CBCS SCHEME

USN

17CV/CT51

# Fifth Semester B.E. Degree Examination, Jan./Feb. 2023
## Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

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



### Module-1

1 a. Explain:
(i) Developmental length of bars (ii) Short term deflection
(iii) Long term deflection (iv) Partial safety factor **(08 Marks)**

b. Simply supported beam of rectangular section of span 6 m has a width of 300 mm and overall depth 600 mm. The beam is reinforced with 4-25 mm bars on tension side. The beam is subjected to moment of 160 kNm. Check the beam for serviceability limit state of cracking. Assume $M_{25}$ and Fe415. **(12 Marks)**

**OR**

2 A rectangular simply supported beam of span 5m is 300 mm × 650 mm is the cross section. It carries a total load of 30 kN/m over its entire span, out of which 10 kN/m is live load. The beam is reinforced with 3 bars of 20 mm on tension side at an effective cover of 50 mm. Calculate the deflection at central span due to shrinkage and creep if:
(i) Ultimate shrinkage strain = 0.0003
(ii) Creep coefficient = 1.6
Concrete mix of grade $M_{20}$ and FE 415 steel. **(20 Marks)**

### Module-2

3 a. A simply supported rectangular beam 250 mm width and 600 mm depth consist of 3 bars of 20 mm dia in tension zone. Use M20 and Fe 415. Determine:
(i) Moment of resistance
(ii) The udl on beam if span is 5m. **(10 Marks)**

b. A rectangular beam is of 230 × 500 mm overall size, with an effective cover of 50 mm both on tension and compression sides. It is reinforced with 3 bars of 20 mm on the compression side. Calculate the steel on the tension side and the total moment of resistance of the section. Assume $M_{25}$ and Fe415. **(10 Marks)**

**OR**

4 a. Calculate the moment of resistance of an isolated T-beam, given the following data:
Simply supported span = 8m Actual width of flange = 1m
Depth of flange = 120 mm Width of web = 400 mm
Effective depth = 450 mm Overall depth = 500 mm
Tension reinforcement = 1500 $mm^2$
Use $M_{20}$ and Fe 415. **(10 Marks)**

b. A rectangular beam of width 350 mm and effective depth 900 mm with effective cover 50 mm consists of 5-20 mm dia in tension and 2-20 mm dia in compression. Determine moment of resistance. Use $M_{20}$ and Fe 415. **(10 Marks)**

## Module-3

5 a. Design a cantilever beam of clear span 3m, supported on 300 mm wide column. The beam is subjected to udl of 10 kN/m and a point load 20 kN at free end. Use $M_{20}$ and Fe 415. Design the beam for flexure and shear. **(10 Marks)**

b. A rectangular beam is to be simply supported on supports of 230 mm width. The clear span of the beam is 6m. The beam is to have width of 300 mm. The super imposed load is 12 kN/m. Use $M_{20}$ and Fe 415. Design the beam. **(10 Marks)**

**OR**

6 Design the reinforcement for a rectangular beam of section 250 × 600 mm. Effective span of the beam is 6m and effective cover should be 50 mm. Imposed load on the beam is 45 kN/m. Apply check for deflection with the neat sketch of reinforcement details. **(20 Marks)**

## Module-4

7 a. Explain one way and two way slab with examples. **(04 Marks)**

b. Design a slab over a room of internal dimension 4m × 5m on 230 mm thick brick wall all edges are simply supported (corner of the slab are held down). Use live load 3 kN/m$^2$, floor finish 1 kN/m$^2$. Use $M_{20}$ and Fe 415. Apply check for deflection with the reinforcement details. **(16 Marks)**

**OR**

8 Design a dog legged stairs for an office building in a room measuring 2.8 m × 5.8 m clear. Vertical distance between the floors is 3.6 m. Width of flight is to be 1.25 m. Allow a live load of 3 kN/m$^2$. Sketch the reinforcement details. Use $M_{20}$ and Fe 415. Assume the stairs are supported on 230 mm wall at the end of outer edges of landing slabs. **(20 Marks)**

## Module-5

9 a. Explain short column and long column. **(04 Marks)**

b. Design a isolated footing for a rectangular column of 300 × 500 mm supporting an axial load of 1000 kN factored. Assume SBC of soil as 1 kN/m$^2$. Use $M_{20}$ and Fe415. Sketch the reinforcement and perform the necessary checks. **(16 Marks)**

**OR**

10 a. What is the role of transverse reinforcements in columns? What are the codal provisions to design the transverse reinforcement? **(05 Marks)**

b. Design necessary reinforcement for reinforced concrete short column 400 × 600 mm to carry on axial load 1800 kN. Use $M_{20}$ and Fe 415 with reinforcement details. **(15 Marks)**

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