

III B. Tech I Semester Supplementary Examinations, April/May -2025
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES
(CIVIL ENGINEERING)

Time: 3 hours

Max. Marks: 70

Answer ONE Question from Part-A and ANY THREE from Part-B
All Questions Carry Marks as Indicated

Use of IS 456:2000 is permitted

PART-A			
1.		Design an isolated footing for a square column of size 400 mm × 400 mm, supporting a service load of 2200 kN. Assume SBC of soil as 250 kN/m ² at a depth of 1.5 m below the ground. Use M20 concrete and Fe 415 steel for the footing and M30 concrete and Fe 415 steel for the column. Assume that the column is reinforced with eight 25 mm bars.	[28 M]
(OR)			
2		A rectangular reinforced concrete beam section is 250 mm wide and 500 mm deep overall. The beam is provided with 3 bars of 20 mm diameter as tension reinforcement at an effective cover of 40 mm, and 2 bars of 16 mm diameter as compression reinforcement at an effective cover of 40 mm. The beam is subjected to a bending moment of 160 kNm. Assuming M20 grade concrete and Fe 250 steel, design and check the safety of the section using the Working Stress Method. Take: Modular ratio $m = 13.33$ $\sigma_{cbc} = 7 \text{ N/mm}^2$ $\sigma_{sc} = 140 \text{ N/mm}^2$ for compression steel $\sigma_{st} = 230 \text{ N/mm}^2$ for tension steel Refer to IS 456:2000 where applicable.	[28 M]
PART-B			
3	a)	A rectangular reinforced concrete beam section is 250 mm wide and 500 mm deep overall. The beam is provided with 3 bars of 20 mm diameter as tension reinforcement at an effective cover of 40 mm, and 2 bars of 16 mm diameter as compression reinforcement at an effective cover of 40 mm. The beam is subjected to a bending moment of 160 kNm. Assuming M20 grade concrete and Fe 250 steel, design and check the safety of the section using the Working Stress Method. Take: <ul style="list-style-type: none"> Modular ratio $m = 13.33$ $\sigma_{cbc} = 7 \text{ N/mm}^2$ $\sigma_{sc} = 140 \text{ N/mm}^2$ for compression steel $\sigma_{st} = 230 \text{ N/mm}^2$ for tension steel Refer to IS 456:2000 where applicable.	[7M]
	b)	Using the moment of resistance obtained by the Limit State Method, determine the maximum central point load (factored) that the beam can carry in addition to its self-weight. Take:	[7M]

		<ul style="list-style-type: none"> Span = 6 m Unit weight of reinforced concrete = 25 kN/m³ <p>Use appropriate load combinations and safety factors from IS 456:2000.</p>	
4	a)	<p>A simply supported RCC slab for a room of internal dimensions 3 m × 7 m. The supporting walls are 300 mm thick. The slab supports a 75 mm thick layer of lime concrete (unit weight = 20 kN/m³) and a live load of 2 kN/m².</p> <p>(a) Determine the effective span of the slab. (b) Calculate the total factored load (UDL) on the slab per square metre, including self-weight, lime concrete topping, and live load. (c) State whether the slab spans in one direction or both directions, based on the span ratio. Use M20 concrete and Fe415 steel.</p>	[7M]
	b)	Using the data from the previous question, design the main tensile reinforcement for the slab using the Limit State Method.	[7M]
5	a)	<p>Design the longitudinal reinforcement for a short circular reinforced concrete column of diameter 300 mm subjected to a service axial load of 800 kN. The column has an unsupported length of 3.0 m and is braced against side sway. Use M20 grade concrete and Fe 415 HYSD bars.</p> <p>Assume: The column is short (no slenderness effect) Reinforcement is provided with helical ties (transverse reinforcement design not required in this part) Design the area and number of longitudinal bars based on IS 456:2000 using the Limit State Method.</p>	[7M]
	b)	<p>Design the helical reinforcement (pitch and diameter of helix) for the column. Use the following data: M20 concrete, Fe 415 steel 4 bars of 20 mm diameter as longitudinal reinforcement Diameter of helix ≥ 6 mm Column is braced and short Follow IS 456:2000 requirements for volume of helix and max. pitch.</p>	[7M]
6	a)	A solid footing has to transfer a dead load of 1000 kN and an imposed load of 400 kN from a square column 400 x 400 mm (with 16 mm bars). Assuming $f_y = 415$, $f_{ck} = 20$ N/mm ² , and safe bearing capacity to be 200 kN/m ² , design the footing.	[7M]
	b)	Design a reinforced concrete circular footing for a circular column of 300 mm diameter supporting a factored axial load of 750 kN. Adopt the safe bearing capacity of the soil as 200 kN/m ² and use M20 grade concrete and Fe500 bars.	[7M]
7	a)	Discuss the types of limit states considered in the design of reinforced concrete structures as per IS 456:2000. Provide examples for each and explain how safety is ensured against these limit states.	[7M]
	b)	A reinforced concrete slab is designed using M25 concrete and Fe 415 steel. Explain the steps involved in checking the slab for deflection and development length as per IS 456:2000. Mention the relevant clauses and criteria.	[7M]
