

6.1 STEEL STRUCTURES DESIGN AND DRAWING

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RATIONALE

This subject is an applied engineering subject. Diploma holders in Civil Engineering will be required to supervise steel construction and fabrication. He may also be required to design simple structural elements, make changes in design depending upon availability of materials. This subject thus deals with elementary design principles as per BIS code of practice IS: 800. Thus one should be able to read and interpret structural drawings of steel structures. The competence to read and interpret structural drawings is best learnt by being able to draw these drawings. Hence there is a need to have a subject devoted to preparation of structural drawings.

COURSE OUTCOMES

After undergoing the training, the students will be able to:

- CO1 Explain structural properties of steel and its designation as per Indian Standards
- CO2 Analyze and design single and double angle section struts and I section compression members
- CO3 Explain different types of trusses, their different components and usability
- CO4 Analyze and design of simply supported steel beams
- CO5 Supervise fabrication and erection of steel structure like trusses, columns and girders
- CO6 Read and interpret steel structural drawing

DETAILED CONTENTS

PART A: Steel Structures Design

UNIT-I

1.1 Structural Steel and Sections:

- 1.1.1 Properties of structural steel as per BIS Code
- 1.1.2 Designation of structural steel sections as per IS handbook and IS: 800
- 1.1.3 Riveted Connections- Types of Rivet, Permissible stresses in rivets, types of riveted joints, specifications as per BIS-800, Failure of riveted joint, strength and efficiency of riveted joint,

Design of Riveted Connection only axially loaded member (No staggered riveting)

UNIT-II

- 2.1 Bolt Connections:-** Types of bolt, permissible stresses in bolt, Types of bolted joints, specifications for bolted joints as per B IS 800. Failure of a bolted joint. Assumptions in the theory of bolted joints. Strength and efficiency of a bolted joint. Design of bolted joints for axially loaded members (No Staggered bolts).
- 2.2 Welded connections:-** Types of welds and welded joints, advantages and disadvantages of welded joints design of fillet and butt weld for axially loaded members

UNIT-III

- 3.1 Tension Members-** Analysis and design of single and double section tension members and their riveted and welded connections with gusset plate as per IS:800-2007
- 3.2 Compression Members-** Analysis and design of single and double angle sections compression members subjected to axial load

UNIT-IV

- 4.1 Roof Trusses-** Form of trusses, pitch of roof truss, spacing of trusses, spacing of purlins, connection between purlin and roof covering. Connection between purlin and principal rafter (no design, only concept)
- 4.2 Column Bases:-** Types of column bases i.e. slab base, gusseted base. Concept of buckling, effective length, slenderness ratio, Analysis and Design of axially loaded single section column.

UNIT-V

- 5.1 Beams-** Analysis and design of single section simply supported laterally restrained steel beams. Introduction to plate girder and functions of various elements of a plate girder
- 5.2 Fabrication and erection** of steel structures like trusses, columns and girders

PRACTICAL EXERCISES

PART B: Steel Structures Drawing

Structural drawing from given data for following steel structural elements.

- (i) Drawing No. 1: Roof Truss – Drawing of Fink Roof Truss with details of joints, fixing details of purlins and roof sheets.
- (ii) Drawing No.2 : Column and Column Bases - Drawing of splicing of steel columns. Drawings of slab base, gusseted base and grillage base for single section steel columns.
- (iii) Drawing No.3 : Column Beam Connections
 - (a) Sealed and Framed Beam to Beam Connections
 - (b) Sealed and Framed Beam o Column Connections
- (iv) Drawing No. 4 : Plate Girder (Bolted)
Plan and Elevation of Plate Girder with details at supports and connection of stiffness, flange angles and cover plate with web highlighting curtailment of plates.
- (v) Drawing No. 5 : Draw atleast Two sheet using CAD software

Important Note:

- (i) Use of IS: 800 and Steel Tables are permitted in examination.
- (ii) 60 Marks external paper should be set for Part-A Steel Structures Design and 60 Marks external paper should be set for Part-B Steel Structures Drawing.

RECOMMENDED BOOKS

1. "Design of Steel Structures" by Duggal SK; Standard Publishers, Delhi
2. "Steel Structures Design and Drawing" by Birinder Singh; Kaption Publishing House, Ludhiana
3. "Design of Steel Structures" by Ram Chandra; Standard Publishers, Delhi
4. "Design of Steel Structures" by S Ramamurtha
5. e-books/e-tools/relevant software to be used a recommended by AICTE/HSBTE/NITTTR.

RECOMMENDED WEBSITES

1. <https://swayam.gov.in/>
2. <https://www.udemy.com/>

3. <https://www.upgrad.com/>

INSTRUCTIONAL STRATEGY

Teachers are expected to give simple problems for designing various steel structural members. For creating comprehension of the subject, teachers may prepare tutorial sheets, which may be given to the students for solving. It would be advantageous if students are taken at construction site to show fabrication and erection of steel structures. IS:800 may be referred along with code for relevant clauses. This subject contains five units of equal weightage.