

**BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT**

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code 

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Fifth Semester B.E. Degree Examinations, September/October 2024

**DESIGN OF RC STRUCTURAL ELEMENTS**

Duration: 3 hrs

Max. Marks: 100

**Note:** 1. Answer any FIVE full questions choosing ONE full Question from each Module.

2. Use of IS 456-2000 and SP-16 is permitted.

3. Missing data, if any, may be suitably assumed.

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>
<b><u>Module-1</u></b>			
1.	a. Write a short note on limit state of design philosophy. Explain (i) Limit state of collapse (ii) Limit state of serviceability	10	(1 : 1 : 1.2.1)
	b. Derive the expression for stress block parameters for compressive force $C_u$ Tensile force $T_u$ and locate its depth $X = 0.42x_u$ from the top compression fiber.	10	(1 : 1 : 1.2.1)
<b>(OR)</b>			
2.	a. Define short term and long term deflection. What are the factors affecting the short term and long term deflection?	05	(1 : 1 : 1.2.1)
	b. A rectangular beam of size $200 \times 450$ mm is reinforced with 3 numbers of 16 mm diameter bars at an effective depth of 420 mm. The beam has 2 hanger bars of 12 mm diameter with the effective span of 5 m. The beam supports a load of 10 kN/m. Determine the short term deflection and long term deflection. Use M-20 grade of concrete and Fe-415 steel.	15	(3 : 1 : 2.1.3)
<b><u>Module-2</u></b>			
3.	a. A RCC beam of section $300 \text{ mm} \times 550 \text{ mm}$ is reinforced with 4 bars of 16 mm $\varnothing$ with an effective cover of 50 mm. The beam is simply supported over a span of 5 m. Analyse the ultimate moment of resistance. Use M20 grade of concrete and Fe 415 steel.	10	(3 : 2 : 2.1.3)
	b. A RCC rectangular beam 250 mm wide and 550 mm deep is reinforced with #4-20 mm diameter on tension and an equal amount of steel on compression side. Calculate the ultimate moment of resistance of the beam section if the beam is simply supported over an effective span of 6 m. Calculate the permissible live load carrying capacity of the beam. Use M20 concrete and Fe 415 steel.	10	(3 : 2 : 2.1.3)
<b>(OR)</b>			
4.	a. A RCC T beam has a following data $D_f = 150 \text{ mm}$ , $b_w = 300 \text{ mm}$ , $d = 550 \text{ mm}$ , $b_f = 1800 \text{ mm}$ , $A_{st} = \#4-20 \text{ mm}$ diameter. Calculate the ultimate moment of resistance use M20 grade of concrete and Fe 415 steel.	10	(3 : 2 : 2.1.3)
	b. A 250 mm wide and 600 mm deep RC beam is reinforced with 2 legged 10 mm diameter inclined stirrups at 250 c/c with $60^\circ$ , longitudinal steel consists of 4-20 mm dia with a eff-cover of 40 mm. Use M20 grade concrete and Fe415 steel , determine the strength of the section in shear.	10	(3 : 2 : 2.1.3)

### **Module-3**

5. a. Design a simply supported beam of span 6 m carries a live load of 14 kN/m. Use M20 grade of concrete and Fe415 steel. **20** (3 :3 : 3.1.4)  
(OR)

6. a. A classroom in an engineering college building measuring 8.5 m × 18 m of effective dimensions. It is provided with a T-beam slab floor such that beams are spaced at 3 m c/c and take a live load 4 kN/m<sup>2</sup>. Floor finishes 0.6 kN/m<sup>2</sup>. Use M20 Grade and Fe 415 steel. Design the interior T-beam and sketch the reinforcement details. **20** (3 :3 : 3.1.4)

### **Module-4**

7. a. Design a cantilever slab of effective span 2 m, carries a live load of 3 kN/m<sup>2</sup> and FF is 0.6 kN/m<sup>2</sup>. Use M20 Grade and Fe415 steel. **20** (3 :4 : 3.1.4)  
(OR)

8. a. Design a dog-legged staircase for an office floor room measuring 3 m × 6 m, clear vertical distance between the floors is 3.5 m. The width of the flight is 1.25 m. Assume an imposed load of 3 kN/m<sup>2</sup>. Use M-20 grade of concrete and Fe-415 steel, assume the stair is supported on 230 mm width support at the outer edge of the landing slab. **20** (3 :4 : 3.1.4)

### **Module-5**

9. a. Design a short square column subjected to axial load of 2000 kN. Use M20 Grade and Fe415 steel. Assume  $e_{min} \leq 0.05D$ . **10** (3 :5 : 3.1.4)  
b. Design a reinforced concrete square column of 500 mm sides to carry an ultimate load of 2000 kN at an eccentricity of 180 mm. Use M20 Grade and Fe415 steel. **10** (3 :5 : 3.1.4)

(OR)

- 10 a. A reinforced concrete column 450 mm × 450 mm supports an axial service load of 850 kN. The SBC of the soil at site is 190 kN/m<sup>2</sup>. Adopt M-20 grade of concrete and Fe-415 steel, design a square footing for the column and sketch the reinforcement details. **20** (3 :5: 3.1.4)

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