

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fifth Semester

Civil Engineering**20CEPC503 - DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES**

Regulations - 2020

(Use of IS 456:2000, IS 456-1976, SP-16 Code book is permitted)

Duration: 3 Hours

Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

- | | <i>Marks</i> | <i>K-
Level</i> | <i>CO</i> |
|---|--------------|---------------------|-----------|
| 1. What is the limit state method of design based on?
(a) The working loads (b) The failure loads
(c) The ultimate loads (d) Multiple limit states | 1 | K1 | CO1 |
| 2. In the limit state method, what is the primary consideration for the design of a singly reinforced beam?
(a) The beam's ability to resist shear forces
(b) The beam's ability to resist bending moments
(c) The beam's ability to resist axial force
(d) The beam's ability to resist torsional forces | 1 | K2 | CO1 |
| 3. What is the purpose of providing compression reinforcement in a doubly reinforced beam?
(a) To increase the beam's shear resistance (b) To increase the beam's flexural resistance
(c) To reduce the beam's deflection (d) To reduce the beam's cracking | 1 | K1 | CO2 |
| 4. Which of the following is a type of flanged beam?
(a) T-beam (b) L-beam (c) Rectangular beam (d) Both A and B | 1 | K1 | CO2 |
| 5. What is the purpose of providing stirrups in an RC beam?
(a) To resist bending moments (b) To resist shear forces
(c) To resist axial forces (d) To resist torsional forces | 1 | K2 | CO3 |
| 6. As per IS code, what is the maximum permissible deflection for a beam?
(a) Span/100 (b) Span/200 (c) Span/250 (d) Span/350 | 1 | K2 | CO3 |
| 7. What is the minimum reinforcement required in a slab as per IS code?
(a) 0.1% of the gross cross-sectional area (b) 0.2% of the gross cross-sectional area
(c) 0.3% of the gross cross-sectional area (d) 0.15% of the gross cross-sectional are | 1 | 1 | CO4 |
| 8. What are the edge conditions for a two-way slab?
(a) Simply supported, fixed, and free
(b) Simply supported, fixed, and continuous
(c) Simply supported, cantilever, and continuous
(d) Fixed, cantilever, and free | 1 | K2 | CO4 |
| 9. How is a column designed for biaxial bending?
(a) Using the interaction diagram for uniaxial bending
(b) Using the interaction diagram for biaxial bending
(c) Using the load-moment interaction equation
(d) Using the moment-curvature relationship | 1 | K2 | CO5 |
| 10. How is the thickness of a footing determined?
(a) Based on the shear force and bending moment (b) Based on the soil bearing capacity
(c) Based on the column load (d) Based on the footing size | 1 | K2 | CO6 |

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

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|---|---|----|-----|
| 11. List the Factors to be considered for limit state of Collapse and Serviceability. | 2 | K1 | CO1 |
| 12. Differentiate WSM from LSM. | 2 | K2 | CO1 |
| 13. On what circumstances doubly reinforced beams are to be adopted. | 2 | K1 | CO2 |

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|--|---|----|-----|
| 14. Enlist the advantages of flanged beams. | 2 | K1 | CO2 |
| 15. Summarize about the distribution of torsional reinforcement as per IS 456:2000. | 2 | K2 | CO3 |
| 16. Define development length. | 2 | K1 | CO3 |
| 17. Sketch the load distribution of one-way and two-way slab. | 2 | K1 | CO4 |
| 18. Show the condition for reinforcement in two-way slab for continuous edge and discontinuous edge. | 2 | K1 | CO4 |
| 19. Differentiate between uniaxial and biaxial bending. | 2 | K2 | CO5 |
| 20. Write down the formula for ultimate load carrying capacity of a short axially loaded column. | 2 | K1 | CO5 |
| 21. When you need a combined footing? | 2 | K1 | CO6 |
| 22. Why punching shear is not encouraged in design of footing? | 2 | K1 | CO6 |

PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

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|--|----|----|-----|
| 23. a) A simply supported RC beam has a width of 200 mm it is reinforced with 2 numbers of 20mm dia of effective depth of 400mm. M20 grade concrete and Fe415 grade steel. Determine the ultimate moment of resistance. | 11 | K3 | CO1 |
| OR | | | |
| b) Design a rectangular section of a reinforced concrete beam having a clear span of 5m which carries an service load of 4 KN/m throughout the span. Use M20 and Fe415 steel. | 11 | K3 | CO1 |
| 24. a) Identify the different Steps involved in the design of flanged beams. And explain it. | 11 | K3 | CO2 |
| OR | | | |
| b) Design a T beam section with a flange width of 1200mm and flange depth of 100mm and a web width of 250mm and effective depth of 500mm, which is subjected to a factored moment of 550KNm. Use M20 and FE415 by Limit state method. | 11 | K3 | CO2 |
| 25. a) Design the shear reinforcement of vertical stirrups required for a beam section with the following data. Beam size 300mm x 600mm ,depth of beam 600mm, factored shear force 180KN percentage of tensile reinforcement is 0.8. Use M15 and Fe250 Steel. | 11 | K3 | CO3 |
| OR | | | |
| b) The rectangular beam of width, 300 mm is having overall depth of 600 mm. The concrete grade is M20 and the grade of reinforcing steel is Fe415. The tensile reinforcement is provided by 4-20 mm bars. In the compression side, the reinforcement is provided by 2-16 mm bars. The effective cover is 50 mm at top and bottom. Determine shear strength of the support section. | 11 | K3 | CO3 |
| 26. a) Design a slab with clear span of 3.5m simply supported on 200mm thick concrete masonry walls to support a live load of 4 KN/m ² . Use M25 & Fe415 HYSD Bars. | 11 | K3 | CO4 |
| OR | | | |
| b) Design a RC roof slab for the following details. Live load = 2 KN/m ² Dimensions of room = 3.3 m X 7.5 m Width of support = 230 mm Edges are simply supported M20 & Fe 415 grade of materials. | 11 | K3 | CO4 |
| 27. a) A rectangular RC column of cross sectional dimension 300mm x 600mm is to be designed to support an ultimate axial load of 2000KN. Design the suitable reinforcement in the column and use M20 & Fe415 HYSD Bars. | 11 | K3 | CO5 |

OR

- b) Design a braced column subjected to a factored load $P_u = 1860\text{kN}$, $M_{ux} = 80\text{kN.m}$, $M_{uy} = 60\text{kN.m}$. The size of the column is $300\text{ mm} \times 600\text{ mm}$ and unsupported length is 4m . Use M20 and Fe415. Reinforcement distributed equally on four sides. 11 K3 CO5
28. a) Design a square footing of uniform thickness for RC column carrying 720 KN and having base of size $300\text{ mm} \times 300\text{ mm}$. the safe bearing capacity of soil is 175 KN/m^2 . Use M20 and Fe 415. 11 K3 CO6
- OR**
- b) Design a footing for 250mm thick masonry wall which support a load of 200KN/m at service state for the following data. Safe bearing capacity of the soil is 150KN/m^2 . Angle of repose of soil 30 degree unit weight of soil is 20 KN/m^3 . 11 K3 CO6