptions made in the theory of simple bending, derivation of bending equation, moment of resistance, bending stress and strain diagrams, flexural rigidity, practical applications of bending equation, beam of uniform strength and beam of maximum strength behaviours of Timber Beams under Bending.		
6. SHEAR STRESS IN BEAMS	6	12
Derivation of shear stress equation, Shear stress equation, shear stress distribution for rectangular section, relation between maximum and average shear stress, permissible shear stresses, shear stress distribution over hollow rectangular symmetrical I section, channel Section, T Section, Circular Section and Triangular		

Sections.		
Total	48	100

TERM-WORK (A) The term work shall consist of journal based on the any twelve of following experiments performed in the laboratory. 24 Periods.

Tension test on mild steel specimen. Compression test on cast iron. Compression test on timber. Charpy impact test. Izod impact test. Brinell hardness test. Rockwell hardness test.

Shear test on mild steel specimen. Flexure test on roofing tiles. Flexure test on flooring tiles. Compression test on bricks. Tension test to determine weld resistance. Determination of modulus of rupture for timber, beam-two point loading. Effect of stress concentration on tensile strength of steel. Torsion test on mild steel specimen. Folding test on ductile metal. Abrasion test for flooring tiles. Effect of stress concentration on bending strength of steel. Bend test on steel.

(B)Four half imperial size sheets (eight problems) - 8 periods

Covering solutions of problems on S.F. and B.M. diagrams, for simply supported, cantilevers, and overhanging beams subjected to point loads, couples, uniformly distributed and variable loading with a report of calculations.

REFERENCE BOOKS

1. Strength of materials by B.B. Lord.
2. Mechanics of Materials by E. S. beam
3. Mechanics of structures Vol. I by S.B. Junarkar
4. Strength of materials by Khurmi
5. Strength of Materials by Singer
6. Strength of Materials by Ramamurtham
7. Theory of Structures by Vizirani and Ratwani.