

Exam.	Regular / 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**.
- ✓ Assume suitable data if necessary.

1. a) Prove that  $S_v = \frac{0.87 f_y \cdot A_{st} \cdot d}{V_s}$  or  $L_d = \frac{0.87 f_y \cdot \phi}{4 \tau_{bd}}$ . The symbols have their usual meanings. [5]  
b) A beam of 6m span is simply supported and carrying 24 kN/m live load and 3 kN/m dead loads excluding self weight. The beam is made of M20 concrete and Fe415 steel. Design the beam. Shear design is not required. [15]
2. a) Discuss briefly Limit State of Serviceability conditions. [5]  
b) Determine the reinforcement in a biaxially loaded column with the following parameters: [15]  
Size of column = 400mm × 600mm  
Factored load,  $P_u = 1500$  kN  
Factored moment,  $M_{ux} = 300$  kNm  
Factored moment,  $M_{uy} = 200$  kNm  
Assume M25 concrete and Fe 415 steel.
3. a) Explain about detailing of reinforcement in staircases. [5]  
b) Design a reinforced concrete rectangular footing for a square column of size 450mm × 450mm, which is subjected to an axial load of 1650 kN and uni-axial moment of 240 kNm at service state. Consider allowable bearing capacity of soil as 120 kN/m<sup>2</sup>. Show design summary and reinforcement detailing with neat sketch. [15]
4. a) What do you understand by splicing of bars? Write down the primary conditions for the application of splicing in reinforced concrete structures. [5]  
b) Design a two-way slab resting on RCC beams on all sides for a room having clear dimensions of 4m × 6m. The slab is subjected to a super-imposed live load of 2.5 kN/m<sup>2</sup> and floor finishes (screeds and flooring) load of 2.75 kN/m<sup>2</sup>. Take M20 concrete grade and Fe415 steel grade. [15]
5. a) Draw idealized stress-strain curve for both steel and concrete and discuss on the design value of stresses. [5]  
b) A rectangular beam 180mm × 400mm is prestressed by a cable with an eccentricity of 75mm above the centroid at the supports and an eccentricity of 50mm below the centroid at the mid-span. Initial prestress is 900 N/mm<sup>2</sup> and area of the cable is 500mm<sup>2</sup>. Calculate the prestressing force at the other end of the beam if its span is 10m. Assume  $\mu = 0.50$  and  $K = 0.0016/m$ . [15]