

# 22502

**22223**

**4 Hours / 70 Marks**

Seat No. 

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Illustrate your answers with neat sketches wherever necessary.
  - (3) Figures to the right indicate full marks.
  - (4) Assume suitable data, if necessary.
  - (5) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (6) 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) Write two advantages and two disadvantages of steel as a construction material.
  - b) Define Partial safety factor and write its values for load and material.
  - c) Define Bolt value. Explain meaning of grade 4.6 bolt.
  - d) Write four advantages of bolted connection over welded connection.
  - e) State two functions of bent up bars provided in flexure section.
  - f) Differentiate between one way slab and two way slabs with respect to aspect ratio, spanning direction, bending curvature and placing of steel.
  - g) Write IS code provisions for minimum eccentricity of axially loaded short column.

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- 2. Attempt any THREE of the following:** **12**
- a) State any 4 structure where Steel Rolled Sections are used. Also draw any two Rolled Section.
  - b) Define and write IS specifications for:
    - i) size of weld and
    - ii) throat of weld and weld connections.
  - c) State the situation where minimum shear reinforcement is provided in RCC beam also give its expression with meaning of each term used.
  - d) Determine the development length of 16 mm diameter of Fe 415 bar in compression if design bond stress is 1.4 MPa for plain bar in tension.
- 3. Attempt any TWO of the following:** **12**
- a) A plate of 100 mm × 10 mm is connected by plate 200 mm × 12 mm by lap joint by means of 18 mm diameter bolt in single line. Calculate number of bolts required to utilise full strength of connection. Assume grade of bolt and plates are 4.6 and Fe410 respectively.
  - b) ISA 100 × 100 × 10 is welded with gusset plate of 12 mm to carry factored pull of 300kN at its centroid 28 mm from outstanding leg. Design fillet weld only on both sides of angle. Assume Fe410 and shop welding.
  - c) (i) Define Limit State and enlist the types of Limit State in RCC.  
(ii) Explain the terms ‘balanced’, ‘over reinforced’ and ‘under reinforced’ sections in flexure and state which is generally preferred in practice.

- 4. Attempt any TWO of the following:** **12**
- a) Calculate limiting moment of resistance and steel required for a beam  $230 \text{ mm} \times 400 \text{ mm}$  effective, if M25 concrete and Fe 500 steel are used.
  - b) A beam  $250 \text{ mm} \times 550 \text{ mm}$  effective size carries a factored BM of 160 kNm. If concrete M20 & steel grade Fe 500 are used, find area of steel.
  - c) Design shear reinforcement in the form of 2 legged 10 mm diameter vertical stirrups for a beam section  $250 \text{ mm} \times 600 \text{ mm}$  effective subjected to ultimate shear force of 220 kN. Use M25 concrete and Fe 415 steel. Take  $\tau_{c\max} = 3.1 \text{ MPa}$  and  $\tau_c = 0.65 \text{ MPa}$ .
- 5. Attempt any TWO of the following:** **12**
- a) Design verandah slab supported along two longer edges having effective span of 2.5 m. Take live load =  $4 \text{ kN/m}^2$ , floor finish =  $1 \text{ kN/m}^2$ . Use M 20 concrete and Fe 415 steel. Take M. F. = 1.4. Also sketch c/s of slab along longer span showing reinforcement details. (No checks required.)
  - b) Design a simply supported slab panel of effective plan dimensions of  $4.0 \text{ m} \times 6.0 \text{ m}$ . The slab is subjected to a live load of  $3.5 \text{ kN/m}^2$  and floor finish as  $1.0 \text{ kN/m}^2$ . Use M25 concrete and Fe 500 steel. Assume M.F. = 1.6 and corners are free to lift up. Take  $\alpha_x = 0.104$  and  $\alpha_y = 0.046$  Sketch the structural details. (Checks not required)
  - c) Design a cantilever chajja with following data : Span = 1.0 m, Width = 1.5 m, L.L. =  $2 \text{ kN/m}^2$  Finish =  $0.5 \text{ kN/m}^2$ , support lintel =  $230 \times 230 \text{ mm}$  Concrete M20, Fe 415 steel. Sketch the C/S of chajja. Showing steel details. (No checks)

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

- a) Calculate safe load carrying capacity of a short column  $450 \text{ mm} \times 450 \text{ mm}$ , reinforced with 10 numbers of 16 mm diameter bars, if M20 concrete and Fe 500 steel is used.
  - b) Calculate the size, depth and area of steel required using only moment criteria for a square footing supporting a column  $500 \text{ mm} \times 500 \text{ mm}$  carrying an axial working load of 1400 kN. Use M25 concrete and Fe 415 steel. Assume SBC of soil is  $400 \text{ kN/m}^2$ . Also, draw the c/s of footing showing reinforcement details.
  - c) Explain the field situation with neat sketch where
    - i) Isolated and
    - ii) Combined RCC footing is used
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