NARSIMHA REDDY ENGINEERING COLLEGE
UGC AUTONOMOUS INSTITUTION
Maisammaguda (V), Kompally - 500100, Secunderabad, Telangana State, India
UGC - Autonomous Institute
Accredited by NBA & NAAC with 'A' Grade
Approved by AICTE
Permanently affiliated to JNTUH

B. Tech III Year I Semester Examinations, January/February - 2023
STRUCTURAL ENGINEERING – I (RCC)
(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 15 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 12 marks and may have a, b as sub questions.
iv) Use of only IS 456 is allowed.

PART – A

(15 Marks)

1.a) What is meant by 'Stress Block'? [1]
b) Explain the terms 'balanced section' as per Limit state method. [2]
c) Explain the term Diagonal tension cracks. [1]
d) Bring out the differences between primary torsion and secondary torsion. [2]
e) What are the Span/Depth ratio in two way slabs for both simply supported slab and continuous slabs? [1]
f) Distinguish between one way and two way slabs with examples. [2]
g) What is meant by short column and long column? [1]
h) What is the significance of the term "slenderness ratio" with reference to the design of compression members? [2]
i) What are the situations in which the combined footings are preferred to isolated footings? [1]
j) How do you select the depth of a footing? What critical section in footing do you check for safety against shear? [2]

PART – B

(60 Marks)

2. Design a singly reinforced section for a simply supported beam of effective span 5 m carrying an imposed load of 10 kN/m. Use M30 grade concrete and Fe 500 grade steel. Assume mild exposure condition. Adopt working stress method. Design reinforcement for flexure and shear. Sketch the reinforcement details. [12]

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 6.3m. The beam has a width of 300mm and the total depth of the beam including the thickness of slab is 650 mm. Assume moderate exposure condition. The floor is to be designed for a service load of 3 kN/m^2 and 1.2 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 M25 concrete and Fe 500 grade steel. Sketch the reinforcement details. [12]

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 5.5 m effective span, is to carry a uniformly distributed load (dead load) of 35 kN/m including its self weight, and a live load of 40 kN/m. Design the beam for shear using Limit state method. Use M35 concrete and Fe 500 grade steel. Sketch the reinforcement details. [4+8]

OR

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

b) For a reinforced concrete tension member, a 12mm diameter rebar has to be lap spliced with a 20mm diameter rebar. Use M 30 concrete and Fe 500 grade steel. Design a suitable splice. [4+8]

6. Design an axially loaded tied column with an unsupported length of 4 m. The column is fixed at one end and pinned at the other end. The column has to carry a factored load of 2000 kN. Use M 35 grade concrete and Fe 500 grade steel. Sketch the reinforcement details. Assume moderate exposure condition. [12]

OR

7. A column 300 mm × 450 mm has an effective length of 4 m. It is subjected to an ultimate load of 1800 kN and an ultimate moment of 350 kNm about its major axis. Determine the longitudinal and transverse reinforcement. Use M30 concrete and Fe 500 grade steel. Assume moderate exposure condition. Sketch the cross-section showing reinforcement details. [12]

8. Design a rectangular isolated stepped footing for a column of size 400 mm × 600 mm carrying an axial load of 2500 kN. The S.B.C. of the soil is 300 kN / m^2. Use M 30 grade concrete and Fe 500 grade steel. Assume severe exposure condition. [12]

OR

9. Design an isolated circular footing for a reinforced concrete circular column 600 mm diameter, subjected to a factored axial load of 1600 kN. The column is reinforced with 8 reinforcing bars of 20 mm diameter. The safe bearing capacity of the soil is 250 kN/m^2 at a depth of 1.2 m. Assume M30 concrete and Fe 500 grade steel. Sketch the reinforcement details. [12]

10. Design a R.C. slab for a room measuring 5 m × 6.5 m. The slab carries a live load of 4 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 350 mm. Use M 25 grade concrete and Fe 500 grade steel. Adopt Limit State method. Sketch the reinforcement details. Assume mild exposure condition. [12]

OR

11. A simply supported doubly reinforced beam of rectangular section 350 mm wide and 600 mm overall depth, is reinforced with 6 bars of 20 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 7 m. Estimate only the long-term deflection. Use M30 concrete and Fe 415 grade steel. [12]

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B. Tech III Year I Semester Examinations, February - 2022
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(Civil Engineering)

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

Answer any five questions
All questions carry equal marks

Note: IS456 and only the Design charts for columns (SP16) are allowed:

1. Explain about balanced, under reinforced and over reinforced sections with neat sketches as per limit state method. [15]

2. Design a simply supported T-beam for the given data. Span: 6m, Spacing of beams:2.5m, slab thickness:120mm and Live load: 4kN/m^2. Use M25 concrete and Fe415 steel. Sketch the reinforcement details. [15]

