[Time : 3 hours] [Marks : 80]

N. B. 1. Question **No.1** is compulsory

2. Answer **any three** questions out of remaining

3. Assume any data, if required and state them clearly.

4. Attempt sub questions in order.

5. Illustrate answer with neat sketches wherever required.

6. Figure to the right indicates full marks.

1. Attempt Any Four.

a. What is the need for the use of high strength concrete and tensile steel in Pre stressed concrete?

b. Derive expression for the position of neutral axis & moment of resistance of balanced rectangular section. **05**

c. State span to depth ratios of two-way slabs for different support conditions to be considered for the control of deflection. **05**

05

d. What are the critical sections of determining the bending moment, one way shear and two way shear in isolated footing? **05**

e. Determine axial load carrying capacity of column 6.5m unsupported length and 500 mm in diameter. Use M20 grade Concrete and Fe 415 grade steel. If the helical reinforcement is provided then what is the load carrying capacity of the same column. **05**

2.

A. Determine the following for a rectangular beam section of width **b** mm and effective depth **d** mm. Use M20 grade Concrete and Fe 415 grade steel.

a. The position of the neutral axis

b. Lever arm

c. Moment of resistance

d. Percentage of steel. **10**

B. A concrete beam is prestressed by a cable carrying an initial prestressing force of 500 kN. The C/S area of the wire in the cable is 300mm^2. Calculate the percentage loss of stress in the cable due to shrinkage of concrete. Assuming the beam to be

a. Pre-tensioned

b. Post-tensioned **10**

3.

A. A 300mmX650mm reinforced concrete beam section is reinforced with 4-20mm diameter tension steel at d= 600mm, and 2-20mm diameter compression steel at d^1= 40mm. The section is subjected to a bending moment of 180 kN-m, use m=18

a. Find the maximum stress in concrete

b. Calculate the stress in tension and compression steel **10**

B. State different methods of post –tensioning and pre-tensioning methods. Discuss any one post-tensioning method in detail. **10**

4 A. A simply supported beam of effective span 5.5 meter is 300mm x 600mm effective, carries a UDL of 60 KN/m. It is reinforced with 4 bars of 20mm diameter in tension zone. Design shear reinforcement. Use M20 concrete & Fe415 steel. **10**

Pt %	0.25	0.50	0.75	1.0	1.25	1.50	1.75	2.0	2.25	2.5
Tc N/mm^2	0.22	0.3	0.35	0.39	0.42	0.45	0.47	0.49	0.51	0.51

B. The roof of a cycle parking stand consist of a reinforced concrete slab which cantilevers 4m on each side of a central reinforced concrete beam supported on columns. Design and detail the cantilever slab. Use M 20 and Fe 415. **10**

5 A. A pre-stressed concrete beam with a rectangular section 250mm wide by 350mm deep supports a uniformly distributed load of 5.5 kN/m, which includes the self weight of the beam. The effective span of the beam is 4.5 m. The beam is concentrically prestressed by a cable carrying a force of 200 kN. Locate the position of the pressure line in the beam **10**

B. Design a sloped footing for a square column of 500 mm x 500 mm with 8 longitudinal bars of 16 mm diameter carrying a service load of 1200 kN. Use M 20 and Fe 415 both for column and footing slab. The safe bearing capacity of soil is 150 kN/m^2. 10

6

A. Design and detail an interior panel 4.5mx5m of simply supported floor slab resting on brick wall on all four sides of thickness 200 mm. Subjected to live load of 3 kN/m^2 & floor finish 1 kN/m^2 . Adopt M20 & Fe415, Use αx =0.089 , αy =0.056 **10**

B. Design a R.C. column to carry an axial load of 300 kN. The size of the column is restricted to 400mmX400mm. The effective height of the column is 5.5m. Use M20 concrete and Fe 500 steel. **10**

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