22502

23124

4 Hours / 70 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. Attempt any FIVE of the following: **10**

a) State types of loads to be considered while designing the steel structures with respective IS codes.

b) State the relation between throat thickness and size of fillet weld with diagram.

c) Write four advantages of bolted connection over welded connection.

d) Define limit state and state its types.

e) State various forms of shear reinforcement in beams write their formula.

f) Differentiate between one way slab and two way slab on any four parameters.

g) State condition of minimum eccentricity for the design of RCC short column as per IS 456-2000.

P.T.O.

Marks

2. Attempt any THREE of the following: **12**

a) State any four types of structural steel sections along with sketches.

b) State and explain types of bolted joints along with sketches.

c) Calculate development length for a bar of 16 mm diameter in tension and compression. The grade of steel is Fe 500 and design bond stress is 1.2 N/mm^2 for plain bars in tension.

d) Define development length and state factors affecting development length.

3. Attempt any TWO of the following: **12**

a) An inclined truss member consists of 2 angles 100 × 75 × 10 mm connected back to back with longer leg to either side of gusset plate 12 mm thick. Design the bolted joint to transfer a design force of 750 kN. Using 16 mm diameter bolt of 4.6 grade and steel Fe 410.

b) Design a suitable fillet weld of size 4 mm to connect a tie bar 80 × 8 mm to 10 mm thick gusset plate. Joint has to be designed for full strength of the tie bar and welding on all three sides. Take Fy = 250 MPa, r_{mo} = 1.1, fu = 410 MPa and r_{mw} = 1.5. Draw a neat sketch showing tap length.

c) i) State IS specifications for

(1) Maximum reinforcement in beams and slabs.

(2) Minimum reinforcement in slab

ii) Draw stress diagram and strain diagram for singly reinforced section in LSM with relevant values.

Marks

4. Attempt any TWO of the following: **12**

a) A beam having dimension 230 × 450 mm effective is reinforced with 4 bars of 16 mm diameter on tension side. Calculate the ultimate moment of resistance of the beam if M20 grade concrete and Fe 415 steel is used.

b) Calculate the area of steel required for a singly reinforced concrete beam 200 mm wide and 400 mm deep overall to resist an ultimate moment of 60 kNm. Use concrete mix M20 and Fe 500 grade steel and effective cover equal to 40 mm.

c) Design shear reinforcement in the form of 2 legged 10 mm diameter vertical stirrups for beam section 300 mm × 600 mm effective subjected to an ultimate shear force of 300 kN. Assume M25 concrete and Fe 415 steel. Take τ_c = 0.65 MPa and $\tau_{c_{max}}$ = 3.1 MPa.

5. Attempt any TWO of the following: **12**

a) Design a simply supported slab for a span 4.5 m to carry live load of 4 kN/m^2 and floor finish of 1 kN/m^2. Width of supporting wall is 230 mm. Use M20 grade of concrete and Fe 415 steel. Take M.F. = 1.4. Sketch c/s of slab showing reinforcement details. (No checks required).

b) Design a cantilever Chajja with following data : Span = 1.2 m, L.L. = 2 kN/m^2, floor finish = 1 kN/m^2, width of support = 230 × 400 mm. Draw the reinforcement details. Use 10 mm diameter bars of Fe 415 and 6 mm diameter bars of Fe 250. Use M20 grade of concrete. (No checks)

c) Design a reinforced concrete slab for 6.3 m × 4.5 m simply supported on all the four sides. It has to carries a live load of 4 kN/m^2 and floor finish as 1 kN/m^2. Use M25 concrete and Fe 415 steel. Assume M.F. = 1.4. Take α_x = 0.062 and α_y = 0.060. Sketch the c/s of slab showing steel details. (No checks)

Marks

6. Attempt any TWO of the following: **12**

a) Design a R.C.C. Square column to carry an axial load of 1600 kN. Effective length of column is 3.15m. Check the column for minimum eccentricity. Use M20 grade of concrete and Fe 415 Steel.

b) Design a RCC square footing for a column 400 mm × 400 mm to carry an axial load of 1200 kN. Take SBC of soil as 200 kN/m^2 and density of soil as 18 kN/m^3. Use M20 concrete and Fe 415 steel. Check for one way shear and two way shear not required. Draw c/s showing reinforcement details.

c) i) State functions of lateral ties in the column.

ii) A square column of side 425 mm is reinforced with 8 bars of 20 mm diameter of grade Fe 500. If the grade of concrete is M25, calculate the safe load of the column can carry.