Code No: 135AJ **R16**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2024
DESIGN OF REINFORCED CONCRETE STRUCTURES
(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.
iv) Use of IS 456 and only design charts for columns from SP-16 are allowed.

PART – A

(25 Marks)

1.a)	When do you prefer 'Doubly Reinforced Sections'?	[2]
b)	Calculate the 'balanced percentage of steel' for M35 concrete and Fe 500 grade steel from first principles.	[3]
c)	What is meant by 'development length'? What is it's significance?	[2]
d)	What is meant by 'compatibility torsion'?	[3]
e)	Distinguish between a 'braced column' and 'unbraced column'.	[2]
f)	Compare the behavior of a tied column with spiral column subjected to axial loading.	[3]
g)	Why is it desirable to eliminate eccentricity in loading on footing?	[2]
h)	Briefly explain the load transfer mechanism in a two column combined footimg.	[3]
i)	Why is corner reinforcement provided in two-way rectangular slabs, if it's corners are prevented from lifting?	[2]
j)	What are the factors affecting 'short-term deflection' and 'long term deflection' of RC Structural elements?	[3]

PART – B

(50 Marks)

2. Design a singly reinforced section for a simply supported beam of effective span 6 m carrying an imposed load of 12 kN/m. Use M25 concrete and Fe 500 grade steel. Assume moderate exposure condition. Adopt working stress method. Design reinforcement for flexure and shear. Sketch the reinforcement details. [10]

OR

3. A floor system consists of a slab 150 mm thick, cast integrally on beams spaced at 3m centre to centre and spanning over 6.6m. The beam has a width of 300mm and the total depth of the beam including the thickness of slab is 600 mm. Assume mild exposure condition. The floor is to be designed for a service load of 3 kN/m^2 and 1.5 kN/m^2 for finishes, excluding the self weight of the floor system. Design one intermediate T-beam for flexure using Limit State method. Use M30 concrete and Fe 500 grade steel. Sketch the reinforcement details. [10]

4.a) With a neat sketch, explain the force components that participate in the shear transfer mechanism at a flexural-shear crack location in a reinforced concrete beam.

b) A simply supported beam of 6.3 m effective span, is to carry a uniformly distributed load (dead load) of 25 kN/m including its self weight, and a live load of 35 kN/m. Design the beam for shear using Limit state method. Use M30 concrete and Fe 500 grade steel. Sketch the reinforcement details. [4+6]

OR

5.a) What are the various 'bond failure' mechanisms?

b) For a reinforced concrete tension member, a 16mm diameter rebar has to be lap spliced with a 20mm diameter rebar. Use M 20 concrete and Fe 500 grade steel. Design a suitable splice. [4+6]

6. Design an axially loaded tied column with an unsupported length of 3.6 m. The column is fixed at one end and pinned at the other end. The column has to carry a factored load of 2500 kN. Use M 30 grade concrete and Fe 500 grade steel. Sketch the reinforcement details. Assume moderate exposure condition. [10]

OR

7. A column 300 mm × 400 mm has an effective length of 3.5 m. It is subjected to an ultimate load of 1600 kN and an ultimate moment of 300 kNm about its major axis. Determine the longitudinal and transverse reinforcement. Use M35 concrete and Fe 500 grade steel. Assume moderate exposure condition. Sketch the cross-section showing reinforcement details. [10]

8. Design a rectangular isolated stepped footing for a column of size 300 mm × 650 mm carrying an axial load of 3000 kN. The S.B.C. of the soil is 400 kN / m^2. Use M 30 grade concrete and Fe 500 grade steel. Assume severe exposure condition. [10]

OR

9. Design an isolated circular footing for a reinforced concrete circular column 650 mm diameter, subjected to a factored axial load of 1800 kN. The column is reinforced with 8 reinforcing bars of 25 mm diameter. The safe bearing capacity of the soil is 350 kN/m^2 at a depth of 1.6 m. Assume M30 concrete and Fe 500 grade steel. Sketch the reinforcement details. [10]

10. Design a R.C. slab for a room measuring 4.5 m × 6 m. The slab carries a live load of 3 kN/m^2. The slab is simply supported at all the four edges with corners free to lift. The width of the supporting walls is 300 mm. Use M 30 grade concrete and Fe 500 grade steel. Adopt Limit State method. Sketch the reinforcement details. Assume mild exposure condition. [10]

OR

11. A simply supported doubly reinforced beam of rectangular section 300 mm wide and 550 mm overall depth, is reinforced with 4 bars of 25 mm diameter on the tension face and 2 bars of 16 mm diameter on the compression face. Assume mild exposure condition. The beam spans over an effective length of 8 m. Estimate only the long-term deflection. Use M25 concrete and Fe 415 grade steel. [10]

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