

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

**Course Code: CE301**  
**Course Name: DESIGN OF CONCRETE STRUCTURES I**  
*Use of IS 456:2000 is permitted*

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Distinguish between balanced, over-reinforced and under-reinforced sections in limit state design. Which of these should be recommended in design? (5)
- b) Find the moment of resistance of a singly reinforced concrete beam of 200 mm width and 400 mm effective depth, reinforced with 4 bars of 16 mm diameter of Fe415 steel. Take M20 concrete. Redesign the beam if necessary. (10)
- 2 a) With neat sketch explain the stress block parameters used in the design of singly reinforced concrete beam as per limit state method. (5)
- b) Design the shear reinforcement for a beam with  $b= 350$  mm,  $d= 550$  mm,  $V_u= 125$  kN,  $f_{ck}= 25$  N/mm<sup>2</sup>,  $f_y= 415$  N/mm<sup>2</sup>. Percentage of steel is 1.67 percent. (10)
- 3 a) A simply supported beam, 300 mm wide and 600 mm effective depth carries a uniformly distributed load of 74 kN/m including its own weight over an effective span of 6 m. The reinforcement consists of 5 bars of 25 mm diameter. Out of these, two bars can be safely bent up at 1 m distance from the support. Design shear reinforcement for the beam. (10)
- b) Define development length and derive an expression for development length. (5)

**PART B**

*Answer any two full questions, each carries 15 marks.*

- 4 a) What are the situations that demand double reinforcement in beams? Compare the stress strain distributions in singly reinforced and doubly reinforced beams. (5)
- b) Determine the moment of resistance of beam having width  $b$  of 350 mm, depth of 900 mm with a cover of 50 mm. Beam is reinforced with 5 tension reinforcements of 20 mm HYSD bars (Fe 415) and 2 compression reinforcements of 20 mm Fe 415 steel. Grade of concrete is M15. (10)

- 5 Design a simply supported RCC slab for a roof of a hall  $4\text{ m} \times 10\text{ m}$  (inside dimensions) with 230 mm walls all around. Assume a live load of  $4\text{ kN/m}^2$  and finish  $1\text{ kN/m}^2$ . Use M 25 concrete and Fe 415 steel. (15)
- 6 a) Differentiate between one way slab and two way slab. (5)
- b) A T-beam has the following data: width of flange= 750 mm, Breadth of beam= 250 mm, Effective depth= 500 mm, Thickness of flange= 90 mm. Determine the limiting moment of resistance of the beam. Use M20 concrete and Fe415 steel. (10)

### PART C

*Answer any two full questions, each carries 20 marks.*

- 7 a) Design a reinforced concrete slab  $6.3 \times 4.5\text{ m}$  simply supported on all the four sides. It has to carry a characteristic live load of  $10\text{ kN/m}^2$  in addition to its dead weight. Assume M25 concrete and Fe 415 steel; also assume mild exposure conditions. (15)
- b) Explain the procedure for estimation of flexural crack width in reinforced concrete members as per IS456. (5)
- 8 a) Design and detail a dog-legged stair for a building in which the vertical distance between the floors is 3.6 m. The stair hall measures  $2.5\text{ m} \times 5\text{ m}$ . The live load may be taken as  $2500\text{ N/m}^2$ . Assume that stair is supported at outer edges. Use M20 concrete and Fe415 steel. (15)
- b) Sketch typical reinforcement detail in tread-riser type stairs. (5)
- 9 a) Design a circular short column to carry an axial load of 1000 kN using helical reinforcement. Use M20 concrete and Fe 415 steel. (12)
- b) How does one (a) check for deflections of two way slabs, and (b) control crack width in two way slabs? (8)

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