Roll No. ☐☐☐☐☐☐☐☐☐☐☐☐☐☐   Total No. of Pages : 03

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M.Tech. (Structural Design) EL-IV (2016 & Onwards) (Sem.–3)
# INDUSTRIAL STRUCTURE
Subject Code : MSTD-306
M.Code : 74808

Time : 3 Hrs.   Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :
1. **Attempt any FIVE questions in all.**
2. **Each question carries TWENTY marks.**
3. **Use of relevant codes is allowed. (IS 875(part3), IS800, steel tables etc).**
4. **Symbols and terms are to be read in context of the subject.**
5. **Missing data if any can be suitably assumed, clearly stating the same.**
6. **Wherever possible support the answer with suitable sketches.**

1. a) Write short answer for the following :

   i. Differentiate nominal diameter and gross diameter of bolt.

   ii. Define the terms gauge, pitch, edge and end distance of bolt joint.

   iii. Arrange the double bolted lap joint with neat sketch.

   iv. Differentiate Lap joint and Butt Joint

   v. Compare the high tension bolt from common black bolt.   (2×5)

   b) A bracket is bolted to the flange of a column as shown in figure using 8mm thick bracket plate. Using M20 bolts of grade 4.6 design the connection.   (10)
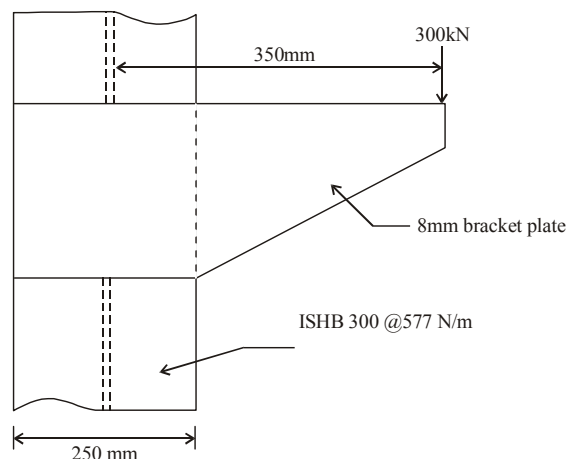
Fig.1

2. The 10mm thick bracket plate shown in the figure is connected with the flange of column ISHB 300 @ 577 N/m. Find the size of the weld to transmit a factored load of 250kN.

(20)

All dimensions in mm
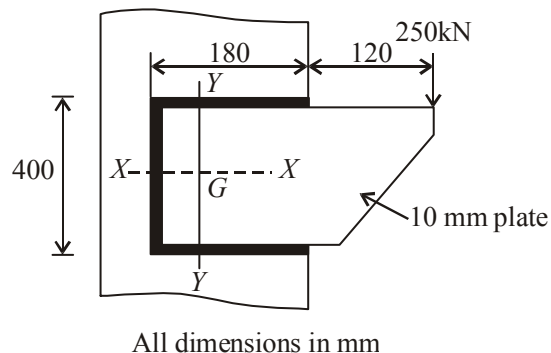
Fig.2

3. a) Design a tension member using 2 unequal angles of size 120mm × 90mm × 8mm with a 10mm thick gusset plate. The short leg is outstanding. The pull on the member of 250kN. (12)

   b) Discuss Shear Lag in Tension member. (8)

4. Design *single lacing system with bolted connections* for built up column to support an axial load of 700kN. The column is 6m in length and is restrained in position but not in direction at both the ends. The column consists of two ISMC 300@351 N/m placed back-to-back at a distance of 220mm. Each channel has the following properties:

   $I_{zz}= 6362.6 \times 10^4 \ mm^4$; $I_{yy} = 310.8 \times 10^4 \ mm^4$

   Area of section=4564 mm^2; h= 300 mm; b=90 mm g=50mm

   Distance of centroid, from web =c_{yy}=23.6 mm t_f = 13.6mm t_w= 7.6mm (20)

5. a) Write short answer for the following :

   i. Distinguish web buckling and web crippling. (5)

   ii. List the various factors affecting the lateral-torsional buckling strength (5)

   b) A simply supported steel joist with a 3.5m effective span carries a udl of 40kN/mover its span inclusive of self weight. The beam is laterally unsupported. Design a suitable section. Take f_y =250N/mm^2. (10)

6. Design a gantry girder for an industrial building to carry an electrical overhead travelling crane having following data :
Crane capacity-250 kN, Weight of crane excluding trolley-200 kN, Weight of trolley(crab)-60 kN, Span of crane girder-20 m, Span of gantry girder-7 m, Wheel base-3.4 m, Weight of rail section-0.25 kN/m, Minimum hook approach- 1.1m, f_y = 250 N/mm^2. (20)

7. a) Design a channel section purlin for the following data :

Spacing of trusses =4.2m   Spacing of purlin= 2m

Live load on galvanized iron roofing sheets = 0.6 kN/m^2

Wind load = 1.4 kN/m^2 Slope of main rafter = 31° (14)

b) What are the functions of providing column bases? (3)

c) Under what circumstances gusset base is used? (3)

8. a) An industrial roof shed of size 20 m × 30 m is proposed to be constructed at Simla near a hillock of 160 m height and slope is 1 in 2.8. The roof shed is to be built at a height of 120 m from the base of the hill. Determine the design wind pressure on the slope. The height of roof shed shall be 12m (10)

b) Discuss briefly the following with neat sketches.

i. Bracing system in roof truss

ii. Connection of purlin to rafter

iii. Anchorages of truss with concrete column. (6,2,2)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.