17604

15162

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.

Marks

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

(a) Define :

(i) Characteristic strength and

(ii) Characteristic load

(b) Write any four assumptions in design for limit state of collapse in flexure.

(c) What are the earthquake damages to R.C.C. buildings ?

(d) Write any four losses in prestressing and describe any one.

(e) What is nominal shear stress ? Write formula for minimum shear reinforcement.

(B) Attempt any ONE : **1 × 6 = 6**

(a) Calculate depth and area of steel at mid span of a simply supported beam over a clear span 6 m. The beam is carrying all inclusive load 20 kN/m. Assume 300 mm bearings. Use M20 and Fe500. Assume (b = ½ d).

(b) A singly reinforced beam 230 mm × 400 mm (effective) is reinforced with 4 – 20 mm ϕ bars. M15 and Fe415 are used. The beam is subjected to factored moment of 60kNm. Find the maximum stresses in steel and concrete.

2. Attempt any TWO : **2 × 8 = 16**

(a) Design a reinforced concrete slab panel for 4.3 m ×6.55 m. It is supported on all four sides by 230 mm thick walls. It has to carry a live load of 2 kN/m^2 in addition to its dead load. Use M20 concrete and Fe415 steel. Sketch the cross-section of the slab along shorter span showing all details. (No check required). Take a M.F of 1.4.

$\frac{l_y}{l_x}$	1.4	1.5	1.75
α_x	0.099	0.104	0.113
α_y	0.051	0.046	0.037

(b) Design a one way slab with the following data, span = 5 m, live load = 4 kN/m^2 floor finish = 1 kN/m^2. Concrete M20 and Fe415 steel. Take M.F. as 1.4. Sketch the cls of slab showing reinforcement details (No check required).

(c) Design a cantilever chajja with the following data : Span = 1.5 m, L.L = 1.0 kN/m^2, Finish = 0.5 kN/m^2. Support is lintel beam = 230 × 230 mm, M20 concrete, Fe415 steel.

Sketch the cls of chajja showing all details. (No check required).

3. Attempt any FOUR : **4 × 4 = 16**

(a) Draw stress diagram for a T-beam for $x_n = D_f$ and write the equation for M_n when x_n x_{nmax} for this beam.

(b) A T-beam with flange width of 1.5 m, an effective depth of 450 mm, slab thickness of 120 mm, breadth of web of 230 mm is reinforced on tension side only. The area of steel is 2100 mm^2. Using LSM calculate the limits of moment of resistance if M20 and Fe415 steel is used.

(c) Find the lap length of 20 mm diameter bar in tension. Assume M20 concrete and Fe500 grade of steel.

(d) Calculate anchorage value of 45° and 90° bond for 20 mm diameter bar.

(e) Write I.S. specifications for minimum eccentricity and transverse reinforcement of an axially loaded short column.

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

(a) State advantages and disadvantages of prestressed concrete (two each).

(b) What are the assumptions made in limit state of collapse in compression ?

(c) Define limit state. State the values of partial safety factors for material strength of concrete and steel for limit state of collapse.

(d) Give two conditions when doubly reinforced sections are preferred.

(B) Attempt any ONE : **1 × 6 = 6**

(a) Find the ultimate moment capacity (Mu) of a beam 250 × 500 mm (effective) if it is reinforced with 4 – 20 mm diameter bars in tension zone and 3 – 12 mm diameter bars in compression zone, each at an effective cover of 40 mm. Assume M15 mix and Fe415 steel.

For Fe415,

d'/d	.05	0.10	0.15	0.20
$\mathbf{f_{sc}}$	355	352	342	329

(b) An R.C. beam 300 × 600 mm (effective), is constructed with M20 concrete and Fe415 steel. Find the steel required if factored moment on beam is 350 kNm. Assume f_{sc} as 353 N/mm^2.

5. Attempt any TWO : **2 × 8 = 16**

(a) Design a rectangular beam for an effective span of 6 m. The super imposed load is 80 kN/m and size of the beam is limited TO 300 ×700 mm overall. Use M20 and Fe415. Assume a cover of 40 mm.

d'/d	.05	0.10	0.15	0.20
$\mathbf{f_{sc}}$	355	352	342	329

(b) A concrete beam of 300 × 600 mm (effective) carries a factored load of 50 kN/m throughout the span of 6 m. It is provided with 4 nos. of 20 mn ϕ bars on tension side. M20 and Fe415 are used. Design shear reinforcement. Bent-up bars are not provided. Take Z_{cmax} = 2.8 N/mm^2. Take Z_c as 0.525 N/mm^2 for %age of steel provided. Assume 8 mm ϕ vertical stirrups.

(c) Design an RC column footing with following data, size of column = 450 × 450 mm, SBC = 180 kN/m^2, load on column = 1500 kN. Concrete in M20 and Fe415 steel. Depth of footing is for BM criteria. No shear check is required.

6. Attempt any FOUR : **4 × 4 = 16**

(a) For a T-beam with following dimensions, b_f = 1500 mm, b_w = 300 mm, d = 500 mm, Δ_f = 120 mm, A_{st} = 3200 mn^2, M20 concrete and Fe415 steel. Calculate the limiting moment of resistance.

(b) Why over reinforced sections are disallowed in LSM ? Give reason.

(c) A T-beam is having a flange width of 1200 mm, depth of flange 100 mm and 4 bars of 20 mm diameter on the tension side. Locate the position of N.A. from the compression edge of it. M15 and Fe415 are used.

(d) State the IS specification for pitch and diameter of lateral ties.

(e) Calculate safe load carrying capacity of a column 300 mn × 300 mn with 8 bars of 12 mn, M20 and Fe415 are used.