

**Module 1****Chapter 1 : Trusses 1-1 to 1-24**

Syllabus : Analysis of Perfect Coplanar Trusses by Method of Joints, Analysis of Perfect Coplanar Trusses by Method of Sections.

1.1	Truss.....	1-1
1.2	Uses of Truss.....	1-1
1.3	Assumptions in Analysis of Pin-jointed Perfect Trusses.....	1-1
1.4	Conditions of Perfect Truss.....	1-1
1.5	Method of Joints.....	1-2
1.6	Method of Sections.....	1-3
1.7	Comparison between Method of Joints and Method of Sections.....	1-3
1.8	Zero Force Members.....	1-16

Chapter 2 : Three Hinged Arches 2-1 to 2-20

Syllabus : Determination of Normal Thrust, Radial shear and Bending Moment for Symmetrical and Unsymmetrical three hinged Parabolic Arches.

2.1	Introduction.....	2-1
2.2	Advantages and Disadvantages of an Arch.....	2-1
2.3	Three Hinged Parabolic Arch.....	2-2
2.4	Normal Thrust (Axial Force) and Radial Shear (Shear Force).....	2-2
2.5	University Theory Questions and Answers.....	2-18

Module 2**Chapter 3 : Influence Line Diagrams and Rolling Loads 3-1 to 3-27**

Syllabus : Influence lines for reactions, Shear Force and Bending Moment at a section of Cantilever, Simply Supported, Overhanging Beams without internal hinges. Rolling Loads, Determination of S.F. and B.M. at a section, value and criteria for maximum S.F. and B.M., Absolute maximum shear force and Bending moment under rolling loads (UDL and series of point loads) for simply supported girder.

3.1	Influence Line Diagram.....	3-1
3.2	I.L.D. for Reactions in Simply Supported Beam.....	3-1
3.3	I.L.D. for S.F. and B.M. in Simply Supported Beam.....	3-2
3.4	I.L.D. for Reactions, S.F. and B.M. in Cantilever Beam.....	3-4
3.5	I.L.D. for Reactions, S.F. and B. M. in Overhanging Beam with Overhangs on Both Sides.....	3-5
3.6	Maximum Bending Moment at a Section in Simply Supported Beam Carrying Moving u.d.l.....	3-14
3.7	Maximum Bending Moment at a Section in Simply Supported Beam Supporting a Chain of Moving point Load.....	3-16
3.8	Maximum Bending Moment under a Chosen Wheel Load.....	3-18
3.9	Absolute Maximum Bending Moment on the Span Under Chain of Wheel Loads.....	3-20
3.10	Difference between S.F.D. and I.L.D. of S.F.....	3-20
3.11	University Theory Questions and Answers.....	3-25

Chapter 4 : Influence Line Diagrams of Trusses 4-1 to 4-25

Syllabus : I.L.D for axial forces in members of pin jointed trusses.

4.1	Introduction.....	4-1
4.2	Truss with Top Chord Members Horizontal.....	4-1
4.3	Truss with Top Chord Members Inclined.....	4-7
4.4	University Theory Questions and Answers.....	4-24

**Module 3****Chapter 5 : Slope and Deflection
(Strain Energy Method) 5-1 to 5-21**

Syllabus : Deflection of statically determinate structures, methods based on energy principles and Castigliano's theorems to evaluate deflection in portal frames, bent up and arch type structures.

5.1	Strain Energy.....	5-1
5.2	Strain Energy under Axial Loading.....	5-1
5.3	Strain Energy due to Bending.....	5-1
5.4	Strain Energy due to Shear.....	5-2
5.5	Strain Energy due to Torsion.....	5-2
5.6	Castigliano's First Theorem.....	5-2
5.7	University Theory Questions and Answers.....	5-19

**Chapter 6 : Slope and Deflection
(Unit Load Method) 6-1 to 6-19**

Syllabus : Application of Unit Load Method for Calculating slope and deflection of a point on rigid jointed frames.

6.1	Introduction.....	6-1
6.2	Procedure.....	6-1
6.3	University Theory Questions and Answers.....	6-18

Chapter 7 : Deflection of Trusses 7-1 to 7-15

Syllabus : Application of Unit Load Method for Calculating slope and deflection of a point on pin jointed truss.

