Question Paper Code: R22A31CE03

R22

ANURAG Engineering College

(An Autonomous Institution)

III B.Tech I Semester Regular Examinations, December – 2024

STRUCTURAL ENGINEERING – I (RCC)

(CIVIL ENGINEERING)

Time: 3 Hours **Max. Marks: 60**

Section – A (Short Answer type questions) (10 Marks)

Answer All Questions

		Course Outcome	B.T Level	Marks
1.	Mention the load combinations as per limit state method.	CO1	L1	1M
2.	Differentiate between singly and doubly reinforced beam.	CO1	L1	1M
3.	Relate the need of design for bond.	CO2	L1	1M
4.	What is the primary consideration in the design of sections for torsion in reinforced concrete structures?	CO2	L1	1M
5.	Differentiate between one and two way slabs.	CO3	L1	1M
6.	Interpret the primary causes of cracking in concrete slabs.	CO3	L2	1M
7.	Relate the difference between uni-axial and bi-axial bending in columns.	CO4	L2	1M
8.	What are the key steps involved in the design of long columns, and how does buckling influence their strength?	CO4	L2	1M
9.	List the type of footings.	CO5	L1	1M
10.	How do soil bearing capacity and the size of columns affect the design of a rectangular footing in reinforced concrete construction?	CO5	L2	1M

Section B (Essay Questions)

Answer all questions, each question carries equal marks. **(5 X 10M = 50M)**

11. A)	Explain the various methods of structural design used in civil engineering. Also discuss the principles, applications, advantages, and limitations.	CO1	L1	10M
	OR			
B)	A reinforced concrete beam of size 300 mm x 500 mm is simply supported over a span of 6 m and carries a uniformly distributed load of 20 kN/m including the self-weight. The concrete grade is M35, and the steel grade is Fe415. The beam is designed to be doubly reinforced. Determine the moment of resistance of the beam. The amount of tensile and compressive reinforcement required for the beam.	CO1	L2	10M
12. A)	Design shear reinforcement for the beam subjected to working shear force of 325 kN and providing 8 bars of 20 mm diameter, in that 4 bars are used as bent-up. Use M30 and Fe415.	CO2	L2	10M
	OR			
B)	Design the reinforcement for a simply supported beam of 6 meters span subjected to a bending moment. The beam is cast in M 30 grade concrete, and Fe415 grade steel reinforcement is used. Moment at the mid-span = 45 kNm; Grade of Concrete = M25; Grade of Steel = Fe415; Diameter of bars = 16 mm; Clear cover = 25 mm; Effective depth = 500 mm; Width of the beam = 250 mm. Calculate the development length for a 16 mm diameter bar, the anchorage length for the same bar.	CO2	L2	10M

13. A)	Design a simply supported one-way slab for the following conditions: Length of the slab = 4.5 m; Width of the slab = 3 m; Live Load = 4 kN/m²; Dead Load = 3 kN/m²; Grade of Concrete = M20; Grade of Steel = Fe415 and Thickness of slab (t) = 120 mm.	CO3	L2	10M
	OR			
B)	Explain the concept of limit state design for serviceability in reinforced concrete structures, with special emphasis on deflection. Discuss the factors affecting deflection, the method of calculating deflection under service loads, and the permissible limits of deflection as per IS 456:2000.	CO3	L2	10M
14. A)	Explain the use of design charts in structural engineering. Discuss the advantages and limitations of using design charts for the analysis and design of structural elements. Provide examples of common design charts used in reinforced concrete design.	CO4	L2	10M
	OR			
B)	Design a reinforced concrete square column 450mm side to carry an ultimate load of 2500 kN at an eccentricity of 180mm. Use M30 and Fe415.	CO4	L2	10M
15. A)	Explain the differences between isolated footings, combined footings, strap footings, and slab and beam footings. In your explanation, discuss the factors that influence the choice of each type of footing.	CO5	L2	10M
	OR			
B)	Design an isolated square footing for a column carrying an axial load, given the following data: Axial load : 800 kN; Size of Column: 400 mm × 400 mm; Soil Bearing Capacity: 200 kN/m²; Concrete Mix: M25; Steel: Fe415. Determine the depth of foundation. Assume that the foundation depth will be determined based on the allowable soil bearing capacity and the design load. The design parameters: Column Load (P) = 800 kN Column Dimensions = 400 mm × 400 mm Soil Bearing Capacity (q_all) = 200 kN/m² Concrete Grade = 25 MPa Steel Grade = 415 MPa	CO5	L2	10M

Note: Allow the Code Book IS456-2000.