DESIGN OF STEEL STRUCTURES

Course Code: 20CE1123

Pre-requisites: Strength of Materials, Structural Analysis

Course Outcomes:

At the end of the course, the student will be able to:

CO1: Analysis and design welded connections (L3)

CO2: Design simple and compound beams as per IS: 800-2007 (L3)

CO3: Design tension and compression members as per IS: 800- 2007 (L3)

CO4: Design built-up column and column base systems as per IS: 800-2007 (L3)

CO5: Calculate wind forces and design of roof trusses (L3)

UNIT-I

WELDED CONNECTIONS:

Introduction, Advantages and disadvantages of welding- Strength of welds - Butt and Fillet welds: Permissible stresses – IS Code requirements. Design of butt weld and fillet weld subjected to simple loads – Design of welded in-plane and out-plane brackets.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Summarize the forces of different structural connections (L2)
- 2. Design the welded connections in structural assembly (L3)
- 3. Detailing the welded connections in structural assembly (L3)

UNIT-II

BEAMS:

Introduction to plastic analysis, Plastic hinge formation – lower and upper bound theorems - Design requirements as per IS Code- Design of simple and compound beams - Curtailment of flange plates, laterally supported and unsupported beams – Design of purlins.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Describe and apply the concept of plastic analysis in the design of flexural members (L2)
- 2. Design the simple and compound beams (L3)
- 3. Design and detail laterally supported and unsupported beams (L3)

UNIT-III

TENSION MEMBERS:

General design of members subjected to direct tension, design and strength of angle for tension with bolting and welding.

COMPRESSION MEMBERS:

Effective length of columns, Slenderness ratio – permissible stresses, Design of compression members composed of a channel and I- sections including strut. Design principles of eccentrically loaded columns and splicing of columns.

(10 Lectures)

(10 Lectures)

(10 Lectures)

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Learning outcomes:

At the end of the unit, the student will be able to

1. Describe the basic concepts of parameters to be consider in the design of tension and compression members (L2)

2. Design and detailing of tension and compression members (L3)

3. Explain the design principles of eccentrically loaded columns and splicing of columns (L2)

UNIT-IV

BUILT UP COLUMNS:

Design of built up compression members made of channel, I sections and angle connecting system – Design of lacings and battens.

COLUMN BASES:

Design of slab base and gusset base. Column bases subjected to axial force and moment.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Explain the design concepts of built-up compression members (L2)
- 2. Describe secondary connection system of lacings and battens (L2)
- 3. Design the slab base and gusset base systems of column foundation (L3)

UNIT-V

(10 Lectures)

DESIGN OF GANTRY GIRDER:

Loading types – Calculation of shear and bending moment – Design of I-section gantry girder.

DESIGN OF PLATE GIRDER:

Introduction - Loading calculations – optimum section – Design of plate girder without stiffeners – concept of web shear buckling.

Learning outcomes:

At the end of the unit, the student will be able to

- 1. Describe the calculation of maximum shear force and bending moment in gantry girder (L2)
- 2. Design the gantry girder for a given loading (L3)
- 3. Design the plate girder without stiffness (L3)

Note: The students should prepare the following plates.

Plate 1 Detailing of simple beams

Plate 2 Detailing of compound beams including curtailment of flange

Plate 3 Detailing of Column including lacing and battens.

Plate 4 Detailing of Column bases – slab base and gusset base

Plate 5 Detailing of Gantry girder and plate girder.

Text Books:

- 1. S.K. Duggal, "Limit state design of steel structures", 1st Edition, TMH publication, 2011
- 2. N.Subramanyan, "Design of Steel structures", 1st Edition, Oxford university press, 2008.

(10 Lectures)

References:

- 1. P. Dayaratnam, "Design of Steel Structures", 2nd Edition, S. Chand Publishers, 2009.
- 2. Prof. Dr. V.L. Shah, Prof. Veena Gore, "Limit State Design of Steel Structures", 1st Edition, Structures Publications, 2009.
- 3. B.C. Punmia, "Comprehensive Design of Steel structures", 10th Edition, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications, New Delhi, 2007.

IS Codes:

IS -800 – 2007, "Code of Practice for General Construction in Steel", BIS, 2007
IS – 875 – Part I, II and III, "Codes of Practice for Design Loads" (other than Earthquake, for Buildings and Structures), 2017.
Steel Tables.

Note: The above codes and steel tables are permitted in the examination

Web References:

1. <u>https://onlinecourses.nptel.ac.in/noc22_ce66/</u>