Total number of printed pages = 4

19/6th Sem/DCE 602

2022

DESIGN OF STEEL STRUCTURE

Full Marks – 100

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) Define lap and butt joints with the figure. What do you mean by single and double shear ? Design a butt joint between two plates of size 120×12 mm thick and 120×14 mm thick so as to transmit a factored load of 150 kN using 20 mm diameter bolts of grade 4.6 and grade 410 plates. 4+3+8=15

   (b) Write short notes on : pitch, gauge distance, edge distance, and end distance. 5

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2. (a) Define the efficiency of a joint. The plates of a tank 12 mm thick are connected by a double-bolted lap joint with 24 mm diameter bolts at 60 mm pitch. Calculate the efficiency of the joint assuming grade 4.6 bolts and Fe 410 plates. 2+10=12

(b) List the failure modes that may control the strength of a bolted connection. Write the advantages of bolted connections over riveted or welded connections. 3+5=8

3. (a) Define groove and fillet welds with figures. What are the various types of groove and fillet welds ? What are the advantages and disadvantages of welding over bolting ? 3+5+5=13

(b) A tie member of a truss consisting of an angle section ISA 120 × 120 × 10 of Fe 410 grade, is welded to a gusset plate. Design a weld to transmit a load equal to the full strength of the member. Assume shop welding. 7

4. (a) What is the design stress of a tension member based on

(i) gross-section yielding,

(ii) net-section rupture and

(iii) block shear failure ?

A steel plate of size 180 × 12 mm is used as a tension member in a roof truss. It is connected to a gusset plate by 6 numbers of 20 mm diameter bolts having a pitch distance of 60 mm, end distance of 40 mm, and gauge distance of 100 mm. Calculate the tensile strength of the plate. 5+15=20

5. (a) What do you mean by slenderness ratio ? Determine the design axial load on the column section ISMB 350, given that the height of the column is 3.3 m and that it is pin-ended. Also assume the following : fy = 250 MPa, fu =410 Mpa and E =2 × 105 MPa. 2+8=10

(b) Calculate the compressive resistance of a 200 × 200 × 18 angle assuming that the angle is loaded through only one leg, when it is connected by 10

(i) two bolts at the ends and

(ii) one bolt at each end.

6. (a) What do you mean by partial penetration and full penetration of groove weld and fillet weld ? Which one is preferred and why ? Under what circumstances are slot and plug welds used ? Why are slot and plug welds not preferred ? 8

(b) Two plates of thickness 12 mm and 10 mm are to be joined by a groove weld. The joint is subjected to a factored tensile force of 275 kN. Assuming an effective length of 150 mm, check the safety of the joint for

(i) Single-V groove weld

(ii) Double-V groove weld joint. 6

(c) Show in figure chain bolting and zigzag bolting. How do you determine gross-section and net area of a plate and an angle ? 3+3=6