UNIT I

Chapter 1 : Direct and Bending Stresses in Vertical Members 1-1 to 1-41

Syllabus :

1.1 Introduction to axial and eccentric loads, Eccentricity about one principal axis only, Nature of stresses. Maximum and minimum stresses, Resultant stresses and stress distribution diagram.

1.2 Condition for no tension or zero stress at extreme fibre, Limit of eccentricity. Core of section for rectangular and circular cross sections, Middle third rule.

1.3 Chimneys of rectangular and circular cross section subjected to wind pressure, Coefficient of wind pressure, Maximum and minimum stresses, Resultant stresses and stress distribution diagram at base.

1.4 Analysis of dams subjected to horizontal water pressure, Conditions of stability, Maximum and minimum stresses, Resultant stresses and stress distribution diagram at base.

1.1 Introduction 1-1

1.2 Axial Load or Direct Load 1-1

1.2.1 Direct Stress 1-1

1.3 Eccentric Load 1-2

1.3.1 Effect of Eccentric Load 1-2

1.4 Resultant Stress Intensities 1-3

1.5 Stress Distribution at Base 1-3

1.6 No Tension Condition or Zero Stress Condition 1-4

1.7 Limiting Eccentricity (e) 1-4

1.8 Middle Third Rule [Limit of Eccentricity] or Limiting Eccentricity for Rectangular Section 1-4

1.9 Core of a Section or Limit of Eccentricity for a Circular Section 1-5

1.10 Core of a Section or Kernel of a Section 1-6

1.11 Limit of Eccentricity for a Hollow Circular 1-6

1.12 Solved Numerical based on, Direct and Bending Stresses for Columns and Compression Member 1-7

1.13 Numericals Based on Compression Member 1-15

1.14 Numericals on Tension Member 1-27

1.15 Chimneys of Rectangular and Circular Cross Section Subjected to Wind Pressure, Coefficient of Wind Pressure, Maximum and Minimum Stresses, Resultant Stresses and Stress Distribution at Base 1-28

1.16 Analysis of Dam, Subjected to Horizontal Water Pressure, Maximum and Minimum Stresses, Resultant Stresses and Stress Distribution Diagram at Base 1-37

1.17 Conditions Stability of a Dam 1-38

1.18 Numericals Based on Dam Subjected to Horizontal Pressure 1-39

UNIT II

Chapter 2 : Slope and Deflection 2-1 to 2-37

Syllabus :

2.1 Concept of slope and deflection, Stiffness of beams, Relation among bending moment, Slope, Deflection and radius of curvature, (no derivation).

2.2 Double integration method to find slope and deflection of cantilever and simply supported beams subjected to concentrated load and uniformly distributed load on entire span.

2.3 Macaulay's method for slope and deflection, Application to cantilever and simply supported beam subjected to concentrated and uniformly distributed load on entire span.

2.1 Concept of Slope and Deflection 2-1

2.1.1 Stiffness of Beam 2-1

2.2 Relation among Bending Moment, Slope, Deflection and Radius of Curvature 2-1

2.2.1 Double Integration Method for Slope and Deflection 2-2

2.3 Boundary Conditions of Beams 2-2

2.4 Double Integration Method to Find Slope and Deflection for Simply Supported Beam and Cantilever Beam Subjected to Concentrated Load

and Uniformly Distributed Load Over Entire Span 2-3

2.5 Macaulay's Method for Slope and Deflection.....2-21

2.5.1 Rules for Macaulay's Method 2-21

2.6 Application of Macaulay's Method to Simply Supported Beam and Cantilever Beam Subjected to Concentrated and Uniformly Distributed Load Over Entire Span.....2-21

2.7 Application of Macaulay's Method to Cantilever Beam.....2-33

UNIT III

Chapter 3 : Fixed Beam 3-1 to 3-24

Syllabus :

3.1 Concept of fixity, Effect of fixity, Advantages and disadvantages of fixed beam over simply supported beam.

3.2 Principle of superposition, Fixed end moments from first principle for beam subjected to central point load, UDL over entire span, Point load other than mid span.

3.4 Application of standard formulae in finding end moments, End reactions and drawing S. F. diagrams showing point of contrashear and B. M. diagrams showing net BM and point of contraflexure for a fixed beam.

3.1 Concept of Fixity.....3-1

3.1.1 Fixing.....3-1

3.2 Fixed Beam 3-1

3.3 Advantages and Disadvantages of Fixed Beam Over the Simply Supported Beam 3-1

3.4 Principle of Superposition.....3-2

3.4.1 Fixed End Moments by using First Principle 3-2

3.5 To Find Fixed End Moments for a Fixed Beam Carrying a Central Point Load.....3-3

3.6 Some Standard Formulae to Find Fixed End Moments 3-9

3.7 Examples Based on Fixed Beam Subjected to Point Loads or Concentrated Loads 3-10

3.8 A Fixed Beam Carrying Two Point Loads 3-14

UNIT IV

Chapter 4 : Continuous Beam 4-1 to 4-34

Syllabus :

4.1 Definition, effect of continuity, Nature of moments induced due to continuity, Concept of deflected shape, Practical example.

