

Roll No. ....

Total Pages : 03

**BT-4/M-20**

**34110**

DESIGN OF STEEL STRUCTURES-I  
CE-204N

Time : Three Hours]

[Maximum Marks : 75

**Note** Attempt Five questions in all, selecting at least one question from each Unit. Assume any missing data appropriately. Use of IS : 800 and Steel tables is allowed.

**Unit I**

- I. (a) What do you understand by the strength of a riveted joint ? **5**
- (b) Determine the load which can be transmitted per pitch length of a double cover butt joint connected by 24 mm diameter shop rivets at 100 mm pitch. The thickness of main plates and cover plates are 16 mm and 12 mm respectively. Take allowable tensile strength of plates equal to  $150 \text{ N/mm}^2$ , allowable shear stress in rivets equal to  $100 \text{ N/mm}^2$  and allowable stress in bearing for rivets equal to  $300 \text{ N/mm}^2$ . Also, determine the efficiency of the joint. **10**

**(2)L-34110**

**1**

2. (a) List the different modes of failure of a tension member. **3**
- (b) A tie member used as a diagonal in a roof truss consists of two angles  $75 \times 50 \times 8$  mm placed back to back on the same side of the gusset plate. The rivets are 18 mm diameter, provided in one row and the angles are tack riveted. Determine the tensile strength of the member. Take  $f_y = 250$  N/mm<sup>2</sup>. **12**

### Unit II

3. (a) State the possible failure modes of an axially loaded column. **3**
- (b) Design a built-up column of effective length 5 m to carry an axial load of 1000 kN using lacing. Take  $f_y = 250$  N/mm<sup>2</sup>. **12**
4. Design a slab base for a column ISMB 300 subjected to an axial load of 900 kN and bending moment of 20 kN.m about the major axis. The base plate rests on concrete of grade M25 and bearing capacity of the soil is 500 kN/m<sup>2</sup>. **15**

### Unit III

5. (a) Explain web-crippling briefly. **3**
- (b) Design a simply supported beam of span 5 m carrying a uniformly distributed load made up of 20 kN/m imposed load and 20 kN/m dead load. Take  $f_y = 250$  N/mm<sup>2</sup>. Apply necessary checks. **12**

(2)L-34110

2

6. Calculate the moment carrying capacity of a laterally unrestrained ISMB 400 member of length 3 m. Apply necessary checks. **15**

#### Unit IV

7. Design a suitable section for a simply supported gantry girder for the following data :  
Spacing of columns = 4 m, Crane capacity = 160 kN, Weight of the crane excluding the crab = 250 kN, Weight of the crab = 60 kN, Minimum clearance of cross travel = 0.8 m, Wheel base = 5.3 m, Centre-to-centre distance between gantry girders = 20 m, Height of the rail = 105 mm. Take  $\gamma_{m0} = 250 \text{ N/mm}^2$  **15**
8. (a) What is meant by curtailment of plates in plate girder? **3**
- (b) A plate girder has the following elements :  
Flange plates 400 × 16 mm - 1 plate for each flange  
Web 2000 × 10 mm  
Compute the sectional properties and moment of resistance of the plate girder. Design also the bearing stiffeners if the plate girder is to carry uniformly distributed load of 120 kN/m. **12**

(2)L-34110

3

—