

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S5 (R,S) (FT/WP/S3 PT) Examination November 2025 (2019 Scheme).

Course Code: CET303**Course Name: DESIGN OF CONCRETE STRUCTURES**

Max. Marks: 100

Duration: 3 Hours

PART A*(Answer all questions; each question carries 3 marks)*

Marks

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| 1 | Explain the term 'Limit State Design'. | (3) |
| 2 | Define characteristic strength & partial safety factor for materials. Why is partial safety factor for material high for concrete than steel? | (3) |
| 3 | What is development length? Obtain an expression for it. | (3) |
| 4 | At what circumstances doubly reinforced sections are preferred? | (3) |
| 5 | Compare one way slab and two way slab. | (3) |
| 6 | Explain the types of staircases based on its structural behaviour. | (3) |
| 7 | Compare the behaviour of tied columns with spiral column subject to axial loading. | (3) |
| 8 | Differentiate between short columns and long columns in RC construction. | (3) |
| 9 | Compare one way shear and two way shear in design of footings. | (3) |
| 10 | What are the objectives behind the special detailing provisions in IS 13920? | (3) |

PART B*(Answer one full question from each module, each question carries 14 marks)***Module -1**

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| 11 | a) Explain under reinforced, over reinforced and balanced section in limit state design of RC structures. | (4) |
| | b) A rectangular beam 250mm wide and effective depth 550 mm has 4 bars of 20mm diameter. Find the moment of resistance of the section if M20 concrete and Fe 415 grade steel are used. As per IS 456:2000 find the limiting moment of resistance also. | (10) |
| 12 | a) Explain the necessity for specifying maximum and minimum tension steel in reinforced beams. What are their values? | (3) |
| | b) Design a simply supported beam of span 6m subjected to a live load of 4 kN/m. Use M20 concrete and Fe415 steel. | (11) |

Module -2

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| 13 | a) Explain different modes of shear failure in beams. | (4) |
| | b) A doubly reinforced rectangular RC beam 250 mm wide and 500 mm effective depth with an effective cover of 50mm is reinforced with 2-12mm diameter bars at top and 4 – 20 mm bars at bottom. Estimate the ultimate moment carrying | (10) |

capacity of the section assuming M20 concrete and Fe415 steel.

- 14 a) Why design shear strength of concrete (τ_c) related to percentage tension steel (P_t)? (2)
- b) Determine the ultimate moment of resistance of an isolated beam of T-shaped cross-section having a span of 6m and cross sectional dimensions are flange width of 1200mm, flange thickness of 100mm, web width of 300mm and an effective depth of 550mm, having tension reinforcement of 8 bars of 25mm diameter bars. The materials used are concrete mix of grade M20 and mild steel of grade Fe 415. (12)

Module -3

- 15 a) Write short note on anchorage bond in design of RC structures. (3)
- b) Design and detail a simply supported slab for a room of size 3.5m x 4.5m subjected to live load of 7 kN/m². Use M20concrete and Fe 415 grade steel. Assume that the corners are held down. The slab is having all the four edges discontinuous. (11)
- 16 a) Draw the reinforcement pattern of a typical continuous slab. (3)
- b) A dog-legged staircase for a residential flat consists of 18 steps, each of 300 mm tread 180 mm rise, with an intermediate landing 1.2 m in width at the middle. The width of staircase is also 1.2 m. If the flights are of equal number of steps, design and detail a single flight. $f_{ck} = 20 \text{ N/mm}^2$ and $f_y = 415 \text{ N/mm}^2$. (11)

Module -4

- 17 a) Explain the design procedure of biaxially loaded columns. (4)
- b) Design a short rectangular column subjected to an axial load of 1000 kN and a uniaxial moment of 100 kNm. Use M25 concrete and Fe415 steel. Sketch the reinforcement details. (10)
- 18 a) What changes are to be made in design for columns with helical reinforcement? (4)
- b) Design a short circular column of effective length 3.3m to carry an axial load of 1200 kN. Provide helical reinforcement as transverse reinforcement. Use M25 concrete and Fe415 steel. (10)

Module -5

- 19 a) What are the objectives of earthquake-resistant design of reinforced concrete structures? (3)
- b) Design and detail an isolated rectangular footing for a column 400 mm x 600 mm to carry a load of 2000 kN. The SBC of the soil is 180 kN/m². Use M20 concrete and Fe415 grade steel. (11)
- 20 a) At what situations a combined footing is recommended? (3)
- b) Design a square footing for an axially loaded column of 450 mm x 450 mm size. Load on column is 700 kN. The safe bearing capacity of soil is 170 kN/m². Use M20 concrete and Fe415 steel. (11)
