17505

21415

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** : **(3×4=12)**
   a) State six advantages and two disadvantages of steel as a construction material.
   b) State different types of limit state and describe any one of them.
   c) State types of loads to be considered while designing a steel structure. Also state respective I.S. codes.
   d) List types of failures in case of Tension member and describe any one of them with a neat sketch along with labelling.

   B) Attempt **any one** : **(1×6=6)**
   a) A tie member 100 × 10 mm has to transmit an axial load of 100 kN. Design fillet weld and calculate necessary overlap by assuming welding on all four sides. Also draw a neat sketch of connection. Take permissible shear stress in weld material as 108 MPa.
   b) A single angle 150 × 90 × 10 mm is used as a tension member. Connected to 12 mm thick gusset plate at ends with 5 of 18 mm dia. bolts. Bolts are pitched at 50 mm. Find Net area, if
      i) longer leg connected to gusset plate
      ii) shorter leg connected to gusset plate.

MARKS

2. Attempt **any two** : **(2×8=16)**

a) A lap joint consists of two plates 200 × 12 mm connected by means of 20 mm dia. bolts of grade 4.6. All bolts are in one line. Calculate strength of single bolt and no. of bolts to be provided in the joint.

b) A strut 2.4 m long of a roof truss consists of a single angle 90 × 90 × 6 mm. Calculate load carrying capacity if it is connected to 8 mm thick gusset plate by welding.

Assume – Properties of ISA 90 × 90 × 6 mm ; f_y = 250 N/mm^2

Area = 1047 mm^2, $C_{xx} = C_{yy}$ = 2.42 mm

$r_{xx} = r_{yy}$ = 27.7 mm. r_w = 17.5 mm

KL/r	:	80	90	100	110	120	130
fcd (N/mm^2)	:	136	121	107	94.6	83.7	74.4.

c) Check whether ISMB 250 is suitable or not, as a simply supported beam over an effective span 6m. It carries a UDL of 15 kN/m including self it. Properties of ISMB 250

b_f = 125 mm, t_f = 12.5 mm t_w = 6.9 mm

$I_{xx} = 5131.6 \times 10^4$ mm^4, $Z_{xx} = 410 \times 10^3$ mm^3

r_1 = 13.0 mm, $Z_p = 465.71 \times 10^3$ mm^3

$r_{mo} = 1.1\ B_b = 1$ and f_y = 250 MPa.

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

a) State types of bolted joints and types of failure in case of bolted joints.

b) State two advantages of welded joints and two disadvantages of bolted joints.

c) Draw sketches of Howe type and Pratt type truss showing pitch, rise, panel point, panel, principal rafters and all members in one of the above types.

d) State different types of loads and its combination considered during design of roof truss. Explain in brief any one of them along with its relevant IS Code.

e) Draw a neat sketch and label of an angle Purlin with principal rafter at Panel Point having root covering is A.C. sheets.

MARKS

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

   a) Define stanchion and column. Draw a neat sketch of any one section used showing dimensions with usual notations.

   b) Define Radius of gyration and Slenderness Ratio. Also state maximum values of slenderness ratio for any two conditions of compression member.

   c) Explain 'limits of width to thickness ratio to prevent buckling' for a single angle strut, the limiting width to thickness ratio for a semi-compact class is $15.7\in$. Check whether ISA 90 × 90 × 6 mm is of semi-compact class or not. f_y = 250 MPa.

   d) Draw a neat labelled sketch of lacing system and state requirements of Lacing to be used.

   B) Attempt **any one** : **(1×6=6)**

   a) Draw sketches of three different modes of failure in case of members subjected to Axial Tension.

   b) Design a tie member using suitable equal angle sections to carry a tensile factored load of 210 kN. The connection are with 20 mm dia. bolts and 12 mm thick gusset plate. Design strength of 20 mm dia. bolts = 45.3 kN.

   f_y = 250 MPa, f_u = 410 MPa, α = 0.8 sections available

ISA .... mm	**Area .... mm^2**
90 × 90 × 8	1137
100 × 75 × 6	1014.0
125 × 75 × 6	1166.

5. Attempt **any two** : **(2×8=16)**

   a) A column ISMB 300 @ 46.1 Kg/m carries an axial load of 1200 kN. Design a slab base and concrete Pedestal for the column. The SBC of soil is 180 kN/m^2. M_{20} – concrete is used for concrete Pedestal.

   For ISMB – 300 b_f = 140 mm, t_f = 13.1 mm, f_y = 250 MPa, f_u = 410 MPa r_{mo} =1.1. Draw a neat sketch as per designed details.

   b) A industrial bldg. has Howe roof truss having 12 m span. Take A/C sheet covering Weighing 175 N/m^2, eight Panel lengths along the tie member, pitch of roof = 1/6 and weight of Purlin is 55 N/m^2. Assume self at of truss as 90 N/m^2. Calculate Panel Point loads for dead and live load.

MARKS

c) Find the wind load per panel point for designing a roof truss of span 10 m and pitch as $\frac{1}{4}$. The height of eaves is 5 m above ground. Assume V_b = 4m/s ; probability factor K_1 =1, size factor K_2 = 0.8, topography factor K_3 = 1 ; Normal Permeability.

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

a) Write steps to calculate the thickness of base plate used in slab base. Why anchor bolts are used in slab base.

b) Differentiate between Laterally supported and unsupported beams with a neat sketch.

c) Define Gusseted base. Also draw its labelled sketch showing all details.

d) How beam sections are classified for bending as per IS : 800 – 2007. Describe any two of them.

e) A simply supported beam of 6 m span supports on R.C.C. slab where in comp. flange is embedded. The beam is subjected to a dead load of 25 kN/m and super imposed load of 20 kN/m, over entire span. Calculate plastic and elastic modulus required. Assume r_f = 1.5, γ_m = 1.1 f_y = 250 N/mm^2.
