

22502

21222

3 Hours / 70 Marks

Seat No.

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15 minutes extra for each hour

- 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 answers in sequential order.

Marks

- 1. Attempt any FIVE of the following:** **10**
- a) Enlist four steel structures with their function.
 - b) Define partial safety factor and state its types.
 - c) Write two advantages and two disadvantages of bolted connection over welded connection.
 - d) Write expression for minimum and maximum reinforcement in beam.
 - e) State two uses of bentup bar.
 - f) Differentiate between one way slab and two way slab with respect to spanning direction and bending curvature.
 - g) Define effective length and slenderness ratio of column.

P.T.O.

- 2. Attempt any THREE of the following:** **12**
- a) Write four advantages and disadvantages of steel as a construction material.
 - b) Differentiate between Under-reinforced and Over-reinforced section w.r. to percentage of steel provided, position of N.A., moment of resistance and failure of member.
 - c) State the reason for providing shear reinforcement in the beam and state its two forms with neat figure.
 - d) Calculate the development length, if a 20mm diameter bar of grade Fe 415 is used for resisting compression. Take $\tau_{bd} = 1.2 \text{ N/mm}^2$ for plain bar in tension.
- 3. Attempt any TWO of the following:** **12**
- a) Determine bolt value of 16mm diameter bolt of 4.6 grade to connect two angles $90 \times 60 \times 6$ mm back to back on opposite side of gusset plate of 8mm thickness. Also determine number of bolts required if it carries a direct factored load of 110kN. Take pitch = 50mm and edge distance = 40mm. Draw neat sketch of designed connection.
 - b) Design suitable fillet welded connection for ISA $80 \times 50 \times 8$ mm with its longed leg connected to gusset plate of thickness 8mm. The angel is subjected to a factored load of 275kN. Take $C_{xx} = 27.3$ mm. Assume welding is applied to two edged and shop welding. $G_y = 250 \text{ MPa}$. $F_u = 410 \text{ MPa}$.
 - c) Draw stress-strain diagram for singly reinforced beam. Show all design parameters by mentioning meaning of notations used in it.
- 4. Attempt any TWO of the following:** **12**
- a) Find limiting moment of resistance and steel required for a beam 300×550 mm effective, if concrete M_{20} and steel Fe 415 is used.
 - b) Design the balanced section for the simply supported beam of span 4m. It carries a working load of 35kN/m including self weight. Use M_{20} concrete and Fe 415 steel. Take $b = 230$ mm.

- c) Design a shear reinforcement in the form and two legged vertical stirrups of 6mm ϕ for a beam of 6m span having service load of 20kN/m. Beam is 300 × 450mm (effective) in size. The reinforcement consists of 6 bars of 20mm in diameter. Use M₂₀ concrete and Fe 415 steel. Use following table.

Pt%	1.0	1.25	1.5	1.75	2.0
τ_c in N/mm ²	0.6	0.64	0.68	0.71	0.79

5. Attempt any TWO of the following:

12

- a) Design a one way slab for an effective span of 3.5m. The super imposed load including floor finish is 4kN/m². Take M.F. = 1.2. Use M₂₀ concrete and Fe 415 steel. Do not apply check for shear and bond. Sketch the cross-section along shorted span.
- b) Design a suitable slab for a internal room size of 4 × 7m. Take live load of 2kN/m² and floor finish of 1kN/m². Assume width of support = 230mm. Take MF = 1.4, $\alpha_x = 0.100$ and $\alpha_y = 0.056$. Use M₂₀ concrete and Fe 415 steel. Do not apply check for shear and bond. Sketch the cross-section along shorter span.
- c) Design a chajja for a span of 0.75m. Take LL = 2.0kN/m² and F.F. = 0.5kN/m². Use M₂₀ concrete and Fe 415 steel. Size of lintel supporting chajja is 230 × 230mm. Do not apply check for shear and bond. Sketch the C/S of chajja.

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

- a) Design a square column to carry an axial load of 1000kN using MS lateral ties. Use M_{25} concrete and Fe 415 steel. Take unsupported length of column = 3.0m. Use 1 % steel and apply check for minimum eccentricity and for short column.
 - b) Design a RC column square footing for a column of size 300×300 mm. Load on column is 1200kN. Take safe bearing capacity of soil = 200 kN/m^2 . Use M_{20} concrete and Fe 415 steel. Calculate depth from BM criteria only. Also, draw the c/s of footing showing reinforcement details.
 - c) State six assumptions made in limit state of collapse in flexure.
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