

Total No. of Questions : 6]

SEAT No. :

P4903

[Total No. of Pages : 2

**T.E./Insem. - 103**  
**T.E. (Civil)**  
**Structural Design - I**  
**(2012 Pattern) (Semester - I)**

*Time : 1½ Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) Neat sketches must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Take Fe 410 grade of steel.*
- 5) Take ultimate stress in bolt,  $f_{ub} = 400 \text{ N/mm}^2$ .*
- 6) Assume suitable data, if necessary.*
- 7) Use of electronic pocket calculator IS : 800-2007 and steel table are allowed.*
- 8) Use of cell phone is prohibited in the examination hall.*

- Q1)** a) Explain Shear lag effect developed in tension members with sketch. [4]
- b) Determine design tensile strength due to yielding and rupture of an ISA 125 x 95 x 10 @ 16.5 kg/m in which longer leg is connected to the 10 mm thick gusset plate by 3 number of M20 black bolts of 4.6 grades. [6]

OR

- Q2)** a) Explain the partial safety factors and characteristic load in limit state design. [4]
- b) Check the adequacy of an ISA 90 x 60 x 6 @ 6.8 kg/m to carry axial tensile load of 150 kN for yielding and block shear only. Assume angle is connected to 8 mm thick gusset plate by 4 numbers of M20 black bolts of 4.6 grades. [6]

*P.T.O.*

- Q3) a)** Explain mode of failure of compression members with suitable sketches. [4]
- b) Check the adequacy of a 2 ISA 70 x 70 x 6 @ 6.3 kg/m to factored axial compressive load of 160 kN. Two angles are connected on either side of 8 mm thick gusset plate by 4 numbers of M20 black bolts of 4.6 grades. The effective length of strut is 2.5 m. [6]

OR

- Q4) a)** A 6 m long column is restrained in translation at both ends and restrained against rotation at one end. If an ISHB 400 @ 77.4 kg/m is used, calculate design compressive strength of the column. [5]
- b) A column 10m long consisting 2 ISMC 300@ 35.8 kg/m spaced 200 mm back to back to carry a factored load of 1100 kN. The column is restrained in translation but not in rotation at both ends. Design a suitable lacing system. [5]

- Q5)** Explain types of column bases and design the size of slab base for a column ISHB 350 @ 67.4 kg/m supporting a factored axial compression of 1200 kN. Consider grade of concrete as M20. [10]

OR

- Q6)** Check the adequacy of ISHB 450 @ 85.4 kg/m to carry a factored axial compressive load of 750 kN at eccentricity of 270 mm about major axis. The effective length of column is 3 m. Consider only section strength. [10]

