17505

16117

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.*

Marks

1. A) Attempt **any three**: **12**

a) Enlist the components and corresponding functions for
i) Gantry girder ii) Steel water tank

b) State any four types of loads to be considered for design of any steel structure with respective IS codes.

c) What do you mean by
i) Limit state of strength ii) Limit state of serviceability ?

d) What is the criteria to decide design strength of Tension Member ? State the formula for any one.

B) Attempt **any one**: **6**

a) Design the Lap Joint between two plates of sizes 100 × 12 mm thick each, to transmit a factored load of 80 kN using single row of bolts of grade 4.6 and 410 grade of plate. (Assume data if required).

b) i) Draw sketches of any two rolled steel sections used as tension members. **2**
ii) State in brief design steps of tension member. **4**

2. Attempt **any two**: **16**

a) An inclined truss member consists of 2 angles 100 × 75 × 10 mm connected back to back with longer leg to gusset plate 12 mm thick. Design the bolted joint to transfer a design force of 750 kN. Steel Fe410 and bolts are of grade 4.6.

b) A strut 3.0 m long of a truss consists of 2 ISA 100 × 100 × 10 mm. Calculate the design strength of strut if it is bolted to 12 mm thick gusset plate on either sides by two rivets at each end.

Take r_{vv} = 19.4 mm. Values of f_{cd} are as

KL/r	130	140	150
f_{cd}(N/mm^2)	74.4	66.2	59.2

Properties of ISA 100 × 100 × 10 mm are A = 19.03 cm^2, $I_{xx} = I_{yy}$ = 177.00 cm^4, $Z_{xx} = Z_{yy}$ = 24.7 cm^3.

P.T.O.

Marks

c) A simply supported beam 5.2 m long carries UDL of 50 kN/m. The beam is laterally supported. Design the section and check for deflection only.

Take $\gamma_{m0} = 1.1$, $\beta_b = 1.0$, $f_y = 250$ MPa and available section properties as

Section	b_f (mm)	t_f (mm)	t_w (mm)	R_1 (mm)	h_2 (mm)	Z_{xx} (mm^3)
ISWB 350	200	11.4	8.0	12.0	27.25	887×10^3
ISWB 400	200	13.0	8.6	13.0	29.75	1171.3×10^3
ISWB 450	200	15.4	9.2	15.0	33.00	1558.1×10^3

3. Attempt **any four**: **16**

a) What do you mean by high strength bolts ? State the uses of HSB with their commonly used property class.

b) Draw the illustrative sketch of fillet weld and state following properties with IS code provisions.
   i) Size of weld
   ii) Throat thickness
   iii) Minimum length of weld

c) Draw line sketches of
   i) Compound fink truss
   ii) North light truss.

   State their span limits.

d) Draw neat sketch (detailed) of a truss support joint and panel point joint (any one) showing arrangement of members. (Sketch should include gusset plate connected with angles with the help of rivets/bolts)

e) State the necessity of purlins in Trusses. State the different checks to be taken while designing the purlin (No formulae)

4. A) Attempt **any three**: **12**

a) Define radius of gyration and slenderness ratio with maximum limit.

b) State in brief design steps of simple compression member.

c) Draw neat sketches of single and double lacing system. State its purpose.

d) Draw and label any four types of built-up compression members.

B) Attempt **any one**: **6**

a) State with sketch different modes of failure of member in axial tension.

b) A tension member consists of two angles ISA 75 × 75 × 8 mm bolted to 10 mm thick gusset plate one on each side using single row of bolt and tack bolted. Determine the maximum load that the member can carry.

   Take : i) Area of angle = 1140 mm^2
   ii) Gauge distance as per IS clause.

Marks

5. Attempt **any two**: **16**

a) An industrial building has trusses for 12 m span. Trusses are spaced at 4 m c/c and rise of truss is 3.0 m. Calculate panel point load in case of Live load and Wind load using following data.

i) Coefficient of external wind action = – 0.7

ii) Coefficient of internal wind action = $\pm$ 0.2

iii) Design wind pressure = 1.15 kPa

iv) No. of panels = 8

b) A hall of size 15 m × 30 m is provided with Fink type steel roof trusses at 3.75 m c/c. Calculate panel point load for dead load and live load cases from following data.

i) Unit weight of roof covering = 175 N/m^2

ii) Self weight of purlin = 100 N/m^2

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

iv) Rise to span ratio = $\frac{1}{5}$

(Assume additional data required if any)

c) A column ISHB 400 carries an axial load of 1600 kN. Design a slab base and concrete pedestal for this column.

Take :

i) SBC of soil = 200 kPa

ii) Grade of concrete = M 20

iii) b_f = 250 mm

iv) t_f = 12.7 mm

v) r_{m0} = 1.10

vi) f_y = 250 MPa.

6. Attempt **any four**: **16**

a) State classification of cross-sections of beams based on moment-rotation behaviour. Explain in brief any one.

b) State important design steps for design of laterally supported beams.

c) Determine the design bending strength of laterally supported beam ISWB 400 @ 667.3 N/m for ISWB 400, b_f = 200 mm, t_f = 13.0 mm, t_w = 8.6 mm, R_1 = 13.0 mm, h_2 = 29.75 mm, f_y = 250 N/mm^2.
Take $Z_p = 1240 \times 10^3$ mm^3 and $Z_e = 1088 \times 10^3$ mm^3.

d) What is the basic concept to decide the plan area of slab base and concrete block below it. State the function of cleat angle.

e) Define gusseted base. Draw labelled sketch of gusseted base showing all components.
