Theory of Structure II
BEG354CI

Year: III **Semester: I**

Teaching Schedule Hours/week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory	Practical	
L	T	P	Duration	Marks	Duration	Marks			
3	3	2/2	3	80	-	-	20	25	125

Course Objective:

Three fold objective of the course is to;

a. Familiarize the technologies and concepts of displacements, stresses, strains, stiffness etc. and their parameters in the contest of indeterminate system,
b. Practice in examples the basic concepts and theorem on static (equilibrium), geometrical (compatibility) and physical (Force, Stiffness and Displacements) conditions in the context of indeterminate systems,
c. Prepare the candidates for advance courses in structural mechanics by introducing to the necessary tools like matrix method, force method, displacement method, plastic analysis etc.

1.0 Statically Indeterminate Structures (3 hrs)

1.1 Types of indeterminate structures
1.2 Static indeterminacy and methods of determination for various types of structures
1.3 Kinematic indeterminacy and methods of determination for various types of structures

2.0 Theorem on Displacements (2 hrs)

2.1 Law of reciprocal deflection (Maxwell's Theorem, Betti's Law)
2.2 Castigliano's Theorem

3.0 Force Method (10 hrs)

3.1 Introduction to force method
3.2 Equilibrium conditions and compatibility equations
3.3 Analysis of statically indeterminate beams including yielding of support
3.4 Analysis of the statically indeterminate frames
3.5 Analysis of statically indeterminate trusses including temperature effects and lack of fit
3.6 Analysis of two-hinged parabolic arches including yield of support and temperature effect

4.0 Slope-Deflection Method (7 hrs)

4.1 Introduction
4.2 Derivation of the slope-deflection equations
4.3 Analysis of statically indeterminate beams including support settlement and rotation of joints
4.4 Analysis of statically indeterminate frames

5.0 Moment Distribution Method (7 hrs)

5.1 Introduction and basic concept
5.2 Stiffness and Carry-over factors
5.3 Distribution factors
5.4 Analysis of statically indeterminate beams
5.5 Analysis of statically indeterminate frames

6.0 Influence Lines for Indeterminate Structures (4 hrs)

6.1 Influence lines for statically indeterminate beams

6.2 Muller-Breslau principle and its application for drawing ILD of continuous Beams

7.0 Introduction to Matrix Method (8 hrs)

7.1 Flexibility matrix and Stiffness matrix

7.2 Relationship between Flexibility and Stiffness Matrix

7.5 Analysis of statically indeterminate beams, frames and trusses by matrix method

8.0 Plastic Theory of Structures (4 hrs)

8.1 Plastic bending of beams

8.2 Shape factor

8.3 Load factor

8.4 Plastic analysis – Determination of collapse load and plastic moment capacity.

Laboratories:

(i) Obtain experimentally the influence line for the horizontal thrust in a two-hinged arch

(ii) Verify the Maxwell's Theorem of reciprocal deflection with the help of a truss and two-hinged arch model.

(iii) Experimental analysis of a portal frame.

(iv) Experimental analysis of a continuous beam.

References:

- C. K. Wang, Intermediate structural analysis, international student edition, McGraw Hill Company Limited, 1989.
- G. S. Pandit, S. P. Gupta, Structural analysis, a matrix approach, Tata McGraw hill company Limited, New Delhi, 1981.
- A. Darkov, Kuznetsov, Structural mechanics, Mir Publishers, Moscow
- C. B. Kukreja, V. V. Sastry, Experimental methods in structural mechanics, Standard Publishers Distributors, Delhi, 1991.
- C.H Norris, Elementary structural analysis
- S.S. Bhavikatti, Structural analysis volume 2
- Reddy, Structural analysis
- Ramaruthum, Theory of structures