

Name :

Roll No. :

Invigilator's Signature :

CS/B.TECH/CE(NEW)/SEM-6/CE-602/2013

2013

DESIGN OF STEEL STRUCTURE

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following :

$$10 \times 1 = 10$$

- i) The partial safety factor for the material of bolts is

- a) 1.0 b) 1.10
c) 1.15 d) 1.25

- ii) The shear strength of the bolt can be written as $f_s \cdot A_n$ where f_s is given by

- a) $\frac{f_y}{\sqrt{3} \times 1.25}$ b) $\frac{f_u}{\sqrt{3} \times 1.25}$
c) $\frac{f_y}{\sqrt{3} \times 1.10}$ d) $\frac{f_u}{\sqrt{3} \times 1.10}$

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CS/B.TECH/CE(NEW)/SEM-6/CE-602/2013

- viii) For gantry girders carrying electrically operated overhead travelling cranes, the lateral force are increased by
- 25% of maximum static wheel load
 - 10% of maximum static wheel load
 - 10% of weight of the crab and weight lifted by the crane
 - 5% of the weight of the crab and weight lifted by the crane.
- ix) A $90 \times 90 \times 10$ angle is connected to the gusset plate of 12 mm thickness by 3 rivets of 20 mm diameter. If this member carry a tensile force of 120 kN, the maximum centre to centre spacing between two consecutive rivets will be (as per IS 800:2007)
- 160 mm
 - 180 mm
 - 192 mm
 - 200 mm.
- x) In a steel structure, bracing members are provided to resist mainly
- lateral loads
 - fatigue loads
 - crane loads
 - accidental loads.
- xi) The slenderness ratio of a web of beam section buckling consideration is given by
- d/t_w
 - $2.45 d/t_w$
 - $85 d/t_w$
 - $67 d/t_w$.

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xii) The design bending strength of a laterally unsupported beam is given by

- I. $\beta_b Z_p f_y / \gamma_{mo}$
- II. $\beta_b Z_p f_{bd}$
- III. $\beta_b Z_p \chi_{LT} f_y / \gamma_{mo}$
- IV. $\beta_b Z_p f_{bd} / \gamma_{mo}$

Of these :

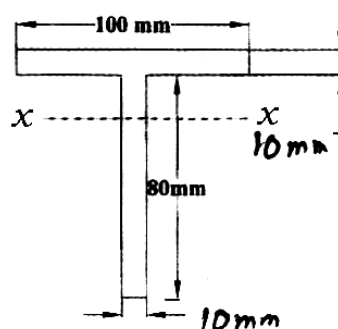
- a) only I is correct b) only II is correct
- c) II and III are correct d) III and IV are correct.

GROUP – B

(Short Answer Type Questions)

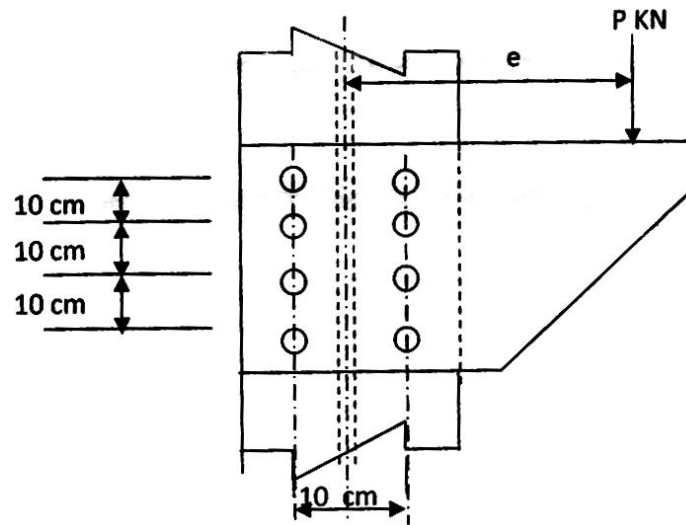
Answer any *three* of the following $3 \times 5 = 15$

2. Two plates of 12 mm and 18 mm thick are to be joined by double cover butt joint. Design the joint for following data : Factored design load 850 kN; Bolt diameter 20 mm grade of steel : Fe 410; grade of bolt 4.6; thickness of cover plate 8 mm (one on each side).
3. Find the shape factor of the section shown below about the xx-axis :



CS/B.TECH/CE(NEW)/SEM-6/CE-602/2013

4. Determine the ultimate eccentric load 'P' on the bracket, if $e = 300$ mm, thickness of bracket plate is 12 mm and M16 bolts of property grade 4.6 are used. Design strength of M16 bolts may be taken as 35 kN.



