10CV72

Seventh Semester B.E. Degree Examination, Feb./Mar.2022
Design of Steel Structures

Time: 3 hrs.   Max. Marks:100

Note: 1. *Answer FIVE full questions, selecting at least TWO questions from each part.*
2. *Use of IS:800-2007 and steel tables are permitted.*

PART – A

1   a. List the different types of loads to be considered in structural steel design.   **(04 Marks)**
    b. What are the advantages and disadvantages of steel structures?   **(08 Marks)**
    c. What are rolled steel sections? Mention any six shapes used as a structural elements with sketches.   **(08 Marks)**

2   a. What are HSFG bolts? What are the advantages of HSFG bolts?   **(08 Marks)**
    b. Determine the efficiency of a lap joint for the following data:
       Diameter of bolt = 16 mm   Property class = 5.6   Grade of plate = 410 N/mm^2
       Thickness of plates = 8 mm and 10 mm respectively   Edge distance = 40 mm
       Three bolts in a line   Pitch distance = 50 mm   Breadth of plate = 200 mm
       Number of bolts = 9
       Assume that bolts are partially threaded.   **(12 Marks)**

3   a. What are the advantages and disadvantages of welded connections?   **(08 Marks)**
    b. Determine the bracket load that the connection can carry. Consider 8 mm fillet weld (s). Refer Fig. Q3 (b). Assume f_u = 410 N/mm^2

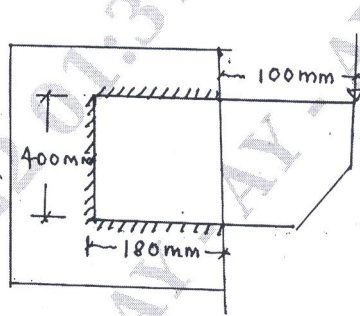Fig. Q3 (b)   **(12 Marks)**

4   a. Show that the plastic hinge will be formed at a distance of $0.414\,\ell$ from the simple support of propped cantilever beam supporting a udl of w/m over the entire span. Calculate the value of M_P.   **(10 Marks)**
    b. Determine the collapse load for the beam shown in Fig. Q4 (b). Sketch BMD at collapse. Refer Fig. Q4 (b).   **(10 Marks)**
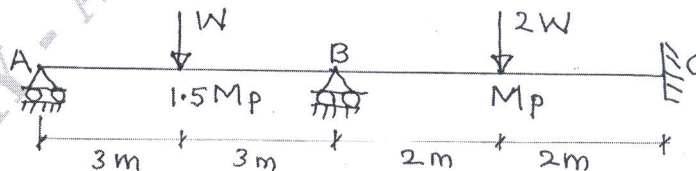

Fig. Q4 (b)

PART – B

5 a. What is lug angle? Explain in brief with sketch. **(05 Marks)**
   b. A single unequal angle ISA $100 \times 75 \times 6$ is connected to 10 mm thick gusset plate with six 16 mmϕ bolts to transfer tension. Determine design tensile strength if longer legs are connected to gusset. Assume pitch and edge distance 40 mm each. **(15 Marks)**

6 a. Calculate the strength of a discontinuous street of length 3.2 m. The steel consists of two unequal angles $100 \times 75 \times 8$ mm ($f_y = 250$ N/mm^2 with long legs connected on the opposite sides of a gusset plate). **(05 Marks)**
   b. Calculate the compressive resistance of a compound column consisting of ISHB 300 with one cover plate of 350×20 mm on each flange and having a length of 5m. Assume that the bottom of the column is fixed and top is rotation fixed, translation free and $f_y = 250$ MPa. **(15 Marks)**
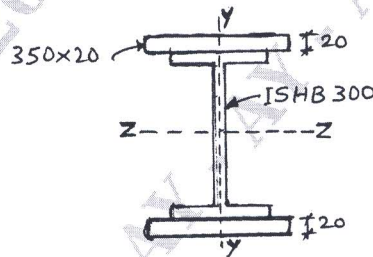

Fig. Q6(b)

7 a. Explain types of column bases. **(06 Marks)**
   b. Design a slab base for a column ISHB300@58.8 kg/m subjected to a service load of 1500 KN. The grade of concrete for pedestal is M$_{20}$ and SBC of soil is 180 KN/m^2. Design slab base and concrete base with welded connection. **(14 Marks)**

8 a. Explain web crippling and web buckling in flexural members. **(06 Marks)**
   b. Simply supported beam ISMB350@52.4 kg/m, is used over a span of 5 m. The beam carries an udl live load of 20 KN/m and dead load of 15 KN/m. Beam is laterally supported. Check the safety of the beam. **(14 Marks)**

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