B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025
Fifth Semester
Civil Engineering
20CEPC503 - DESIGN OF REINFORCED CEMENT CONCRETE STRUCTURES
Regulations - 2020

(Use of IS456-2000, Code of Practice for Reinforced Cement Concrete and IS456-1978 Design Aids for Reinforced Cement Concrete is permitted)

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K-Level	CO
1.	What does RC stand for in "RC Structures"?	1	K1	CO1
	(a) Resilient Columns (b) Real Construction (c) Reinforced Concrete (d) Ready for Construction			
2.	What is the modular ratio for M50 grade concrete?	1	K1	CO1
	(a) 5.83 (b) 18.67 (c) 6.44 (d) 7.18			
3.	What is the maximum area for tension reinforcement in a beam?	1	K1	CO2
	(a) 4% (b) 8% (c) 6% (d) 2%			
4.	At which point does shear stress is zero in a beam?	1	K1	CO2
	(a) Centroid (b) Extreme Fibres (c) End Points (d) Centre of the beam			
5.	The moment of resistance can be increased by not more than ____ % over the balanced section.	1	K1	CO3
	(a) 10% (b) 15% (c) 20% (d) 25%			
6.	Where are the doubly reinforced beams required?	1	K1	CO3
	(a) Where depth of the beam is restricted (b) Where width of the beam is restricted (c) Where concrete amount is restricted (d) Where high strength is required			
7.	The minimum spacing for the parallel reinforcement bars of a slab thickness 70mm is given as which of the following?	1	K1	CO4
	(a) 350mm (b) 150mm (c) 200mm (d) 300mm			
8.	Which of the following is not an example of two-way slab?	1	K1	CO4
	(a) Flat plates (b) Waffle slabs (c) Flat slabs (d) Chajja slab			
9.	Which is equivalent to the spacing of the tied reinforcement?	1	K1	CO5
	(a) Diameter of the helical reinforcement (b) Perimeter of the helical reinforcement (c) Range of the helical reinforcement (d) Pitch of the helical reinforcement			
10.	Which of the following is the test for determining the safe bearing capacity of soil?	1	K1	CO6
	(a) Plate load test (b) Direct shear test (c) Triaxial shear test (d) Unconfined compression test			

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

		Marks	K-Level	CO
11.	Relate the term Characteristics strength of materials and Characteristics of loads.	2	K1	CO1
12.	What is the necessity of providing reinforcements in concrete? Why steel is used as reinforcement?	2	K2	CO1
13.	Recall the formula for the effective flange width of isolated I-beam.	2	K1	CO2
14.	Define balanced section.	2	K1	CO2
15.	Define development length.	2	K1	CO3
16.	Recall the equation for nominal shear.	2	K1	CO3
17.	Demonstrate the middle strip and edge strip of two way slab with neat sketch.	2	K2	CO4
18.	Classify one way and two way slab.	2	K2	CO4
19.	Compare between long and short column.	2	K2	CO5

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **13474**

20. Recall under which condition a column is designed with axial load and biaxial bending.	2	K1 CO5
21. Recall under which circumstances combined rectangular footings are suitable.	2	K1 CO6
22. Define Punching shear.	2	K1 CO6

PART - C (6 × 11 = 66Marks)
Answer ALL Questions

23. a) A doubly-reinforced concrete beam is 250mm wide and 500mm deep to the centre of tension reinforcement. The centre of the compression reinforcement is 50mm from the compression edge. The area of the compression and tension steel are 1016mm^2 and 1256mm^2. If m=13.33 and the bending moment of the section is 70kNm. Calculate the stresses in concrete and steel. *11 K3 CO1*

OR

b) Design a singly reinforced concrete beam to carry a load of 9.5 kN/m. The clear span of the beam is 5.5m. The bearing at each end is 300mm. Use grade concrete as M25 and grade of steel as Fe415. *11 K3 CO1*

24. a) A T-beam an effective flange width of 2500mm is required to resists an ultimate moment of 1200 kN-m, the thickness of the flange is 150mm, the width of the side is 300 mm and the effective depth is 900mm using m20 concrete and Fe250 shear determine the area of reinforcement required. *11 K3 CO2*

OR

b) A T-beam of flange width 1000mm, flange thickness 100mm effective depth 550mm and rib width 275mm has to be designed as a balanced section determine the area of shear required and the limiting moment of resistance use M20 concrete and Fe415 shear. *11 K3 CO2*

25. a) A reinforced concrete beam of cross section 250 x 600 mm is reinforced with 4 bars of 22mm dia out of 2 bars of bent up near the support section at an angle of 45° where a factored shear force of 350kN is acting. Use M20 grade concrete and Fe415 grade steel. Design suitable shear reinforcement at the support section. *11 K3 CO3*

OR

b) Design the reinforcement required for a rectangular beam section with the following data:
Size of the beam section = 300mm x 600mm
Factored shear force = 95kN
Factored torsion = 45kNm
Factored Bending moment = 115kNm *11 K3 CO3*

26. a) Design a one way slab with a clear span of 5m, simply supported on 230mm thick masonry walls and subjected to a live load of 4kN/m² and a surface finish of 1kN/mm².Assume Fe 415 steel. Assume that the slab is subjected to moderate exposure conditions. *11 K3 CO4*

OR

b) Design a two-way slab for an office floor to suit the following data:
Size of floor = 6.3 m x 4.5 m
Live load = 10 kN/m^2
Edge conditions: Simply supported on all four sides
Assume the exposure condition to be moderate
Use grade concrete as M25 and grade of steel as Fe415. *11 K3 CO4*

27. a) Determine the longitudinal steel for a column 400 mm x 600 mm carrying a axial load of 1600 kN and factored moment (Major axis) = 120 kN-m, factored moment (Minor axis) = 90 kN-m, use M20 &Fe415 using SP16 method. *11 K3 CO5*

OR

	b)	Design the reinforcements in a circular column of diameter 300mm to support a service axial load of 800kN. The column has an unsupported length of 3m and is braced against side away. The column is reinforced with helical ties. Adopt M20 grade concrete and Fe415 HYSD bars.	*11*	*K3* *CO5*

28.   a)   A 230mm thick masonry wall is to provided with a reinforced concrete footing on a site having soil with SBC, unit weight and angle of repose of 125 kN/m^2, 17.5 kN/m^3 and 300 respectively. The M20 grade of concrete and HYSD steel bars of grade Fe 415. Design the footing when the wall supports at service state: a load of 150 kN/m length.

11   K3   CO6

OR

b)   A rectangular RCC column size 300 mm x 450 mm carrying a an axial load of 1500 kN. If the safe bearing capacity of the soil is 120 kN/ sq.m. Design a suitable footing. Consider M25 & fe415 grade steel.

11   K3   CO6