4.2 Clapeyron's theorem of three moment (no derivation) Application of Clapeyron's theorem maximum up to three spans and two unknown support moment only. Supports at same level, spans having same and different moment of inertia subjected to concentrated loads and uniformly distributed loads over entire span.

4.3 Drawing SF diagrams showing point of contra shear and BM diagrams showing net BM and point of contraflexure for continuous beams.

4.1 Continuous Beam.....4-1

4.2 Effect of Continuity 4-1

4.2.1 Nature of Moments Induced Due to Continuity 4-2

4.3 Concept of Deflected Shape.....4-2

4.4 Clapeyron's Theorem of Three Moments.....4-3

4.5 Some Standard Cases of Centroid and Areas for μ Diagram 4-4

4.6 Steps to Find Support Moments by Using Clapeyron's Theorem of Three Moments.....4-5

4.7 Solved Numericals Based on Clapeyron's Theorem of Three Moments for a Continuous beam with Simply Supported Ends.....4-5

4.8 Concept of Zero Span or Concept of Imaginary Zero Span in case of Clapeyron's Theorem.....4-16

4.9 Solved Example based on Clapeyron's Theorem of Three Moment for a Beam with One End Simply Supported and Other End is Overhang 4-21

4.10 Numericals Based on Clapeyron's Theorem of Three Moment for a Beam with Both Ends Fixed.....4-26

4.11 Solved Numericals on Application of Clapeyron's Theorem For a Continous Beam Having Same or Different Moment of Inertias 4-28

UNIT V

Chapter 5 : Moment Distribution Method 5-1 to 5-71

Syllabus :

5.1 Introduction to moment distribution method, Sign convention, Carry over factor, Stiffness factor, Distribution factor.

5.2 Application of moment distribution method to various types of continuous beams subjected to concentrated loads and uniformly distributed load over entire span having same or different moment of inertia, Supports at same level, up to three spans and two unknown support moments only.

5.3 Drawings SF diagrams showing point of contrashear and BM and point of contraflexure for continuous beams.

5.4 Introduction to portal frames - Symmetrical and unsymmetrical portal frames with the concept of Bays and stories. (Numericals on Symmetrical portal frames only).

5.5 Drawing SF diagrams and BM diagrams for Symmetrical portal frames only.

5.1 Introduction 5-1

5.2 Hardy Cross Sign Convention....5-1

5.3 Carry Over Factor....5-3

5.3.1 Some Important Cases for Carry Over Factors....5-4

5.4 Carry Over Moment....5-5

5.5 Basic Definitions used in the Moment Distribution Method....5-5

5.6 Procedure to Calculate Support Moments by using Moment Distribution Method 5-9

5.7 Numericals Based on to Calculate the Support Moments of a Continuous Beam with Simply Supported Ends....5-16

5.8 Solved Numericals on Continuous Beam with One End Simply Supported and Other End is Overhang....5-33

5.9 Solved Numericals on a Continuous Beam with Fixed and Other End is Simply Supported....5-41

5.10 Portal Frames....5-61

UNIT VI

Chapter 6 : Simple Trusses 6-1 to 6-30

Syllabus :

6.1 Types of trusses (Simple, Fink, Compound fink, French truss, Pratt truss, Howe truss, North light truss, King post and Queen post truss).

6.2 Calculate support reactions for trusses subjected to point loads at nodal points only.

6.3 Calculate forces in members of truss using method of joints and method of sections.

6.4 Graphical method of analysis of truss. (No numerical on graphical method of analysis of truss).

6.1 Introduction of Truss....6-1

6.1.1 Types of Trusses....6-1

6.1.2 Classification of a Truss 6-2

6.1.3 Perfect Truss (Stable Truss) or Perfect Frame 6-2

6.1.4 Imperfect Truss (Unstable Truss) or Imperfect Frame....6-2

6.1.5 Redundant Truss or Redundant Frame 6-3

6.1.6 Deficient Truss or Deficient Frame 6-3

6.2 Analysis of Truss or Frames....6-3

6.2.1 Assumptions in Analysis of Simple Frame or Truss....6-3

6.2.2 Method of Analysis....6-4

6.2.3 Method of Joints....6-4

6.2.4 Method of Sections or Method of Moments 6-4

6.3 Solved Numericals on Method of Joints....6-5

6.4 Solved Numericals on Method of Sections 6-21

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