**15CV51**

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# Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
## Design of RC Structural Elements

Time: 3 hrs.                                                                                  Max. Marks: 80

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Assume any missing data suitably*
3. *IS 456 : 2000 and SP -16 are allowed.*

## Module-1

1  a. Explain the following with sketch.
(i) Characteristics load  (ii) Characteristics strength  (iii) Partial safety factors.  **(06 Marks)**
b. Enumerate various limit states to be considered in design and explain briefly.  **(04 Marks)**
c. With neat sketch of stress – strain Diagram write the assumptions made in limit state designing.  **(06 Marks)**

### OR

2  a. What is Stress block? Derive expression for stress block parameters.  **(06 Marks)**
b. Explain briefly about balanced, under reinforced and over reinforced sections with strain Diagram.  **(04 Marks)**
c. Explain: i) Short term deflection  ii) long-term deflection  iii) Slenderness limits for beam lateral stability.  **(06 Marks)**

## Module-2

3  a. Differentiate between singly reinforced and doubly reinforced beams, and list the situation in which doubly reinforced section are used.  **(04 Marks)**
b. A rectangular Reinforced concrete beam of size 300mm × 550mm is simply supported over an effective span of 7mtr, is reinforced with 4 bars of 20mm diameter. Determine maximum super imposed UDL which can be carried by beam apart from its self weight, and also find area of tension steel to be modified to make section an balanced section. Use M20 grade concert and Fe 415 steel. Assume effective cover for tension steel 50mm. Density of RCC 25kN/m$^3$.  **(12 Marks)**

### OR

4  a. Write the expressions for moment resisting capacity of flanged sections for various cases of Neutral axis depth with respect to Depth of Flange.  **(06 Marks)**
b. A rectangular beam is 250mm wide and 500mm deep, is reinforced with 3 bars of 20mm dia bars in compression zone. Determine the area of tension reinforcement needed to make the section fully effective. Also find the moment of resistance of section. Assume M20 Grade concrete and Fe 415 steel, cover for reinforcement is 50mm.  **(10 Marks)**

## Module-3

5  a. Brief about codal provisions made in providing longitudinal and lateral reinforcement in beams.  **(04 Marks)**
b. A simply supported rectangular beam is supported on 300mm wide walls, over a clear span of 6mtrs. Design the beam by using M25 grade concrete and Fe 415 Grade steel. Superimposed load on beam is 15kN/m and breadth of beam is 230mm.  **(12 Marks)**

**OR**

6  a. What is Torsion? Write expression for equivalent bending moment and equivalent shear force for members subjected to torsion. **(03 Marks)**

   b. A T-beam slab floor has 125mm thick slab forming a part of T-beam. The end bearing are 450mm wide. Clear span is 8m. Spacing of T-beam is 3.5m clear. Live load on floor is $3kN/m^2$ Design an intermediate beam. Use M20 Grade concrete and Fe 415 steel. **(13 Marks)**

### Module-4

7  a. What is Development length? Write expression for Development length of MS and HYSD bars. **(04 Marks)**

   b. Design a cantilever balcony slab having projection of 1.25mtr from beam face. Consider live load on slab $3kN/m^2$ and floor finish $1kN/m^2$. Use M20 grade concrete and Fe 415 steel. Calculate the development length of main steel to be embedded. **(12 Marks)**

**OR**

8  a. Differentiate between one way and two way slab, and mention codal provisions for steel reinforcement in slabs. **(03 Marks)**

   b. Design two way slab for a room of size 4m × 5m. The slab is simply supported over 300mm thick wall. Live load and floor finish on slab is $4kN/m^2$ and $1kN/m^2$ respectively. Corners are held Down. Use M20 Grade concrete and Fe 415 Grade steel. **(13 Marks)**

### Module-5

9  a. What are the codal provision to design longitudinal and lateral reinforcement for columns. **(06 Marks)**

   b. A RC column of size 300mm × 400mm is 5 mtrs long is effectively held and restrained against rotation at both ends subjected to an ultimate load of 1100kN and ultimate moment of 150kN-m about major axis. Design column by using SP -16 for 2 side and 4 side reinforcement arrangement. Use M25 Grade concrete and Fe415 steel. **(10 Marks)**

**OR**

10  Design a RC Footing for column size 400mm × 400mm, which carries a maximum load of 800kN. SBC of soil is $200kN/m^2$, If one side of footing is to be restricted to 1.50 mtr. Use M20 grade concrete and Fe 415 Grade steel. **(16 Marks)**

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