17505

15116

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) Mobile Phone, Pager and any other Electronic Communication devices are ***not permissible*** *in Examination Hall.*
(8) ***Use*** *of steel tables, logarithmic, Mollier's chart is* ***permitted****.*
(9) IS 800-2007 ***not allowed****.*

Marks

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

a) State objectives and factors to consider by a designer in designing steel structure.
b) Explain the limit states of serviceability applicable to steel structure.
c) List the values of partial safety factors for material strength in case of resistance by-yield, buckling, ultimate stress and bolt connection.
d) Explain what do you mean by shear lag.

B) Attempt **any one**: **(1×6=6)**

a) Design the Lap joint for the plates of sizes 100 × 16 mm and 100 × 10 mm thick connected so as to transmit a factored load of 100 kN using single row of 16 mm dia bolts of grade 4.6 and plate of 410 grade.
b) Draw neat sketches of bolted connections in case of –
i) Beam to Beam connection when flanges are at same level.
ii) Beam to Beam connection when flanges are not at same level.
iii) Beam to column connection.

2. Attempt **any two**: **(2×8=16)**

a) Design a suitable fillet weld of size 4 mm to connect a tie bar 80 × 8 mm to a 10 mm thick gusset plate. Joint has to be designed for full strength of the tie bar and welding on all three sides. Draw a neat sketch showing lap length.

Take - $f_y = 250$ N/mm^2, $\gamma_{m0} = 1.10$

$f_u = 410$ N/mm^2, $\gamma_{mw} = 1.50$.

P.T.O.

Marks

b) In a truss 2 ISA 100 × 100 × 6 mm, 2.80 m long is used as a strut. It is connected to 10 mm thick gusset plate on either sides by two bolts at each end.

Determine the load carrying capacity of the angle strut –

i) If connected by bolts

ii) If connected by weld.

Properties of ISA 100 × 100 × 6 mm –

$A = 1167\ mm^2$, $I_{xx} = I_{yy} = 111.3 \times 10^4\ mm^4$

$C_{xx} = C_{yy} = 26.70$ mm

KL /r →	60	70	80	90	100
f_{cd} (N/mm^2) →	163	152	136	121	107

c) An ISMB 350 @ 514 N/m is used as a simply supported beam for 5 m span. The compression flange of beam is laterally supported through out span. Determine design bending strength of beam. Also calculate working UDL the beam can carry per m span. Check the member for deflection.

Take – $Zp = 889.6 \times 10^3\ mm^3$, $\gamma_{m0} = 1.10$

$\beta b = 1$, $f_y = 250$ MPa, $I_{xx} = 13630.3 \times 10^4\ mm^4$

$E = 2 \times 10^5\ N/mm^2$

3. Attempt **any four**: **(4×4=16)**

a) In steel construction bolts of grade 4.6 are generally used. What do you mean by grade 4.6 ?

b) Sketch any one type of bolt. Why drilled holes are preferred over punched holes ?

c) Define component parts of a roof truss with a labelled sketch.

d) Draw neat sketches of connection of an angle purlin with principal rafter at panel point and the correct orientation of placement of channel section purlin over principal rafter.

e) List the factors considered in calculation of wind load. Write the steps to calculate wind load on roof truss as per IS 875.

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

a) Sketch different sections used as built-up strut and built-up column.

b) State with a sketch the effective length for a compression member as per IS 800 – 2007 having end conditions as

i) Translation restrained at both ends and rotation free at both ends.

ii) Translation and rotation restrained at both ends.

c) State the function of lacing and battening.

d) Limiting width to thickness ratio for single beam section of plastic class is 9.4 and d/tw = 84. State whether ISMB 500 @ 852 N/m is of plastic class or not. For ISMB 500 h = 500 mm, $b_f = 180$ mm, $t_f = 17.2$ mm, $t_w = 10.2$ mm, $r_1 = 17.0$ mm, $f_y = 250$ MPa.

Marks

B) Attempt **any one** : **(1×6=6)**

a) Find the value of permissible stress in axial tension (6 at) for f_y = 250 MPa. State why unequal angles with long legs connected are more efficient ?

b) Design a tension member consisting of single unequal angle section to carry a tensile load of 340 kN. Assume single row 20 mm bolted connection. The length of member is 2.4 m. Take – f_u = 410 MPa, α = 0.80

Section available (mm)	**Area (mm^2)**
ISA 100 × 75 × 8	1336
ISA 125 × 75 × 8	1538
ISA 150 × 75 × 8	1748

5. Attempt **any two** : **(2×8=16)**

a) Design a slab base for a column ISHB 350 @ 724 N/m to carry factored axial compressive load of 1500 kN. The base rests on concrete pedestal M20. For ISHB 350 @ 724 N/m – b_f = 250 mm, t_f = 11.6 mm f_u = 410 MPa, γ_{m0} = 1.10.

b) A hall of size 14 m × 20 m is provided with fink type roof trusses at 4 m c/c. Calculate panel point load in case of dead load and live load for following data :

i) Unit Wt. of roof covering = 165 N/m^2

ii) Self Wt. of purlins = 100 N/m^2

iii) Weight of bracing = 60 N/m^2

iv) Rise to span ratio = 1/5

v) Number of panels = 8

c) A industrial building has trusses for 16 m span. Trusses are spaced at 4 m c/c and rise of truss is 3.50 m. Calculate the panel point load in case of live load and wind load using following data.

i) Coefficient of external wind pressure (Cpe) = – 0.7

ii) Coefficient of internal wind pressure (Cpi) = $\pm$ 0.2

iii) Design wind pressure = 1200 N/m^2

iv) No. of panels = 12

Marks

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

a) Draw plan of gusseted base showing all components.

b) State four classification of cross sections of beam based on moment-rotation behaviour as per IS 800-2007.

c) An ISMB 450 is used as a simply supported beam of 4 m span which carry 20 kN/m load. Check the section for shear only.

Take – f_y = 250 MPa, γ_{m0} = 1.10, t_w = 9.4 mm.

d) Why beams are laterally restrained ? State methods of providing lateral restrainment.

e) State the necessity of column bases. Also state the function of cleat angle and anchor bolts in slab base.