Exam.		Back	
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

Subject: - Design of Reinforced Concrete Structures

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Four** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ IS 456, IS 1343 and SP16 are allowed to use.
- ✓ Notations given are of usual meaning.
- ✓ Assume suitable data if necessary.

1. a) Write the characteristics of steel reinforcing bars used in the reinforced concrete structures. [5]

   b) Design a simply supported reinforced concrete beam of rectangular section at limit state of collapse in flexure and shear. The beam is subjected to a design load of 45 KN/m (including self weight). Clear span of the beam is 6m. Take M20 grade of concrete and Fe415 steel as the materials of beam. [15]

2. a) Show that $L_d \leq 1.3 \, M_l / V_u + l_d$ [10]

   Where, L_d - Required development of reinforcement
   M_l - Moment resisting capacity of flexure member
   V_u - Design shear force
   l_d - Additional anchorage length of reinforcing bar

   b) A reinforced concrete column of size 600mm×400mm with A_{st} = 8-28mm diameter is subjected to M_{ux} = 350 KN-m, M_{uy} = 50 KN-m and P_u = 2000KN. Check whether the column is safe for above combination of load and bending moments. Take M20 and Fe415 grades of concrete and steel respectively and the effective cover to reinforcing bar 60mm. [10]

3. a) What is the principle of sufficient stiffness method to control deflection? How the deflection of RC flexure member is controlled by this method. [6]

   b) Design a simply supported RC slab of 4m×6m at limit state of collapse in flexure. Arrange the designed reinforcing bars and draw a neat sketch of slab showing arrangement of top and bottom reinforcements. [14]

   Take,   Live load = 4 KN/m2   Floor finish = 1 KN/m2
   Grade of concrete = M20   Grade of steel reinforcement = Fe500

4. a) Design a RC concrete spread footing of a RC wall having 4m length and 300mm width. Total load on wall is equal to 1000KN at service state. Take M20 and Fe415 grades of concrete and steel respectively, and safe bearing capacity of soil = 150KN/m². [12]

   b) Explain how a RC structural member subjected to torsion, shear force and bending moment is designed by IS code method. [8]

5. a) A rectangular beam of 200mm wide and 375mm deep has an effective span 9m. The prestressing cable has a triangular profile with zero eccentricity at ends and 75mm at mid span. The effective prestressing force is 800KN after all loss. Determine maximum value of concentrated load that the beam can support at mid span. [10]

   b) Write down design steps for the design of RL long column of unbraced frame. [10]

***