17505

11819

4 Hours / 100 Marks Seat No. | | | | | | | | |

Instructions : *(1)* ***All*** *questions are* ***compulsory****.*
(2) Answer ***each*** *next main question on a* ***new*** *page.*
(3) Illustrate your answers with neat sketches ***wherever*** *necessary.*
(4) Figures to the ***right*** *indicate* ***full*** *marks.*
(5) Assume suitable data, if ***necessary****.*
(6) Use of Non-programmable Electronic Pocket Calculator is ***permissible****.*
(7) Use of Steam steel tables, logarithmic, Mollier's chart is ***permitted****. Steel table's xerox copy is not allowed. (Give the data sheet as given in last exams)*

Marks

1. A) Attempt **any three** : **(4×3=12)**

a) State the full form of ISMB, ISHB, ISJC, ISMT.
b) State any four types of load to which structures are subjected along with respective relevant codes.
c) Draw any four sketches of sections used as tension member.
d) Draw graph of stress-strain curve for mild steel.

B) Attempt **any one** : **(1×6=6)**

a) Design the lap joint for plates 100 × 10 mm and 80 × 10 mm thick connected, to transmit 100 kN factored load using single raw of 18 mm dia. bolts of 4.6 grade and plates of 415 grades.
b) Write down the step-by-step design procedure of angle purlin as per the IS 800-2007.

2. Attempt **any two** : **(8×2=16)**

a) A flat 250 × 10 mm is connected to gusset plate using 20 mm dia. bolts of 4.6 grade, design lap joint and draw neat sketch of joint designed.
b) A built-up column, consist 2 ISMC-225 placed back to back at 140 mm. The length of column is 8 m effectively held in position and restrained against rotation at both ends. Find design strength of column. For 1ISMC225, A = 3301 mm^2, $I_{XX} = 26.946 \times 10^6$ mm^4, $I_{yy} = 1.872 \times 10^6 mm^4$ C_{yy} = 23.1 mm

KL/r	40	50	60	70	80	90	100
Fcd (MPa)	198	183	168	152	136	121	107

c) An ISMB 400 @ 6043 N/m is used as simply supported beam for 4 m span. The compression flange is laterally supported, determine flexural strength and working udl beam can carry. Take Zp = 1176.18×10^3 mm^3 γ_{mo} = 1.1 βb = 1 fy = 250 MPa.

P.T.O.

Marks

3. Attempt **any four** : **(4×4=16)**

a) Define bolt value, pitch, gauge and edge distance in bolted joint.

b) State two types of welded joint and draw sketch of any one.

c) Write the specifications of IS code for design of angle purlin.

d) Enlist any 8 types of steel roof trusses with their spans used.

e) Write the design steps for wind load in steel roof truss.

4. A) Attempt **any three** : **(4×3=12)**

a) Define effective length and slenderness ratio for column.

b) Draw a neat sketch of (a) V-butt welded joint and (b) lap bolted joint.

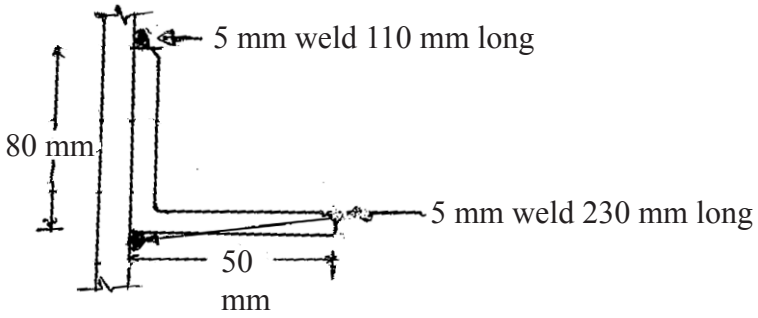
c) State general requirements of lacing as per IS Code.

d) Draw a neat sketches of lacing and battening system showing with weld connection.

B) Attempt **any one** : **(1×6=6)**

a) Explain the concept of shear lag phenomenon with suitable example. Also comment whether this phenomen is same for both welded and bolted connection or not.

b) Determine the design strength of single angle in tension member using ISA 80×50 ×8 mm. The longer leg is connected to gusset plate 10 mm thick by 5 mm weld as shown in fig. For ISA Ag = 978 mm^2, β = 1.18.



