17505

14115

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) Preferably, write the answers in sequential order.

Marks

1. a) **Attempt any <u>THREE</u> of the following:** **12**

(i) Write the function of steel towers, roof trusses, steel bridges and crane girders.

(ii) State any four types of structural steel sections used giving their full names along with sketches.

(iii) Define:

1) importance factor

2) zone factor

3) response reduction factor and

4) fundamental natural period.

(iv) Enlist two types of sections used as a tension member along with sketches. Also, write function of gusset plate used.

Marks

b) **Attempt any <u>ONE</u> of the following:** **06**

(i) A plate 150 mm × 10 mm is connected by 8 mm fillet weld. Find lap required to be provided for longitudinal weld only. Draw neat sketch showing lap length. Take, permissible stress in weld material as 108 N/mm^2.

(ii) The longer leg of a single angle 90 × 60 × 10 mm is connected to the gusset plate with 3 bolts in a line of 20 mm diameter at a pitch of 60 mm for this tension member. Determine the block shear strength.

2. Attempt any <u>TWO</u> of the following: **16**

a) Determine the bolt value of 20 mm diameter bolt connecting 10 mm plate in:

(i) single shear and

(ii) double shear.

Bolts used are 4.6 grade and plate of 410 grade. Take, area of bolt as 245 mm^2 and pitch as 50 mm.

b) A discontinuous compression member consists of 2 ISA 90 × 90 × 10 mm connected back to back on opposite sides of 12 mm thick gusset plate. Tacking rivets are provided along the length along with one bolt at each end. Determine the design compressive strength of the member. The centre to centre distance of connections is 3 m. For single ISA 90 × 90 × 10 mm, A = 1703 mm^2, γ_x = 27.3 mm, $C_x = C_y$ = 25.9 mm, $I_x = I_y = 12.67 \times 10^5$ mm^4.

KL/γ	80	90	100	110	120	130
f_{cd} (MPa)	136	121	107	94.6	83.7	74.4

c) A simply supported beam of 6 m span supports RCC slab wherein compression 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. Design the beam. The section ISLB 450 @ 640.6 N/m is available having b_f = 170 mm, t_f = 13.4 mm t_w = 8.6 mm, γ_1 = 16 mm, $Z_{xx} = 1223.8 \times 10^3$ mm^3, Zp = 1401.35×10^3 mm^3, $I_{xx} = 275.36 \times 10^6$ mm^4 Check the beam only for shear and deflection.

Marks

3. Attempt any <u>FOUR</u> of the following: **16**

a) Explain any two types of failure of bolted joint along with drawing of respective sketches.

b) Write any four disadvantages of welded connections with respect to bolted.

c) Define steel roof truss and write any three advantages of using steel roof truss.

d) Define purlin. Also state IS code provisions for angle purlin design.

e) Write any four selection criteria of type of roof truss. Also define the term pitch and slope of roof truss.

4. a) Attempt any <u>THREE</u> of the following: **12**

(i) Draw and labelled any four forms of builtup compression members.

(ii) Write any four general requirements for lacing.

(iii) Define effective length of column. Also state the effective length of column having translation and rotation restrained at one end and translation free but rotation restrained at other end along with sketch showing end conditions and effective length.

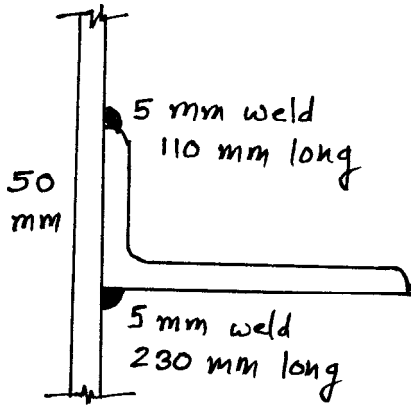
(iv) What is local buckling in case of compression member? What is its effect? What is to be done to prevent it?

Marks

b) **Attempt any <u>ONE</u> of the following:** **06**

(i) Explain gross-section yielding and net section rupture in case of design strength of tension member. Also write two measures are taken to prevent rupture.

(ii) Determine the design strength of a single angle tension member consisting of single angle 80 mm × 50 mm × 8 mm. The shorter leg of the angle is connected to the gusset plate by 5 mm weld as shown in Fig. No. 1. Gross sectional area (Ag) for this angle is 978 mm^2.



<u>Fig. No. 1</u>

5. Attempt any <u>TWO</u> of the following: **16**

a) Calculate the panel point load in case of dead load and live load, for a roof truss having rise of truss = 3 m, span of truss = 16 m, spacing of trusses = 3.5 m c/c, No. of panels = 8 Nos., weight of roof covering = 120 N/m^2, weight of purlin = 80 N/m^2 and weight of bracing = 75 N/m^2.

b) A truss of 20 m span has rise of 4.5 m and these trusses are spaced at 5 m c/c. The design wind pressure is 1.65KPa and number of panels are 10. Coefficient of external wind action is – 1.0 and coefficient of internal wind action is ± 0.5 for this data, calculate panel point load for wind load and live load.

c) A column ISMB 300 carries an axial load of 1.58 MN. Design a slab base and concrete pedestal for the column. Take the SBC of soil is 200 KPa and M20 grade of concrete is used for concrete pedestal. For ISMB 300, consider b_f = 140 mm and t_f = 13.1 mm. Take f_y = 250 MPa and γ_{mo} = 1.10.

Marks

6. Attempt any <u>FOUR</u> of the following: 16

a) Define laterally supported beam along with suitable sketch. State any three methods of providing lateral supports to the beam.

b) Determine the design bending strength of laterally supported beam of ISWB 250 @ 40.12 N/m. Take steel grade is fe 410. Check for deflection and shear is not required.
For ISWB 250 @ 401.2 N/m, b_f = 200 mm, t_f = 9 mm, t_w = 6.7 mm, γ_1 = 10 mm, Z_p = 527.57 × 10^3 mm^3 and Z_e = 475.4 × 10^3 mm^3.

c) Classify the cross sections of beams based on moment-rotation behavior and explain each of them.

d) Differentiate between slab base and gusseted base on any four parameters.

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