17604

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.

(8) Use Limit state method for all design.

(9) Write the answers in sequential order.

Marks

1. [A] Solve any THREE : **3 × 4 = 12**

(a) Define “Limit State” and state types of Limit States.

(b) State four assumption made in Limit State of collapse for flexure.

(c) State two Ductile detailing provision in IS 13920.

(d) State two advantages and two disadvantages of prestressed concrete.

(e) State various forms of shear reinforcement in beams.

P.T.O.

[B] Solve any ONE : **1 × 6 = 6**

(a) A beam 300 mm × 500 mm effective size carries a factored BM of 175 kN·m. If concrete M20 & steel grade Fe 500 are used, find area of steel.

(b) Find moment of resistance if steel provided is 4 bars of 16 mm diameter in a beam 300 × 600 mm effective & concrete M20 and steel Fe 500 are used.

2. Solve any TWO : **2 × 8 = 16**

(a) Design a one way slab with following data, span = 4.5 m, Live load = 4 kN/m^2, floor finish = 1 kN/m^2. Concrete M20 & Steel Fe 415, M.F. = 1.4. Sketch C/S of slab showing reinforcement details. (No checks)

(b) Design a reinforced concrete slab panel for 6.3 × 4.5 m simply supported on all the four sides. It has to carries a live load of 4 kN/m^2 in addition to its dead load. Use M25 concrete Fe 415 steel. Sketch the C/S of slab along shorter span showing steel details. (No checks) Use α_x = 0.062 & α_y = 0.060.

(c) Design a cantilever chajja with following data :

Span = 1.0 m, Width = 1.5 m, L.L. = 1.00 kN/m^2

Finish = 0.5 kN/m^2, support lintel = 230 × 230 mm

Concrete M20, Fe 415 steel. Sketch the C/S of chajja. Showing steel details. (No checks)

3. Attempt any FOUR : **4 × 4 = 16**

(a) State the conditions of formation of Flanged beams & State effective flange width for T & L beam.

(b) Find the moment of resistance (M_4) of tee (T) beam with following data :

D_f = 120 mm, b_f = 1100 mm, b_w = 275 mm, d = 450 mm, A_{sf} = 2400 mm^2, Concrete M 25, Steel Fe 500.

(c) Diameter of steel bar is 16 mm. Use Fe415 steel and design bond stress is 1.2 MPa. For plain bars in tension. Find development length in tension and compression.

(d) Define development length & state factors affecting development length.

(e) Design a column with following data :

Factored load = 3000 kN, concrete M20, Steel Fe415, Unsupported length = 3.0 m. Assume 1% steel.

4. [A] Attempt any THREE : **3 × 4 = 12**

(a) State methods of prestressing and explain in brief any one.

(b) Calculate load carrying capacity of column 300 mm × 450 mm in size reinforced with 4.16 mm ϕ & 412 mm ϕ dia. bars. Use M20 and Fe 415 steel.

(c) Define term partial safety factor & identify the various factors & values recommended in IS 456 for steel & concrete.

(d) Enumerate at least three situations in which a doubly reinforced beam is provided.

[B] Attempt any ONE : **6**

(a) Determine the ultimate moment (M_U) capacity of a beam b = 280 mm, d = 510 mm, d' = 50 mm, A_{sf} = 2455 mm^2, A_{sc} = 402 mm^2, f_{ck} = 30 N/mm^2, f_y = 415 N/mm^2. Use f_{sc} = 353 N/mm^2.

(b) An R.C. beam 200 × 300 mm effective is constructed with concrete M20 and Steel Fe415. Find the steel required if factored moment on beam is 74 kN·m. Assume d' = 30 mm & σ_{sc} = 353 N/mm^2.

5. Attempt any TWO : **2 × 8 = 16**

(a) A doubly reinforced beam section 250 × 500 mm effective, carries a factored moment of 165 kN·m. Find the area of steel required if M20 concrete & Fe 500 are used. Assume d' = 50 mm & σ_{sc} = 353 N/mm^2.

(b) A beam 300 × 1010 mm effective has a span of 7 m carrying a udl of 45 kN/m throughout the span & provided with Tensile steel is 6.22 mm ϕ bars. If concrete M20 & Fe415 steel are used. Design shear reinforcement. $\tau_{c_{max}}$ = 2.8 N/mm^2, τ_c = 0.56 N/mm^2 for 0.75% steel.

(c) Design an RC column footing with following data size of column = 400 mm × 400 mm, safe bearing capacity on soil = 200 kN/m^2, load on column = 1000 kN. Concrete is M20 and Steel 415. Depth of footing is from B.M. criteria. No shear check is required.

6. Attempt any FOUR : **4 × 4 = 16**

(a) Find (M_U) limiting moment of resistance of a T-beam with following data b_f = 1500 mm b_w = 300 mm, d = 700 mm, D_f = 100 mm, A_{sf} = 2500 mm^2. Concrete M20 & Fe 415 steel.

(b) What do you understand by under reinforced and Balanced section ?

(c) What is the minimum and maximum percentage of tension steel that should be provided in flanged beams ?

(d) What is the minimum and maximum percentage of steel allowed in an R.C. column ? Also state necessasity of lateral ties in column & its spacing.

(e) Calculate the area of longitudinal steel for short circular column of diameter 400 mm with effective length 4.5 m to carry a factored load of 900 kN. Use M20 & Fe 500 steel.

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