5. Design a slab base for a column ISHB 350 @710·2 N/M subjected to an factored axial compressive load of 1200 kN. Load is transferred to the base plate by direct bearing of column flanges. Take, $f_u = 410$ Mpa, $f_y = 250$ Mpa.
6. An ISMC 250 is used to transmit a factored force of 600 kN. The channel section is connected to one side of a gusset plate of 10 mm thick. Design a fillet weld if overlap is limited to 300 mm. Use slot weld if required. Sketch the connection. Consider the welding is done at site. Assume necessary data if required as per IS 800 : 2007 and SP 6(1) : 1964. Assume the grade of steel is E250 (Fe 410W) A.

CS/B.TECH/CE(NEW)/SEM-6/CE-602/2013

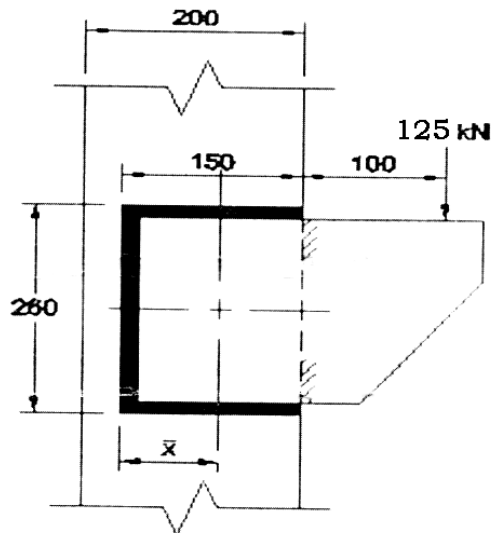
GROUP – C**(Long Answer Type Questions)**Answer any *three* of the following. $3 \times 15 = 45$

7. In a steel roof truss having inclination 30° , purlins are spaced @ 0.9 m centre to centre. The purlins are continuous over rafters. Truss spacing = 3 m. If ISJC 100 @ 5.8 kg/m is used as the purlin, check its adequacy.

Weight of roof covering = 0.70 kN/m^2 , wind pressure = 1.5 kN/m^2 acting normal to roof surface.

Properties of ISJC 100 : $b_f = 45 \text{ mm}$, $t_f = 5.1 \text{ mm}$, $t_w = 3 \text{ mm}$, $Z_{pz} = 28.38 \text{ cm}^3$ and $Z_{py} = 9.0 \text{ cm}^3$, E250 grade steel is used.

8. A bracket plate is welded to the flange of a column ISHB 200 as shown in the figure below. Calculate the size of the weld required to support a factored load of 125 kN.



CS/B.TECH/CE(NEW)/SEM-6/CE-602/2013

9. A built-up column consists of two MC 250 placed back to back and connected with lacing. Using steel grade Fe 410, determine the axial load carrying capacity of the column considering effective length as 4.5 m. Also determine the minimum back to back spacing between two channels and design the lacing.
10. Design a welded plate girder of span 30 m and simply supported at both end is subjected to a superimposed load of 40 kN/m. Avoid the use of bearing and intermediate stiffeners. use E250 (Fe 410 W) A steel. Assume necessary data if required as per IS 800 : 2007 and SP 6(1) :1964.
11. A gantry girder for an EOT crane is provided with a section consisting of ISWB 600 with ISMC 300 on its top with flanges down. Check the suitability of the girder section against factored bending moment due to dead load, live load and impact load amounting to 700 kN-m and factored S.F. of 500 kN.

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