17604

11718

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.

Marks

1. (A) Attempt any THREE : **3 × 4 = 12**

(a) Define 'characteristic load' and 'characteristic strength' of material.

(b) Why overreinforced section are not provided in LSM ?

(c) State any two ductile detailing provisions as per IS 13920.

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

(e) When minimum shear reinforcement is provided ? State the equation used for min. shear reinforcement giving meaning of terms used in it.

(B) Attempt any ONE : **1 × 6 = 6**

(a) A rectangular beam 230 mm wide and 400 mm effective depth is reinforced with 4 bars 16 mm diameter on tension side. Calculate the ultimate moment of resistance if M20 grade concrete and Fe415 steel is used.

(b) Draw stress-strain diagram for singly reinforced beam in LSM. State the position of neutral axis in terms of 'd' for critical section and maximum mom. of resistance in terms of b & d using assumption in LSM as per IS 456-2000.

2. Attempt any TWO : **2 × 8 = 16**

(a) Design a slab for a hall 4 m × 10 m for residential building with following data :

Live load = 2 kN/m^2, floor finish = 1 kN/m^2

Width of support = 230 mm, M.F. = 1.4

Main steel 10 mm diameter bars of Fe 415

Distribution steel 6 mm diameter bars of Fe250

Use M20 grade concrete. Also draw the reinforcement detail (No checks)

(b) Design a two way slab with following details :

Size of room = 3.00 m × 4.50 m, LL = 2 kN/m^2

FF = 1 kN/m^2, width of support = 230 mm

BM coefficient α_x = 0.104, α_y = 0.046

Also draw the reinforcement details using 10 mm diameter bars of Fe415. Use M20 grade concrete.

(c) Design a Cantilever Chajja with following data :

Span = 1.2 m, LL = 2 kN/m^2, FF = 1 kN/m^2

Width of support = 230 mm × 400 mm beam.

Draw the reinforcement details.

Use 10 mm diameter bars of Fe 415 & 6 mm diameter bars of Fe 250.

Use M20 grade concrete.

3. Attempt any FOUR: **4 × 4 = 16**

(a) Find the moment of resistance of 'T' beam with following data :

Df = 120 mm, bf = 1200 mm, bw = 300 mm

d = 450 mm, Area of tension reinforcement = 2000 mm^2.

Use M20 grade concrete and Fe415 steel.

(b) A 'T' beam and 'L' beam are provided over a hall of 10 m × 8 m. Spacing of beam is 2.5 m c/c and span 8 m. Calculate the effective flange width of 'T' and 'L' beam. Width of rib = 230 mm, flange thickness = 120 mm.

(c) Define 'development length'. Also determine the development length for 16 mm diameter bar of Fe415 in tension. Take τbd = 1.4 N/mm^2 for a plain bars in tension.

(d) Calculate the shear resisted by two bent up bars of Fe415. Take $\alpha = 45°$.

(e) Write any four assumptions in limit state of collapse in compression as per IS 456 – 2000.

4. (A) Attempt any THREE : **3 × 4 = 12**

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

(b) Calculate the load carrying capacity of a column 400 mm × 400 mm is reinforced with 1% steel of Fe415. Use M20 grade concrete.

(c) State the critical combination of loads as per Is 456-2000. Also state the partial safety factors for concrete and steel for collapse.

(d) Define 'doubly reinforced section'. State any two conditions in which doubly reinforced section is provided.

(B) Attempt any ONE : **1 × 6 = 6**

(a) Determine the ultimate moment of resistance of a doubly reinforced section 250 mm × 400 mm (effective), if Ast = 1500 mm^2, Asc = 600 mm^2. Assume M20 grade concrete and Fe415 steel. fsc = 353 N/mm^2, $\frac{d'}{d} = 0.1$, fcc = 0.45 fck.

(b) Determine the area of steel in tension and compression of a RCC rectangular beam 300 mm × 450 mm (effective). If it is carries a factored moment of 240 kN-m fcc = 0.45 fck, fsc = 353 N/mm^2 $\frac{d'}{d} = 0.1$.

5. Attempt any TWO : 2 × 8 = 16

(a) A doubly reinforced beam 230 mm × 500 mm overall. It carries a design moment of 280 kN-m. Cover on both sides is 40 mm. Use M20 grade concrete and Fe415 steel. Calculate

(i) Design moment of resistance for tension reinforcement.

(ii) Compression steel.

(iii) Total tensile reinforcement.

fcc = 0.45 fck,

$\frac{d'}{d}$	0.05	0.10	0.15
fsc (N/mm^2)	355	353	342

(b) A simply supported beam of span 5 m carries a working udl of intensity 40 kN/m. Size of beam 350 mm × 500 mm (effective). It is reinforced with 4 bars 20 mm diameter. Design 8 mm diameter 2 legged stirrups if one 20 mm diameter bar is bent up. Take Cc = 0.5 N/mm^2, Cc max = 2.8 N/mm^2. Use M20 grade concrete and Fe415 steel.

P.T.O.

(c) Design RC column footing for an axially loaded square column 400 mm × 400 mm. It carries a factored load of 1600 kN. Safe bearing capacity of soil = 200 kN/m^2. Calculate the depth of footing from bending moment criteria only. (No shear check is required) Use M20 grade concrete & Fe415 steel.

6. Attempt any FOUR : 4 × 4 = 16

(a) A 'T' beam with following details :

bf = 1400 mm, bw = 230 mm, d = 650 mm

Df = 100 mm, Ast = 2600 mm^2

Check the neutral axis fall within the depth of the flange.

(b) State the IS specification for the beam

(i) Horizontal spacing between the tension bars.

(ii) Vertical spacing between the tension bars.

(iii) Cover

(iv) Minimum reinforcement.

(c) Define 'T' beam. State the situations where a flanged RCC section is preferred.

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

(e) State the IS specification for the following :

(i) Minimum diameter of bar in column.

(ii) Minimum numbers of bars in circular column.

(iii) Cover to the column.

(iv) Minimum and maximum steel in column.
