16CE209 STRUCTURAL ANALYSIS- I

Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSH	CS	SA	S	BS
45	-	30	20	30	6	10	3	5

Course Description and Objectives:

This course offers fundamental concepts to analyse all structural components for different load conditions. It gives a detailed idea about different methods involved in calculating the deformations in a structure. The objective is to make students understand the influence of loads and forces on a determinate structures. In addition to that, provide knowledge about strain energy concepts for analyzing determinate and indeterminate structures.

Course Outcomes:

The students will be able to:

- understand the classification of structures.

- understand the deflection profile of a beam.

- calculate the strain energy due to Flexure and Axial loading.

- analyze the structures using conventional methods and strain energy concepts.

- estimate the influence and effect of force on any parameter chosen.

- analyze the determinate and indeterminate structures.

SKILLS:

✓ *Classify different types of structures based on degrees of freedom.*

✓ *Identify the deflection profile of structures subjected to several types of loadings.*

✓ *Analyze the behavior of structures subjected to moving loads.*

✓ *Analyze pin jointed frames for dead and live loads.*

✓ *Analyze steel beams and columns.*

UNIT - 1   **L-9, T-3**

DEFLECTION OF BEAMS: Introduction to structural analysis, Classification of structures, Deflection equation for elastic curve of a beam, Deflection and slope for cantilever beam and simply supported beams using doubleintegration method, Macaulay's method, Area moment method.

UNIT - 2   **L-9, T-3**

ENERGY METHODS : Displacements of determinate structures using energy methods, Maxwell's reciprocal theorem, Maxwell-Betti's generalized reciprocaltheorem, Castigliano's theorems, Application of Castigliano's theorem for calculating deflection of beams, Frames and trusses, Virtual work method for deflections.

UNIT - 3   **L-9, T-3**

PROPPED CANTILEVER: Analysis of propped cantilever by method of consistent deformation.

FIXED BEAMS: Fixed end moments for a fixed beam of uniform section for different types of loading, Effect of sinking of supports, Effect of rotation of a support, bending moment diagram for fixed beams.

CLAPEYRON'S THEOREM OF THREE MOMENTS: Analysis of continuous beam by Clapeyron's theorem of three moments.

UNIT - 4   **L-9, T-3**

STRAIN ENERGY METHOD: Strain energy method for analysis of continuous beams and rigid joined plane frames up to second degree redundancy.

REDUNDANT PIN JOINTED FRAMES: Analysis of pin jointed frames up to second degree redundancy, Forces in indeterminate pin jointed frames due to temperature variation and lack of fit.

UNIT - 5   **L-9, T-3**

INFLUENCE LINES FOR STATICALLY DETERMINATE STRUCTURES: Moving loads and influence lines, Influence lines for beam reactions, Influence lines for shear force, Influence lines for bending moment, Calculation of maximum shear force and bending moment at a section for rolling loads, Calculation of absolute maximum bending moment, Influence lines for simple trusses.

TEXT BOOKS:

1.   Vazirani and Ratwani, "Analysis of Structures", Vols.1 and 2, 20th edition, Khanna Publishers, Delhi, 2001.

2.   S. S. Bhavikatti, "Structural Analysis", Vol.1, 3rd edition, Vikas PublishingHouse Pvt. Ltd, 2009.

REFERENCE BOOKS:

1.   C. K. Wang, "Indeterminate Structural Analysis", 1st edition, McGraw-HillPublications, 1984.

2.   Junnarkar and Shah, "Mechanics of Structures–II", 20th edition, CharotarPublishing House, 2008.