21718

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 : **12**

(a) State the meaning of partial safety factors for material strength and loads.

(b) Draw a neat sketch showing strain diagram & stress diagram for a singly reinforced balanced section.

(c) State the functions of vertical stirrups provided in the beam.

(d) State the meaning of magnitude of earthquake and intensity of earthquake.

(e) Differentiate between pretensioning and pos-tensioning.

(B) Attempt any ONE : **6**

(a) A R.C. beam 230 mm × 400 mm deep effective is reinforced with 1.02% steel of grade Fe 415. Determine the position of NA and ultimate moment of resistance of the beam if f_{CK} = 25 N/mm^2.

(b) A R.C. slab, 120 mm thick effective, has a simply supported effective span of 3.2 m. It is reinforced with 12 mm diameter bars at a spacing of 100 mm. Calculate the safe load (including self weight) the slab can carry if f_{CK} = 20 N/mm^2 and f_Y = 415 N/mm^2.

2. Attempt any TWO : **16**

(a) A 3 m wide passage, supported on 230 mm thick side walls, carries a superimposed load of 3.75 kN/m^2 including floor finish. Design the suitable slab using M20 concrete and Fe415 steel. Use 8 # and 6 ϕ bars. Take MF = 1.4. Apply the checks for maximum area of reinforcement, minimum area of reinforcement and spacing. Do not apply checks for shear and bond. Sketch the cross-section. Use effective cover-20 mm.

(b) Design a two way slab for panel of effective size 5.6 m × 4 m simply supported on all four sides. It carries a live load of 3.5 kN/m^2 and a floor finish of 1 kN/m^2. Use M20 concrete, Fe 500 steel, MF of 1.2, 10 # bars & effective cover of 20 mm. Take α_x = 0.099 & α_y = 0.051. Do not apply check for shear & bond. Draw the cross-section along shorter span.

(c) (i) Draw the cross-section of a dog-legged staircase showing reinforcement details.

(ii) A cantilever slab of effective span 1.0 m carries a superimposed load of 1.5 kN/m^2 including floor finish. Calculate the depth and area of reinforcement. Use M20 concrete and mild steel. Take MF = 1.55.

3. Attempt any FOUR : **16**

(a) State the necessary conditions for the beam to act as a flanged beam.

(b) Write the expressions for effective flange width of T and L beams. State the meaning of each term.

(c) State when and how minimum shear reinforcement is provided. Write the expression for minimum shear reinforcement giving the meaning of terms involved.

(d) A 16 mm diameter bar of grade Fe500 is used for resisting compression. Calculate the development length if the design bond stress is 1.2 N/mm^2 for plain bars in tension.

(e) Write IS specifications for longitudinal and transverse reinforcement of an axially loaded short column.

4. (A) Attempt any THREE : **12**

(a) Define characteristic strength and characteristic load.

(b) Why doubly reinforced beam is provided ? Write the expression for its moment of resistance if $x_u < x_{umax}$.

(c) Enlist the losses in prestressed concrete. Explain any one in brief.

(d) A square column of side 425 mm is reinforced with 8 bars of 20 mm diameter of grade Fe500. If the grade of concrete is M25, calculate the safe load the column can carry.

(B) Attempt any ONE : **6**

(a) A doubly reinforced beam of size 250 mm × 400 mm is reinforced with 3, 20 # bars in tension and 2, 16 # bars in compression each at an effective cover of 40 mm. Calculate the ultimate moment of resistance if f_{CK} = 20 MPa, f_Y = 415 MPa & f_{SC} = 353 MPa.

(b) Calculate the area of steel reinforcements required for a doubly reinforced beam 250 mm × 450 mm over all, subjected to ultimate bending moment of 165 kN-m. Take f_{CK} = 20 MPa, f_Y = 415 MPa, d′ = 45 mm & f_{SC} = 353 MPa. The effective cover to tension steel is 45 mm.

5. Attempt any TWO : **16**

(a) A simply supported beam of span 4 m carries a superimposed load of 50 kN/m. The size of the beam is limited to 230 mm × 400 mm effective. Design the beam using concrete M20 & Fe415 steel. Assume the cover of 40 mm to both reinforcements. Take f_{SC} = 353 N/mm^2 and unit weight of R.C.C. as 25 kN/m^3.

(b) A beam 230 mm × 450 mm deep effective is reinforced with 4–16 # bars of grade Fe415. The beam is subjected to a factored shear force of 147 kN. Design the shear reinforcement. Use two legged vertical stirrups of 8 # bars. Take τ_{uc} = 0.57 N/mm^2.

(c) Design a square column to carry an axial load of 1500 kN. The unsupported length of the column is 3.5 m. Use M20 concrete & 1% Fe500 steel for longitudinal reinforcement. Use MS bar for lateral ties. Apply the check for minimum eccentricity.

6. Attempt any FOUR : **16**

(a) Differentiate between balanced and under-reinforced sections.

(b) Draw the sketch showing the cross-section of an isolated square slopped footing. Show all the reinforcement details.

(c) A column of size 400 mm × 400 mm carries an axial load of 1500 kN. Calculate the size and depth for B.M. of a square pad footing using M20 and Fe500. The safe bearing capacity of soil is 350 kN/m^2.

(d) Calculate the ultimate moment of resistance of a T-beam having – flange width – 1250 mm, thickness of slab – 115 mm, effective depth – 600 mm, width of web – 300 mm & tension reinforcement consisting of 4 bars of 25 mm diameter of grade Fe500. The grade of concrete is M20.

(e) Draw the cross-section, strain diagram and stress diagram for a singly reinforced T beam with the neutral axis within the flange.
