

4022 – THEORY OF STRUCTURES – I									
Teaching Schedule Per Week			Progressive Assessment	Examination Schedule (Marks)					
Lectures	Practical	Credits		Theory		Practical Ex		Total	
4	-	4	25	3Hrs.	100	-	-	125	
Pre-requisite		Source	Semester	Theory	Test	Total	TW	PR	Gr Total
4232		CVL		75	25	100	-	-	100

RATIONALE - The course contents have been designed to assist in the determination of forces acting on a structure and to assess the effects of these forces and the behaviour of the structure in the case of eccentric and lateral loading, complex stress systems and torsion. Further more, the course contents also comprises of the study of influence lines, rolling loads and stability of structures which will develop the cognitive abilities and skills to facilitate the higher level study of design of structures.

COURSE CONTENTS		Hrs	Mks
1. FLITCHED BEAMS		8	12
Definition of flitched beam, flitched beam theory, transformed section and modular ratio. Moment of resistance of composite section, permissible stresses, stress distribution across composite section. Analysis of beams of composite sections, symmetrical and asymmetrical above the neutral axis. Shear connectors.			
2. COMBINED BENDING AND AXIAL LOADING		10	16
Typical cases of structure subjected to bending and axial loading-eccentricity about one principal axis, standard cases of stress distribution, limits of eccentricity for uniform stress distribution system, middle third rule, middle quarter rule. Eccentricity about both principal axis. Limits of eccentricity. Core of section for different standard sections. Extreme intensities of stress. Equation of zero-stress line.			

3. COMPLEX STRESS SYSTEMS	14	20
Uni-axial stress system, resolution of stress on oblique plane. Magnitude and direction of oblique stress, graphical solution using Mohr's stress circle, location of principal planes and planes of maximum shear. Two-dimensional stress system, Normal and tangential component of stress on oblique plane, magnitude and direction of resultant stress, maximum obliquity of the resultant stress, schematic representation. Construction of Mohr's circle of stress, stresses on mutually perpendicular oblique planes. Location of principal planes and planes of maximum shear. General two-dimensional stress system. Normal and tangential components of resultant stress, maximum obliquity of resultant stress. Location of principal planes and planes of maximum shear. Principal stresses and maximum shear stresses, Mohr's circle of stress. Principal stresses in beams.		
4. INFLUENCE LINES FOR BEAMS	8	12
Influence lines (ILD) Definition, Basic concept, uses of influence lines. Influence lines for simply supported beams. ILD for beam reactions at supports, ILD for shear force at given section of beam, Influence lines for simply supported beam with overhangs, ILD for beam reactions at supports, ILD for shear force at given section of beam, Influence lines for simply supported beams with overhangs, ILD for beam reactions at supports, ILD for shear force at given section of beam, ILD for Bending moment at given section of beam, the loads should be considered for solving the problems are point load and uniformly distributed load.		
5. ROLLING LOADS	7	12
Concept of rolling loads, cases of rolling loads for single span with and without overhang, a single concentrated load, UDL between the supports, UDL between and beyond the support, two concentrated loads spaced at some distance apart, quantities to be determined are maximum SF at a section, maximum BM at a section, maximum BM in the beam for given load.		
6. STABILITY OF STRUCTURES	7	12
Types of structures. Determinate and indeterminate structure. Internal and external stability of structure. Degree of indeterminacy. Statically indeterminate structure. Uses of indeterminate structure.		
7. TORSION OF CIRCULAR SHAFTS	10	16
Concept of simple torsion, assumptions made in torsion theory, derivation of torsion equation, polar modulus of section of a solid circular shaft, torsional moment of resistance (torque), torsional rigidity, torsional shear, stress distribution over cross-section of solid circular shaft, principal stresses and strain due to torsion, torsional strain energy for a solid circular shaft. Torsion of hollow circular shafts, polar modulus of section of a hollow circular shaft, torque resisted by a hollow circular shaft as compared with a solid shaft of a given area of cross-section, stress distribution over cross-section of a hollow circular shaft, torsional strain energy for a hollow circular shaft. Advantages of a hollow circular shaft. Torsion of thin walled tubes. Combined bending and torsion induced principal stresses, equivalent bending moment, combined bending, torsion and axial thrust.		
Total	64	100

REFERENCE BOOKS

1. Theory of Structures by S. Ramanurtham
2. Mechanics of Structure - Vol I and II by Junarkar and Alvai
3. Theory of Structures by O. P. Jain and B.K. Jain
4. Analysis of Structures by B. C. Punani
5. Strength of Materials by B.B. Lord
6. Mechanics of Materials by E.S. Hearn
7. Strength of Materials by Singer