5. Attempt **any two** of the following : **(2×8=16)**

a) Design a square slab base and concrete block for column section SC250 with two cover plates 300 × 25 mm carrying 3000 KN axial load. Take M 15, tf = 17 mm, bf = 250 mm, overall height h = 300 mm and SBC = 300 kPa.

b) Calculate DL and LL per panel for steel roof truss having span = 20 meter, panel points = 10, spacing = 4 m, Rise = 3 m, wt. of GI sheet = 100 N/m^2, bracing = 75 N/m^2 wt. of purlin = 150 N/m^2.

c) Explain the design procedure with formulae and meaning of each terms in it to calculate panel point live load and wind load for steel roof truss.

6. Attempt **any four** : **(4×4=16)**

a) Enlist any four components of plate girder and write their functions.

b) State the design steps for rolled steel beam when it is laterally restrained.

c) Draw a neat sketch showing the main tie member at support having free to slide horizontally.

d) State the effective length for a compression member having end conditions are :

i) Restrained against translation and free against rotation at both ends.

ii) Restrained against translation and free against rotation at one end bat roller supported at the other end.

e) State the classification of cross-sections of beams based on moment rotation behaviour.

IS : 800-2007 Equations (Formula Sheet)

$$V_{nsb} = \left(\frac{f_u}{\sqrt{3}}\right)\left(n_n A_{nb} + n_s A_{sb}\right), \qquad V_{dsb} = \frac{V_{nsb}}{\gamma_{mb}}, \qquad V_{dpb} = \frac{V_{npb}}{\gamma_{mb}},$$

$$T_{dg} = \frac{A_g f_y}{\gamma_{m0}}, \qquad V_{npb} = 2.5 k_b d\, t\, f_u$$

$$T_{dn} = \frac{0.9 A_{nc} f_u}{\gamma_{m1}} + \beta \frac{A_{go} f_y}{\gamma_{m0}} \text{ where } \beta = 1.4 - 0.076 (w/t) (f_y/f_u) (bs/Lc) \quad \leq (f_u \gamma_{m0} / f_y \gamma_{m1}) \geq 0.7$$

$$T_{dn} = \frac{\alpha A_n f_u}{\gamma_{m1}}, \qquad T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}, \qquad T_{db2} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$$

$$P_d = A_e f_{cd}, \qquad P_z = 0.6\, V_Z^2, \qquad V_z = V_b k_1 k_2 k_3$$

$$f_{cd} = \chi \frac{f_y}{\gamma_{m0}}, \qquad \chi = \frac{1}{\phi + \sqrt{\phi^2 - \lambda_e^2}}, \text{ where } \phi = 0.5\left[1 + \alpha (\lambda_e - 0.2) + \lambda_e^2\right]$$

$$\lambda_e = \sqrt{k_1 + k_2 \lambda_{vv}^2 + k_3 \lambda_\varphi^2}$$

$$\text{where } \lambda_{vv} = \frac{\left(\frac{l}{r_{vv}}\right)}{\varepsilon\sqrt{\frac{\pi^2 E}{250}}} \text{ and } \lambda_\varphi = \frac{(b_1 + b_2)/2t}{\varepsilon\sqrt{\frac{\pi^2 E}{250}}}$$

$$t_s = \sqrt{\left[2.5 w (a^2 - 0.3 b^2) \gamma_{m0} / fy\right]} > t_f$$

Values of χ and fcd (N/mm^2) for different values of KL/r_{min} as per buckling curve 'c'

KL/r_{min}	10	20	30	40	50	60	70	80	90
χ	1.000	0.987	0.930	0.870	0.807	0.740	0.670	0.600	0.533
fcd	227	224	211	198	183	168	152	136	121

KL/r_{min}	100	110	120	130	140	150	160	170	180
χ	0.471	0.416	0.368	0.327	0.291	0.261	0.234	0.212	0.192
fcd	107	94.6	83.7	74.3	66.2	59.2	53.3	48.1	43.6