12222

15116

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 <u>THREE</u> of the following:** **12**

(i) State four assumptions made in working stress method.

(ii) State I.S. code clauses for deciding diameters of bar for lateral ties and for deciding pitch of lateral ties in case of columns.

(iii) Define balance under reinforced and over reinforced section with neat sketch and state w.r.t. LSM. which section is performed?

(iv) Draw stress-strain diagram for doubly reinforced section in LSM. State meaning of each term shown in diagram.

Marks

b) **Attempt any <u>ONE</u> of the following:** **06**

(i) Design a R.C. rectangular beam having effective span of 5.0 m. It carries a u.d.l. of 20 kN/m (inclusive of self wt.) throughout its span. Take width of beam as 230 mm. Use material as M20 and Fe415.

(ii) A R.C.C. beam 230 mm wide and 400 mm deep (effective) is supported over an effective span of 6 m and reinforced with four bars of 20 mm diameter along tension side. Calculate the working load which the beam can carry including self weight. Use M20 concrete and Fe415 steel.

2. Attempt any <u>TWO</u> of the following: **16**

a) Calculate ultimate moment of resistance of R.C. beam section 230 mm × 370 mm effective in dimensions. It is reinforced by three bars of 12 mm diameter as compression steel, with an effective cover of 30 mm, where as four bars of 16 mm diameter are placed on tension side. Use M20 and Fe415 steel. Take Fsc = 352.75 N/mm^2 (Use L.S.M.)

b) Design simply supported RCC slab for a roof of a hall 3.5 × 8 m (inside dimension) with 300 mm walls all around. Assume a live load of 3 kN/m^2 and floor finish 1 kN/m^2. Use M25 concrete and Fe415 grade of steel. Draw a neat labelled section and plan giving dimensions and reinforcement details.

c) Design R.C.C. slab for room 4.3 m × 5 m effective. The slab carries total load of 5.48 kN/m. The corner's are free to lift Use grade of concrete M20 and steel Fe415. Assume modification factor M.F. = 1.8, αx = 0.086 and αy = 0.058.

Marks

3. Attempt any TWO of the following: **16**

a) A beam 230 × 560 mm effective reinforced with 6 bars of 25 mm diameter, effective span is 8 m and loaded with 25 kN/m. Design shear reinforcement for beam. Take M20 grade of concrete and Fe415-steel. Use following Table

% Pt	1.0	1.25	1.50	1.75	2.0
τc	0.6	0.64	0.68	0.71	0.70

b) Design a column to carry an axial load of 1600 kN. Use M20 and Fe415 steel. Design suitable links. Sketch the reinforcement details.

c) Design a square isolated footing for a column 300 mm×230 mm, subjected to axial load of 800 kN. Safe bearing capacity of soil is 200 kN/m^2. Use M20 and Fe415. Design for moment and two-way shear only.

4. a) Attempt any THREE of the following: **12**

(i) State two advantages and two disadvantages of pre-stressed concrete.

(ii) State four losses in pre-stressing.

(iii) Define:

1) Characteristics strength of a material

2) Partial safety factor

(iv) Write four IS-specifications for longitudinal reinforcement in columns.

Marks

b) **Attempt any ONE of the following:** **06**

(i) A T-beam is to be provided for a span of 3 m and c/c distance between beam is 4 m. Calculate the effective flange width if width of web is 230 mm and depth of flange is 120 mm.

(ii) A T-beam flange width of 1200 mm and an effective depth of 400 mm. The slab thickness is 100 mm and the breadth of web is 230 mm. The beam is reinforced on tension side only with total steel area of 2000 mm^2. Calculate limiting moment of resistance if M20 and MS Grade I is used.

5. Attempt any FOUR of the following: **16**

a) A doubly Reinforced beam. 250 × 600 mm overall has to resist a factored moment of 310 kN/m. Find the amount of steel required on compression and tension side, if cover on both sides is 50 mm. Concrete M20 and mild steel are used.

b) Define bond stress. State types of bond.

c) Determine the shear reinforcement for a reinforced concrete beam 300 mm wide and 600 mm deep to following data - concrete M15, Steel fy = 250 N/mm^2, % Pt = 0.8, factored shear force = 175 kN, $\tau cmax = 2.5\ N/mm^2$ and $\tau c = 0.55\ N/mm^2$.

d) Draw a neat sketch of T-beam and state conditions for formation of T-beam.

e) Distinguish between one-way slab and Two-way slab giving two points each.

Marks

6. Attempt any FOUR of the following: 16

a) A cantilever slab of effective span 1.75 m is subjected to the design moment of 20 kN/m. Calculate the depth of the slab and the area of reinforcement required. M20 and mild steel are used. Take modification factor of 1.5

b) Draw a labelled sketch of reinforcement details of two-way slab in cross-section along longer and shorter span in plan.

c) Design a slab for a hall 3 mm × 4.5 mm carrying a load of 3 kN/m^2 and floor finish of 1.2 kN/m^2. Supported on walls of 300 mm, all the four corners are free to lift using M20 concrete and Fe415 steel, use $\alpha x = 0.104$ and $\alpha y = 0.046$.

d) Write I.S. specification for minimum eccentricity and transverse reinforcement of an axially loaded short column.

e) Calculate the safe load carrying capacity of column 300 × 300 mm provided with 8 bars of 12 mm ϕ. Use M20 mix and Fe415 steel.