7.1	Unit Load Method.....	7-1
7.2	University Theory Questions and Answers.....	7-13

Chapter 8 : Determinacy and Indeterminacy 8-1 to 8-26

Syllabus : Static and Kinematic Indeterminacies : Types of structures occurring in practice, their classification, linear and non-linear behaviour of materials, geometric non-linearity, static and kinematic indeterminacy and indeterminacy of structures

8.1	Types of Structures.....	8-1
8.2	Equations of Static Equilibrium.....	8-1
8.3	Degree of Static Indeterminacy.....	8-2
8.4	Degree of Internal Indeterminacy in Hybrid Structures.....	8-3
8.5	Degree of Kinematic Indeterminacy (D_k) or Degree of Freedom.....	8-3
8.6	Stability.....	8-4
8.7	Complimentary Energy (Linear and Non-linear Elastic Materials).....	8-5
8.8	University Theory Questions and Answers.....	8-23

Module 4**Chapter 9 : Three Moment Theorem
(Clapeyron's Theorem) 9-1 to 9-23**

Syllabus : Analysis of fixed beam. Application of Clapeyron's theorem of three moments to fixed beam and continuous beam.

9.1	Continuous Beam.....	9-1
9.2	Theorem of Three Moments (Derivation).....	9-1
9.3	University Theory Questions and Answers.....	9-21

Chapter 10 : Flexibility Method 10-1 to 10-38

Syllabus : Flexibility coefficient and their use in formulation of compatibility equations. Application of flexibility method to propped cantilevers, fixed beams, continuous beams and simple rigid jointed frames.

10.1	Flexibility Method.....	10-1
10.2	Flexibility.....	10-1
10.3	University Theory Questions and Answers.....	10-36

Module 5**Chapter 11 : Stiffness Method 11-1 to 11-42**

Syllabus : Stiffness coefficients for prismatic members and their use for formulation of equilibrium equations. Application of Direct Stiffness Method to indeterminate beams and simple rigid jointed frames.



11.1	Definition.....	11-1
11.2	Step by Step Procedure in Stiffness Method (Displacement Method)	11-1
11.3	Relation between Flexibility Matrix and Stiffness Matrix.....	11-2
11.4	Fixed End Moments (Formulae).....	11-2
11.5	University Theory Questions and Answers.....	11-40

Module 6

Chapter 12 : Moment Distribution Method 12-1 to 12-41

Syllabus : Application to Intermediate Beams and simple Rigid Jointed Frames and Frames with inclined member but having only single translation degree of freedom including the effect of support settlement.

12.1	Introduction	12-1
12.2	Sign Convention	12-1
12.3	Carry Over Factor (C.O.F.).....	12-1
12.3.1	Carry Over Factor for a Member with One End Fixed and Other Simply Supported or Hinged	12-1
12.3.2	Carry Over Factor for a Member with Both Ends Simply Supported or Hinged.....	12-2
12.4	Stiffness Factor (Relative Stiffness)	12-3
12.5	Distribution Factor	12-3
12.6	Fixed End Moments (Formulae).....	12-4
12.7	NON-SWAY Frames	12-18
12.8	Frames with Sway.....	12-23
12.9	University Theory Questions and Answers.....	12-37

Chapter 13 : Plastic Analysis of Structures 13-1 to 13-32

Syllabus : Introduction to plastic analysis, concept of plastic hinge, plastic moment carrying capacity; shape factor, Static and kinematic method of plastic analysis. Determination of collapse load for single and multiple span beams.

13.1	Elastic Method of Design/Working Stress Method	13-1
13.2	Plastic Method/Ultimate Load Method	13-1
13.2.1	Working Loads	13-1
13.2.2	Collapse Load/Ultimate Load.....	13-1
13.2.3	Load Factor	13-1
13.3	Difference between Elastic and Plastic Analysis.....	13-1
13.4	Ductility of Steel.....	13-2
13.5	Plastic Bending of Beams.....	13-2
13.5.1	Yield Moment	13-3
13.5.2	Plastic Moment (M_p)	13-3
13.5.3	Shape Factor (S).....	13-3
13.5.4	Plastic Neutral Axis (P.N.A.).....	13-3
13.6	Shape Factors for Different Sections	13-4
13.6.1	Rectangular Section	13-4
13.6.2	Circular Section.....	13-4
13.6.3	Rhombus Section/Diamond Section	13-4
13.6.4	Triangular Section	13-5
13.6.5	Square Section with Diagonal Horizontal	13-5
13.7	Plastic Hinge	13-12
13.8	Mechanism	13-12
13.9	Location of Plastic Hinges.....	13-12
13.10	Relation between Plastic Moment and Ultimate Load.....	13-13
13.11	University Theory Questions and Answers.....	13-29