C20-C–501

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BOARD DIPLOMA EXAMINATION, (C-20)

MAY/JUNE—2023

DCE - FIFTH SEMESTER EXAMINATION

STEEL STRUCTURES

Time : 3 Hours] [*Total Marks* : 80

PART—A

3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

(4) Use of IS : 800-2007, IS : 875-1987 and steel tables are permitted.

1. What are the physical properties of steel? State with values.

2. Define the following terms :

(a) Size of fillet weld

(b) Throat thickness of fillet weld

3. What shall be the maximum size of the fillet weld applied to the *(a)* square edge of a plate and *(b)* round edge of a flange?

4. Sketch the different types of sections used for tie members.

5. Define the following terms :

(a) Least radius of gyration

(b) Slenderness ratio

6. Give the values of effective length for any two cases of end conditions of column as per IS 800–2007.

7. What is lacing? Write down the objectives of lacing.

8. What is plated beam? Sketch any two forms of plated beams.

9. A beam ISLB 400 @ 569 N/m has to carry superimposed load of 30 kN/m over a span of 6 m including self-weight. Check the beam section for shear stress. Assume f_y = 250 N/mm^2.

10. Define slope and pitch of the roof trusses.

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* An angle ISA 100 mm × 100 mm × 12 mm is carrying an axial design tensile force of 220 kN acting through the CG of the angle is to be connected to a gusset plate of 12 mm thick by a lap joint using side and end welds, at site. Design the joint taking the ultimate design stress in the fillet weld as 410 N/mm^2.

(OR)

(b) A tie in a truss consists of an ISA 100 × 75 × 8 mm connected to a 12 mm thick gusset plate through the longer leg by shop fillet weld. Design the welded joint if the permissible stresses in the angle and ultimate shear stress in the fillet weld are 150 MPa and 410 MPa respectively.

12. *(a)* Design a single angle section to carry a tension of 300 kN. The angle is to be connected to its longer leg to a gusset plate of 12 mm thick with fillet welds. The yield and ultimate stresses in steel are 250 MPa and 410 MPa respectively. Check for block shear is not necessary.

(OR)

(b) Determine the design tensile strength of a roof stress member ISA 90 × 60 ×6 mm connected to its longer leg to a gusset plate of 8 mm thickness with 6 mm size fillet weld on each side. The effective length of weld is 200 mm. Take f_u = 410MPa, f_y = 250MPa.

13. *(a)* Design a steel column using a rolled I-section to carry an axial load of 750 kN. One end of the column is restrained translation and rotation and the other end restrained against translation and free against rotation. The actual length of the column between intersections is 5 m and the yield stress of steel is 250 MPa.

(OR)

(b) Design a slab base for a column section consisting of ISHB 300 @ 577 N/m carrying an axial load of 800 kN. Use M_{20} grade concrete and yield stress of steel as 250 MPa. Also, design the concrete pedestal if the safe bearing capacity of soil is 190 kN/m^2.

14. *(a)* A truss consists of 2 ISA 100 × 100 × 6 mm acting as a strut of 3 m long. Find the strength of the member if the angles are connected on both sides of 12 mm thick gusset plate by welding. The gusset fixity may be taken as hinged. Assume f_y = 300 MPa.

(OR)

(b) Determine the design compressive strength of the single angle discontinuous strut ISA 80 × 50 × 8 mm of length 2 m when connected to gusset plate through long leg by fillet welds at each end. Yield stress of steel used is 340 MPa and E = 2 × 10^5 MPa. The gusset fixing may be taken as hinged.

15. *(a)* Design a rolled steel beam using I-section for simply support beam of effective span of 5 m carrying a UDL of 40 kN/m including the self-weight of the beam. The beam is adequately supported laterally. Check the beam for deflection and shear if E = 2 × 10^5 N/mm^2 and f_y = 250 N/mm^2.

(OR)

(b) *(i)* Write a note on the effect of holes in the tension zone of a laterally supported beam.

(ii) Determine the shape factor for a rectangular section of width 300 mm and depth 200 mm.

PART—C

10×1=10

Instructions : (1) This question is compulsory.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. Rolled steel I-sections are to be provided at 3 m intervals to support a R.C. slab of 150 mm thick. The live load on the slab is 3 kN/m^2 and floor finishes is 0·75 kN/m^2. The effective span of the beam is 6 m. Design a suitable section for the beam assuming f_y = 250 MPa and E = 2 × 10^5 MPa.

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