

Fifth Semester B.E. Degree Examination, June/July 2019
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. Use of IS456-2000 and SP-16 is permitted.
3. Assume any missing data suitably.*

Module-1

- 1 a. Explain the principles of limit state design. (06 Marks)
b. Enlist the reasons for adopting partial safety factors for loads and material strength. (05 Marks)
c. Derive from the fundamentals the expression for the area of stress block $0.36 f_{ck} x_u$. (05 Marks)

OR

- 2 a. Explain short term deflection and long term deflection. (06 Marks)
b. A simply supported RCC beam of size 300mm × 600mm carries a Udl live load of 25 kN/m and superimposed load [Dead load] 12 kN/m over an effective span of 5m. It is reinforced with 4 - # 16mm diameter bars. The effective cover is 50mm. Calculate the short term deflection and long term deflection of beam, if i) Ultimate shrinkage coefficient = 0.0003, ii) Creep co-efficient = 1.6, concrete grade M20, and steel Fe415 are used. (10 Marks)

Module-2

- 3 a. A singly reinforced concrete beam of 250mm × 450mm deep upto the centre of reinforcement is reinforced with 3-#16 at an effective cover of 50mm, effective span 6m, M20 concrete and Fe415 steel. Determine the central point load that can be supported in addition to the self weight. (10 Marks)
b. Determine the moment of resistance of a T-beam for the following data:
Breadth of the flange = 740mm,
Effective depth = 400mm,
Breadth of web = 240mm,
Area of steel = 5 – 20 and
Depth of flange = 110mm,
Adopt M20 grade concrete and Fe415 steel. (06 Marks)

OR

- 4 a. A doubly reinforced beam section is 250mm wide and 450mm deep upto the centre of the tensile reinforcement. It is reinforced with 2-φ16 as compression reinforcement at an effective cover of 50mm and 4-φ25 as tensile steel, using M20 concrete and Fe250 steel, calculate the ultimate moment of resistance of the beam section. (09 Marks)
b. A Tee beam has the following data:
i) C/C spacing of beams = 3.20mt,
ii) Simply supported efficiency span of (simply) beam ⇒ 8m
iii) Depth of slab = 150mm
iv) Size of web of beam = 300mm × 500mm.
Calculate the balanced moment of resistance. (07 Marks)

Module-3

- 5 Design a reinforced concrete beam of rectangular cross-section using the following data: Effective span = 5m, width of beam = 250mm, overall depth = 500mm, service load including dead load and live load = 40kN/m, tension cover = 50mm. Adopt M20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details. (16 Marks)

OR

- 6 a. List the circumstance under which doubly reinforced beam are recommended. (04 Marks)
b. A rectangular beam 230mm × 550mm deep is subjected to a sagging BM of 40 kNm, shear force of 30kN and twisting moment of 11.5 kNm at a given section. Design the reinforcement if M20 grade concrete and Fe415 steel are used. Sketch the details. (12 Marks)

Module-4

- 7 Design a R.C.C. slab for an office floor 4.5m × 5.5m with all four edges discontinuous and corners held down. The live load on the slab is 3kN/m². Assume floor finish as 0.6 kN/m² and ceiling finish as 0.4 kN/m². Use M20 concrete and Fe415 steel. Sketch the reinforcement details. (16 Marks)

OR

- 8 Design a Dog legged Stair for an office building in a room measuring 2.8m × 5.8m clear vertical distance between the floors is 3.6m. The width of flight is to be 1.25m. Assume live load of 3kN/m². Use M-20 concrete and Fe-415 grade steel. Assume that the stairs are supported on 230mm at the outer edges of landing stairs. Sketch the reinforcement details. (16 Marks)

Module-5

- 9 a. Design the reinforcement for a square column of size 450mm × 450mm to support a service load of 1500kN. Use M20 concrete and Fe-415 steel. (08 Marks)
b. A column size of 300mm × 400mm has an effective length of 3.6m and is subjected to $P_u = 1100\text{kN}$ and $M_u = 150\text{kNm}$, about the major axis. Assuming the bars on two sides, design the column using M25 concrete and Fe415 steel. (08 Marks)

OR

- 10 Design an isolated footing of uniform thickness of a RC column, bearing a vertical load of 600kN and having a base of size 500mm × 500mm. The safe bearing capacity of the soil may be taken as 120kN/m². Use M-20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details. (16 Marks)