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Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025 Design of Steel Structure

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS800 : 2007 and steel tables are permitted.
3. Missing data, if any, may be suitably assumed.*

Module-1

- 1 a. Explain the advantages and disadvantages of steel structures. (10 Marks)
- b. Explain the failure criteria of steel. (05 Marks)
- c. Explain the different types of structural section classification as per IS800 – 2007. (05 Marks)

OR

- 2 a. Explain the terms plastic hinge, shape factor, plastic moment, upper bound theorem and collapse mechanism. (10 Marks)
- b. Determine the shape factor for a triangle of base 'b' and height 'h'. (10 Marks)

Module-2

- 3 a. Explain the advantages and disadvantages of HSFG bolts. (05 Marks)
- b. Explain the behavior or failure of bolts in bolted connection with neat sketch. (05 Marks)
- c. Design a bolted connection for a lap joint of plate thickness 10 mm and 12 mm to carry a factored load of 150 kN. Use M16 bolts of property class 4.6. Assume bolts with complete threads. (10 Marks)

OR

- 4 a. With neat sketch, explain the common defects in welding. (08 Marks)
- b. Design the weld to transmit the load equal to the design strength of member ISA100 × 75 × 10 mm welded to a 12 mm thick gusset plate. Consider the welding in all 3 sides of a member and grade of section as Fe410. Consider the welding at site condition. (12 Marks)

Module-3

- 5 a. Explain the different modes of failure of compression members. (08 Marks)
- b. Calculate the compressive strength of a compound column made up of ISMB 400 @ 604 N/m with two cover plates of size 300 mm × 20 mm. Length of column is 4.5 m. It is fixed at one end and hinged at the other. (12 Marks)

OR

- 6 Design a double angle discontinuous strut to carry a factored load of 175 kN. The length of the strut is 3 m between intersections. Consider the following cases:
 - i) Angles are placed on opposite sides of gusset plate.
 - ii) Angles are placed on the same side of gusset plate.
 Take gusset plate of 10 mm thick. Assume grade Fe 410 steel with $f_y = 250$ MPa. (20 Marks)

Module-4

- 7 a. Explain different modes of failure of tension members with neat sketch. Write the formulae. (08 Marks)
- b. A single unequal angle $100 \times 75 \times 6$ mm is connected to a 8 mm thick gusset plate @ the ends by 4 mm weld as shown in figure. Determine the design tensile strength of the angle if the gusset is connected to 100 mm leg. Assume average length of weld as 225 mm. (12 Marks)

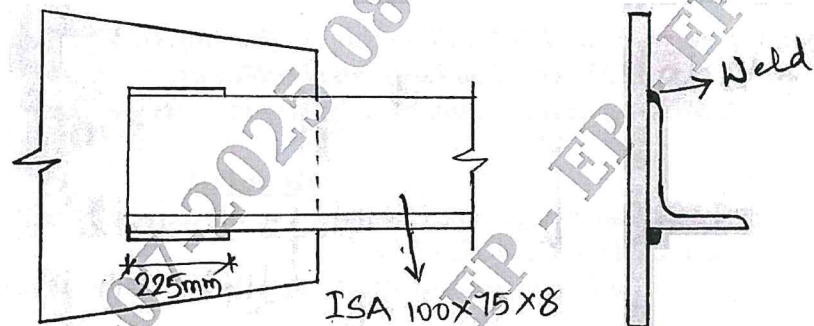


Fig.Q.7(b)

OR

- 8 a. What are lug angles? Explain with neat sketch. (05 Marks)
- b. Design a slab base for a column ISHB 300 @ 58.8 kg/m. It carries a factored axial load of 1500 kN. The grade of concrete is M20 and SBC of soil is 180 kN/m^2 . Design the slab base, concrete base and suitable connections. (15 Marks)

Module-5

- 9 a. With the help of neat sketch, explain the following: (08 Marks)
- Laterally restrained beam
 - Web buckling and web crippling.
- b. Calculate the design bending and design shear strength of a laterally restrained beam ISMB 600 @ 122.6 kg/m. Assume the beam is in low shear condition. (12 Marks)

OR

- 10 Design a laterally restrained simply supported rolled I-beam to support the slab of a hall $6 \text{ m} \times 21 \text{ m}$. Center to center spacing of beams is 3 m. Slab is of 100 mm thick. Consider a floor finish of 0.75 kN/m^2 and live load of 3 kN/m^2 . The slab is resting on a wall of thickness 300 mm all round. Perform all necessary checks for the design. (20 Marks)
