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

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

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (S, FE) / S3 (PT) (S,FE) Examination June 2024 (2015 Scheme)



Course Code: CE301

Course Name: DESIGN OF CONCRETE STRUCTURES I

Max. Marks: 100

Duration: 3 Hours

Use of IS 456-2000 is permitted

**PART A**

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

Marks

- |   |    |  |      |
|---|----|--|------|
| 1 | a) | Compare the three design philosophies  | (5)  |
|   | b) | Calculate the safe UDL that can be carried by a simply supported beam having span 6m and of rectangular beam of cross section 320 mm x 600 mm reinforced with 4 Nos of 20 mm dia bars in the tension side. Use M20 grade concrete and Fe 415 steel.  | (10) |
| 2 | a) | Show that the limiting depth of neutral axis for a rectangular cross section reinforced with Fe 415 grade steel is 0.48d.  | (5)  |
|   | b) | Design the shear reinforcement for a rectangular beam of size 300 mm x 500 mm in size if it is simply supported over a span of 5 m and carries a UDL of 50 kN/m and a central concentrated load of 50 kN. Use M25 concrete and Fe 415 steel.   | (10) |
| 3 | a) | Calculate the development length of 16 mm diameter bars in M25 concrete if steel is (a) Fe 250, (b) Fe 415.  | (5)  |
|   | b) | A 300 mm wide and 450 mm deep RC beam is reinforced with 3, 16mm bars of Fe 415 grade, of which one of the bars is bent up at 45° near the support. The beam is provided with 8 mm dia vertical stirrups of Fe 415 grade at a spacing of 150 mm c/c throughout. Determine the shear capacity of the section if the grade of concrete is M20. | (10) |

**PART B**

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

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|---|----|--|------|
| 4 | a) | A T beam floor consists of 120 mm thick RC slab monolithic with 300 mm wide beams. The beams are spaced at 4m c/c and their effective span is 5m. If | (10) |
|---|----|--|------|

the superimposed load on the slab is  $5\text{kN/m}^2$ . Design an intermediate T beam using M20 concrete and Fe415 steel.

- b) Draw the typical reinforcement detailing in a continuous beam. (5)
- 5 a) Design a simply supported roof slab for a room  $8\text{m} \times 3.5\text{m}$  clear size for a superimposed live load of  $4\text{kN/m}^2$ . Use M20 concrete and Fe415 steel (12)
- b) Draw the reinforcement detailing in a cantilever slab (3)
- 6 a) Design the torsional reinforcement in a rectangular beam section  $300\text{mm} \times 600\text{mm}$  subjected to a twisting moment  $70\text{ kNm}$ , combined with bending moment of  $90\text{ kNm}$  and a shear force of  $60\text{ kN}$ . Assume M20 concrete and Fe 415 steel. (15)

### PART C

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

- 7 a) Design a two way slab over a class room  $5\text{m} \times 7\text{m}$  with  $230\text{mm}$  brick walls around. Assume a live load of  $4\text{kN/m}^2$  and a finishing load of  $1\text{ kN/m}^2$ . Assume that the slab corners are free to lift up. Use M20 concrete and Fe 415 steel (14)
- b) Explain IS code procedure for the calculation of long term deflection. (6)
- 8 a) A simply supported beam having  $4\text{m}$  span is  $300\text{mm} \times 500\text{mm}$  in cross section. The beam is subjected to a bending moment  $150\text{ kNm}$  under service loads and is reinforced with 3,  $20\text{mm}$  dia bars in the tension side. Calculate the crack width under a bar in the tension side. Use M20 concrete and Fe 415 steel. (12)
- b) Design a short axially loaded column for a factored load  $4000\text{ kN}$ . The Unsupported length of column is  $3\text{m}$ . Use M20 concrete and Fe415 steel (8)
- 9 a) Differentiate between short columns and long columns (5)
- b) Design and detail a dog legged stair for the following data: The clear height between floors =  $3\text{m}$ , rise =  $150\text{mm}$ , tread =  $25\text{ cm}$ , width of flight =  $1.25\text{ m}$ , landing width- $1.25\text{ m}$ , live load  $5\text{ kN/m}^2$ . Assume the stair to be supported on  $200\text{mm}$  brick wall at the outer edges of landing parallel to the risers. Use M20 M20 concrete and Fe 415 steel (15)

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