Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2024
CIVIL ENGINEERING
(2020 SCHEME)

Course Code : 20CET401

Course Name: Design of Steel Structures

Max. Marks : 100 **Duration: 3 Hours**

Use of Codes IS 800, IS 875, IS 883 and steel table permitted
Assume suitable data wherever necessary

PART A

(Answer all questions. Each question carries 3 marks)

1. Sketch and explain any three failure patterns of bolted connection.
2. Differentiate between bearing type connection and friction type connection.
3. What is shear lag? How it can be reduced?
4. Explain the condition for the design strength of a tension member?
5. Enumerate the modes of failures in a column.
6. Differentiate between slab base and gusseted base for steel columns.
7. What is the maximum deflection to be allowed in steel beams? Explain web crippling?
8. Explain the reason for providing intermediate stiffeners for plate girders.
9. Enlist the classification of truss according to the pitch.
10. Describe purlins.

PART B

(Answer one full question from each module, each question carries 14 marks)

MODULE I

11. A boiler shell is made up of 14 mm thick Fe410 plates. The joint is double bolted lap joint with bolts of grade 4.6 at distances of 50mm as shown in Figure 1. Determine the strength of the joint. Per pitch width for a safe design if the internal dia of the shell is 1m and steam pressure is 12 MPa. (14)

OR

12. Find the bolt value of the connection between two plates of thickness 16mm which are to be joined using M20 bolts of grade 4.6 by (i) Lap joint (ii) Butt joint [using 10mm cover plates] as shown in Figure 2 (14)

MODULE II

13. a) A single unequal angle ISA 90×60×6 mm is connected to a 10 mm thick gusset plate at the ends with 5 Nos of 16 mm dia bolts to transfer tension. Determine the design tensile strength of the angle if the gusset is connected to the 90mm leg. (11)
    b) Explain the use of Tension splice. (3)

OR

14. Design a single angle section for the tension member of a roof truss to carry a factored load of 225 kN. The member is subjected to a possible reversal of stress due to the action of wind. The length of the member is 3m. Use 20 mm shop bolts of grade 4.6 for the connection. (14)

MODULE III

15. Design a column 4 m long to carry a factor load of 6000 kN column is effectively held at both ends and restrained in direction at one end. Design the column using beam section ISHB 450 @ 907 N/m (14)

OR

16. Design a laced column with 2 channels back to back of length 10 m to carry an axial factored load of 1400 kN. The column may be assumed to have restraint in position but not in direction at both ends. (14)

MODULE IV

17. Design a simply supported beam of effective span 6.5 m carrying a factored concentrated load of 85 kN at mid-span. (14)

OR

18. a) Enumerate the various factors affecting the lateral-tensional buckling strength. Explain web buckling? (7)
    b) Describe plate girder and list its applications? Explain the importance of bearing stiffener in the beam. (7)

MODULE V

19. Design an I section purlin for an industrial building to support a galvanized corrugated iron sheet roof. (14)

Given:

Spacing of the trusses=5.0 m
Spacing of purlins=1.5 m
Inclination of the main rafter to horizontal=30°
Weight of galvanized sheet taking into account laps and connecting bolts=130 N/m^2
Imposed load=1.5k N/m^2
Wind load= 1.0 kN/m

OR

20. a) In the context of fire engineering, how do environmental factors, building codes, and occupancy requirements impact the design and assessment of fire-resistant steel structures? (8)

b) What are the key material properties of steel that engineers need to consider when assessing fire resistance at elevated temperatures in a steel structure? (6)

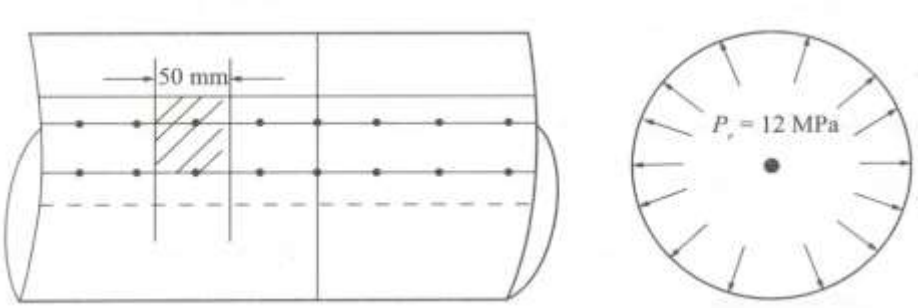

Figure 1

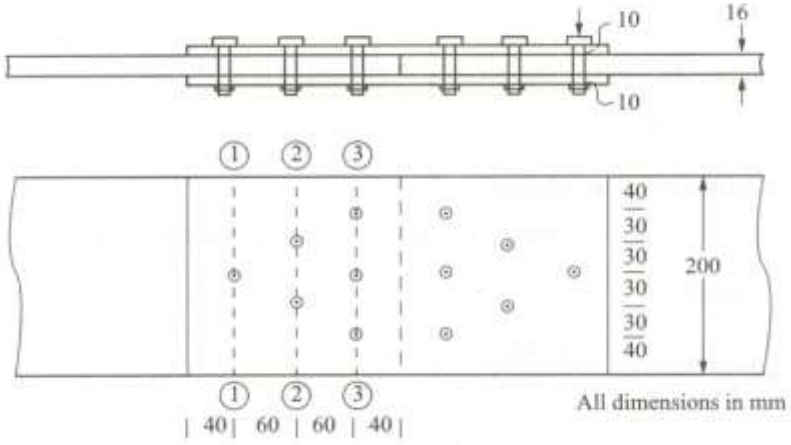

Figure 2

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