*Roll No. .....*

# 23393

# M. Tech. 1st Sem. Civil Engg.
# (Specialisation in Structural Design)
# Examination – December, 2014

## DESIGN OF STRUCTURES - I

**Paper : MTSD-104**

*Time : Three Hours ]* *[ Maximum Marks : 100*

*Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.*

*Note :* Attempt any *five* questions.

1. (a) Explain & draw stress-strain curve of mild steel in detail & also explain the design specification as per IS 800:2007. 10

   (b) What are the benefits of using structural steel sections instead of concrete members? Write down the advantage and disadvantages of steel sections. 10

2. (a) Design a column of effective length 6m it is subjected to an axial load of 1600kN provide two channels back to back connected with battens by welded connection. Assuming fy = 250MPa. 10

(b) Design a beam of 5m effective span carrying a uniform load of 50kN/m if the compression flange is laterally unsupported. Assuming $f_y = 250N/mm^2$. 10

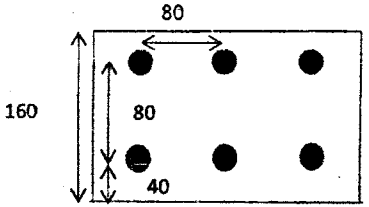
**3.** (a) Design a tubular purlin section for the (following data : 10

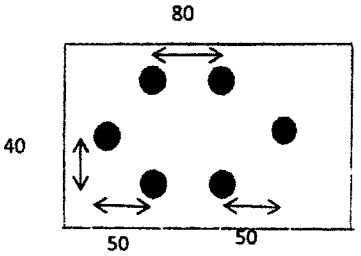
| | |
|---|---|
| Spacing of the roof truss c/c | 6m |
| Dead load of roofing | 0.8 kN/m |
| Live load on purlin | 1.3 kN/m |
| Wind load on purlin | –2.0 kN/m |

(b) A mild steel plate of size 160mm X 16mm is used as a tension member in a roof truss. It is connected at its ends, to a gusset plate using 22mm river by : 10

(k) Chain riveting

(1) Zigzag riveting as shown below :




Calculate the maximum tension which the plate can carry in each case. Which arrangement is stronger?

4. Design a roof truss of following data : 20

Location = Kolkata

Life span = 75 years

Permeability = Normal

Spacing = 3.5 m

Span of Truss = 18 m

Central rise = 3.5 m

Height of truss at eaves level = 10 m

Fy = 250 Mpa

Corrugated GI sheet (self wt. 131 $N/m^2$)

Spacing of purlin limited to 1.3 m

5. (a) Explain the following in details : 10

(i) Behaviour of members subjected to flexural & axial loads.

(ii) Stress-strain relationship for concrete and steel.

(b) A singly R/Fed concrete beam has an effective depth of 600 mm and width of 300 mm & is R/Fed with 8 bars of 20 mm diameter at the centre of the span. From the requirements of bending stresses, it is known that four these bars can be safely bent up at a distance of 1.6 m from the support. The maximum S.F. at the ends is 160kN & the distance from the either support in which shear R/Fment is needed is 1.30 m Explain how you would use the bent up bars as diagonal reinforcement. Also design the stirrup reinforcement required. Take $\sigma_{sv}$ = 140N/$mm^2$ & M 25 concrete. 10

6. Design a R.C. slab for a room measuring 4m × 5m from inside. The slab carries a live load of 2000N/m2 & is finished with 20 mm thick granolithic topping. Use M 20 concrete & Fe 415 steel. The slab is simply supported at all the four edges, with corners free to lift. 20

7. (a) Explain all types of footings with neat and clear sketch and also write down IS code recommendations for design of footing. 10

   (b) Design a rectangular isolated footing of uniform thickness for R.C column bearing a vertical load of 1000kN and having a base size of 500 × 700mm. the safe bearing capacity of the soil may be taken as 180kN/$m^2$. Use M25 concrete & Fe500 steel. 10

8. (a) What are the difference between short column & long column, also write down IS 456 : 2000 specifications for the design of column. 10

   (b) A circular column 4.6 m height is effectively held in position at both ends and restrained against rotation at one end. Design the column, to carry an axial load of 1200kN, if its dia is restricted to 450 mm. Use M 20 mix & Fe 415 steel. 10