### STRUCTURAL ANALYSIS-I

# **Course Learning Objectives:**

- To impart concepts of Bending Moment and Shear force for beams with different boundary and loading conditions and to draw the diagrams of variation across the length.
- To give preliminary concepts of assessment of bending moment and shear force in Propped cantilevers, fixed beams and continuous beams due to various loading conditions.
- The concepts above will be utilized in measuring deflections in beams under various loading and support conditions
- Impart concepts for determination of Forces in members of plane pin-jointed perfect trusses by different methods

### **Course Outcomes:**

Upon successful completion of this course the student will be able to

- Draw the diagrams indicating the variation of the key performance features like bending moment and shear forces.
- Assess the deflections across the length of the beams using various methods
- Distinguish between the determinate and indeterminate structures and calculate the fixed end moments of fixed beams.
- Analyze the continuous beams using three moment theorem.
- Analyze the pin jointed frames.

## **SYLLABUS**

#### **UNIT I**

## **Shear Force & Bending Moment:**

Definition of beams – Types of beams – Concept of shear force and bending moment – S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

### **UNIT II**

## **Deflection of Beams:**

Bending into a circular arc – slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods – Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, Uniformly distributed loads, Uniformly varying loads Mohr's theorems – Moment area method – application to simple cases

#### **UNIT III**

# **Propped Cantilevers & Fixed Beams**

Introduction to statically indeterminate beams -Analysis of propped cantilevers-shear force and Bending moment diagrams-Deflection of propped cantilevers.

### **Fixed Beams:**

Fixed beams with U. D. load, central point load, eccentric point load, number of point loads, uniformly varying load, couple & combination of loads - shear force and Bending moment diagrams-Deflection of fixed beams including effect of sinking of support, effect of rotation of a support.

### **UNIT IV**

#### **Continuous Beams:**

Introduction-Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia with one or both ends fixed, continuous beams with overhang, continuous beams with different moment of inertia for different spans-Effects of sinking of supports-shear force and Bending moment diagrams.

### **UNIT V**

# **Analysis of Pin-Jointed Plane Frames:**

Determination of Forces in members of plane pin-jointed perfect trusses by (i) method of joints and (ii) method of sections. Analysis of various types of cantilever and simply supported trusses by method of joints, method of sections.

### **TEXT BOOKS:**

- 1. Basic Structural Analysis by C. S. Reddy Tata Mc.Graw-Hill, New Delhi.
- 2. Analysis of Structures by T.S. Thandavamoorthy, Oxford University Press, New Delhi
- 3. Analysis of Structures- Vol. I and II by V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi

### **REFERENCES:**

- 1. Theory of Structures by B. C Punmia, A. K Jain & Arun K. Jain, Lakshmi Publications
- 2. Theory of Structures by R.S. Khurmi, S. Chand Publishers.
- 3. Structural analysis by R.C. Hibbeler, Pearson, New Delhi.
- 4. Structural Analysis-I by Hemanth Patel, Yogesh Patel, Synergy Knowledgeware, Mumbai
- 5. Analysis of Statically Determinate Structures by P. N. Chandramouli, Yesdee Publishing Pvt Limited, Chennai