Total No. of Questions : 10]

SEAT No. :

**P2914**

[Total No. of Pages : 3

# [5669]-503

## T.E. (Civil)

## STRUCTURAL DESIGN - I

## (2015 Pattern)

*Time : 3 Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) *Answer Q.1 Or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.*
2) *Neat diagrams must be drawn wherever necessary.*
3) *Figures to right indicate full marks.*
4) *Assume Fe410 amd $F_y$ = 250 N/mm² steel and $f_{ub}$ = 400 N/mm² for bolts if not specifically given in the problem.*
5) *Use of electronic pocket calculator, IS 800-2007 and steel table are permitted.*
6) *Assume suitable data if necessary.*

***Q1)*** a) Explain philosophy of partial safety factors used in Limit State Method of design. **[3]**

b) Determine tensile load carrying capacity of ISA 125×75×8 section connected to gusset plate with its longer leg. The details of welding are as shown in figure 1. **[7]**

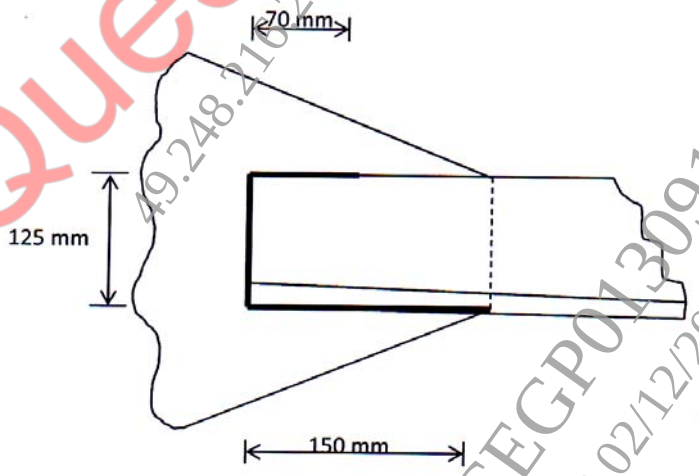


Figure 1

OR

***P.T.O.***

***Q2)*** a) Explain what is effective length and factors on which it depends. **[3]**

b) A column is subjected to reactive working dead load, live load and wind load from a truss combined as below -

i) DL + LL = 500 kN

ii) DL + WL = 100 kN

iii) DL + LL + WL = 300 kN

It is held in position and restrained in direction at both ends. Height of column is 4.5 m. Design a column using I section. **[7]**

***Q3)*** a) Explain function of lacing/battening system required in case of compound column. Describe various types of lacing and battening system with diagram. **[4]**

b) Design a slab base for column ISMB 300 @ 44.2 kg/m which is carrying axial service load of 650 kN. Concrete in pedestal is of M25 grade. **[6]**

OR

***Q4)*** Design a gusseted base for a column ISWB 400 @ 66.7 kg/m with cover plate of 300 × 16 mm at each flange. It is carrying axial factored load of 2500 kN. The grade of concrete for pedestal is M20. **[10]**

***Q5)*** A cantilever beam of effective span of 5 m is subjected to service dead load of 15 kN/m and service imposed load of 15 kN/m. The compression flange of beam is restrained latterly throughout the span. Design a section for a beam and apply check for bending, shear, deflection, web buckling and web crippling. Stiff bearing length at support may be assumed as 100 mm. **[16]**

OR

***Q6)*** ISMB 600 @ 122.6 kg/m section is used as a beam for effective span of 4 m. The compression flange of beam is laterally unsupported throughout the span. Determine working uniformly distributed load the beam can carry safely. The load is resulting from combination of dead load and live load. Also provide check for serviceability. **[16]**

***Q7)*** a) Explain bolted and welded seated beam end connection with the help of neat diagram. **[5]**

b) An ISMB 350 @ 52.4 kg/m section is acting as a secondary beam and transferring end reaction of 450 kN to the web of ISMB 500 @ 86.9 kg/m used as main beam. Design a bolted framed connection. Bolts of grade 4.8 are available for use. Draw neat diagram of connection. **[12]**

OR

***Q8)*** Design an economical section for a laterally supported welded plate girder to carry working uniformly distributed load of 60 kN/m and central point load of 300 kN an span of 25 m. Apply usual checks. Design welded connection between flange and web. Also design end bearing stiffener. Draw neat diagrams showing details. **[17]**

***Q9)*** In an industrial building, a gantry girder is required to carry manually operated crane with following details. Design a section for gantry girder. **[17]**

i) Span of gantry girder = 8 m

ii) Span of crane girder = 16 m

iii) Crane capacity = 200 kN

iv) Self-weight of crane girder excluding trolley = 200 kN

v) Weight of trolley = 40 kN

vi) Minimum hook approach = 1.2 m

vii) Wheel spacing = 3.5 m

viii) Self-weight of rails = 0.3 kN/m

OR

***Q10)*** A roof truss as shown in figure 10 is used for industrial building situated at Pune. The trusses are placed at 3 m centre to centre. It is covered with GI sheets as roofing material. Assume $k_1 = 1$, $k_2 = 0.82$, $k_3 = 1$ for wind load calculations. Design angle section purlin for the building. Determine panel point dead load, imposed load and wind load. **[17]**

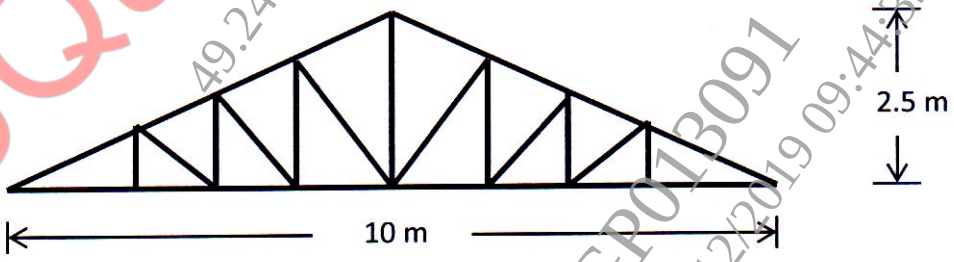


Figure 10

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