12222

11122

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 the basis on which the R.C. member is designed in Working Stress Method. State the factor of safety applied for steel and concrete in WSM.

(ii) State the meaning of 'Nominal Cover'. State the purpose of providing cover to the reinforcement.

(iii) Compare under reinforced section with over reinforced section with respect to following points- ultimate strain in steel, position of N.A., moment of resistance and nature of failure.

(iv) What is meant by doubly reinforced sections? State the situations in which they are provided?

Marks

b) **Attempt any <u>ONE</u> of the following:** **6**

(i) For a balanced rectangular section of width 'b' mm and effective depth 'd' mm determine the position of NA, ultimate moment of resistance and percentage steel area. Use concrete of grade M25 and steel of grade Fe415.

(ii) A simply supported beam of effective span of 4m carries a load of 35kN/m including self weight. Design the balanced section for the beam for mild exposure using concrete M20 and steel Fe415. Take b = 230mm.

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

a) A beam 300mm × 450mm overall is reinforced with 6 bars of 20mm diameter on tension side and 4 bars of 20mm diameter on compression side with an effective cover of 40mm on both sides. Calculate the moment of resistance if the grades of concrete and steel are M20 and Fe415 respectively. Take f_{sc} = 352MPa.

b) A verandah, 3m wide, is supported on 230mm thick side walls. It carries a super imposed load of 3kN/m^2 including floor finish. Design a suitable slab using concrete M20 and steel Fe415. Take modification factor of 1.4. Sketch the cross-section of the slab along shorter span showing reinforcement details. Check for shear and deflection is not expected.

c) The effective dimensions of a slab panel are 6m × 4m. It carries a superimposed load of 2.5kN/m^2. The weight of finish is 1kN/m^2. Design a suitable slab using M25 and Fe415. Take modification factor of 1.25, α_x = 0.104 and α_y = 0.046. Sketch the cross-section of the slab along longer span showing reinforcement details. Check for shear and deflection is not required.

Marks

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

a) A beam 250mm × 400mm deep effective is reinforced with 3 bars of 16mm diameter of grade Fe415. The shear force at the support is 60kN. Design the shear reinforcement if grade of concrete used is M20. Use 6mm diameter vertical stirrups.

% pt ⟶	0.50	0.75
τ_c in MPa ⟶	0.48	0.56

b) Design a short square column carrying an axial load of 1500kN. The unsupported length of the column is 3.4m. Use concrete M20 and 1.5% steel of grade Fe415. Apply the check for minimum eccentricity and sketch the cross section of the column showing reinforcement details.

c) A square column of size 450mm × 450mm carries an axial load of 1600kN. Determine the size of a square pad footing for the column if the SBC of soil is 300kN/m^2. Calculate the depth of the footing for B.M. criteria and for two way shear action. the grade of concrete used is M25 and steel Fe415.

Marks

4. a) **Attempt any <u>THREE</u> of the following:** **12**

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

(ii) Write four points of differences between pretensioning and post tensioning.

(iii) Define:

(1) Characteristic strength and

(2) Characteristic load.

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

b) **Attempt any <u>ONE</u> of the following:** **6**

(i) Calculate the ultimate moment of resistance of a T-beam for following data-
Width of flange - 1200mm, Depth of flange - 110mm
Effective depth - 600mm, Width of web - 300mm.
Area of tension reinforcement - 1963.5mm^2.
The materials used are M20 and Fe415.

(ii) A floor beam 250mm × 500mm, continuous over three supports, is simply supported at its ends. Each span is 5m. The slab supported by the beams is 120mm thick. Determine the effective flange width of T-beam.

Marks

5. Attempt any <u>FOUR</u> of the following: **16**

a) Draw stress - strain diagram for a doubly reinforced section.

b) State the reasons for providing minimum shear reinforcement in the form of stirrups.

c) Calculate the development length for a bar of diameter 16mm in compression. The grade of steel is Fe500 and design bond stress is 1.2N/mm^2. for plain bars in tension.

d) Draw a neat labelled sketch showing cross section of a T-beam. Write the functions of its flange and web.

e) A cantilever slab of effective span 1.75m is subjected to the design moment of 20kN-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.

6. Attempt any <u>FOUR</u> of the following: **16**

a) A one way simply supported slab of effective span 2.88m is 130mm thick. It is reinforced with 8mm diameter bars of Fe415 at 190mm c/c as main steel and 6mm diameter bars of Fe250 at 140mm c/c as distribution steel. Alternate main bars are bent up. The slab is designed for an ultimate load of 9.37 kN/m. Apply the check for shear for the slab if τ_{uc} for % pt < 0.15 is 0.28 N/mm^2 and k = 1.3.

b) Write the steps in the design of a two way simply supported slab with corners free to lift.

Marks

c) The thickness of waist slab of flight of a dog-legged staircase is 200mm The rise and tread is 150mm and 250mm respectively. If the live load and weight of finish is 3.0kN/m and 1kN/m. Calculate the design load.

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

e) A square R.C. column, 400mm × 400mm in section is 3.6m long with both ends hinged. Whether the column is long or short? Can this column be designed as axially loaded or not?

12222

11122
4 Hours / 100 Marks