3. Design a beam of 400mm deep and 350mm wide cantilever subjected to a concentrated point load of 2kN at 3 m from fixed support and U.D.L of 1kN/m over entire span of 6m. Check for shear and deflection. Use M20 mix and Fe415 grade steel. [15]

4. Find the reinforcement required for a rectangular beam section with the following data: Width of section = 350 mm, depth of section = 500 mm, factored B.M = 70 kN-m, factored torsional moment = 50 kN-m, factored S.F. = 80 kN. Adopt M 25 grade of concrete and Fe 500 grade of steel. Sketch the reinforcement details. [15]

5. Design a slab for room of size 4m×5m supported on 300mm thick masonry walls all around. The corners are free to lift. The Live load is 2.5kN/m^2. Use M25 concrete and Fe500 steel. Assume mild exposure condition. Sketch the reinforcement details. [15]

6. Design a continuous one way slab having three equal span of 3m each with the following data: Imposed load = 2.5kN/m^2, Thickness of floor finish = 3cm, concrete grade= M25 and Fe 500 grade steel. Sketch the reinforcement details. [15]

7. Design a circular column of diameter 300mm to carry a factored axial load of 1500kN by using (a) helical reinforcement, (b) hoop reinforcement. Use M25 concrete and Fe500 steel. Sketch the reinforcement details. [15]

8.a) List the steps involved in the design of combined footings.
b) List the steps involved in the design of wall footing. [9+6]

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B. Tech III Year I Semester Examinations, August - 2022
STRUCTURAL ENGINEERING – I (RCC)
(Civil Engineering)

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

Answer any five questions
All questions carry equal marks

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Note: Use of only IS 456 and interaction diagram for columns from sp-16 is permitted.

1.a) Explain about the balanced section as per working stress method and limit state method for design of reinforced concrete structures.

b) Determine the moment of resistance of a doubly reinforced concrete beam section, 300 mm wide and 400 mm effective depth, reinforced with 2 bars of 16 mm diameter in compression zone and 3 bars of 20 mm diameter in tension zone. Determine the moment of resistance of the section. Use M 25 grade concrete and Fe 500 steel. [4+11]

2.a) Explain the structural behaviour of different types of RCC beams.

b) An L-beam has 900 mm wide and 100 mm thick flange, 300 mm wide web and 450 mm total depth. Design the steel reinforcement to resist a factored bending moment of 450 kNm. Use M 30 grade concrete and Fe 500 steel. Sketch the reinforcement details. [6+9]

3. A simply supported reinforced concrete beam of effective span 5.0 m has rectangular cross-section 300 mm×500 mm (total depth). The beam is reinforced with 2 bars of 12 mm diameter in compression and 4 bars of 20 mm diameter as tension steel of which two bars are curtailed at 750 mm from the supports. Design the shear reinforcement if the beam is subjected to uniformly distributed load of 60 kN/m in addition to the self-weight. Use M 25 grade concrete and Fe 415 steel. [15]

4. Design the reinforcement of a beam section, 230 mm×500 mm (effective depth), subjected to an ultimate twisting moment of 90 kNm, ultimate shear force of 120 kN and ultimate BM of 200 kNm. Use M 25 concrete and Fe 415 steel. Sketch the reinforcement details. [15]

5. Design a simply supported RCC slab for a room of clear dimensions 3.5 m×6.5 m subjected to live load of 3 kN/m^2 and floor finish of 1.5 kN/m^2. Assume the width of the supports is 230 mm. Use M 25 concrete and Fe 500 steel. Sketch the reinforcement details. [15]

6. A simply supported reinforced concrete beam of effective span 5 m has cross-section 300 mm × 450 mm (overall depth) is reinforced with 3 bars of 20 mm diameter in tension and 2 bars of 12 mm diameter in compression. The beam is subjected to super imposed working load of 40 kN/m. Determine the short term and long term deflections. Adopt M 25 grade concrete and Fe 500 steel. [15]

7. Design the reinforcement of a 450 mm×450 mm column of unsupported length 4.2 m subjected to an axial load of 1600 kN with bi-axial moments 150 kNm and 100 kNm. Use M 25 concrete and Fe 500 steel. Sketch the reinforcement details. [15]

8. Design the combined footing for two columns each of size 400 mm×400 mm and spaced at 4.2 m centre-to-centre. Each column is required to support an ultimate load of 900 kN. The safe bearing capacity of the soil is 160 kN/m^2. Draw the reinforcement details. [15]

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B. Tech III Year I Semester Examinations, March - 2021
STRUCTURAL ENGINEERING – I (RCC)
(Civil Engineering)

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

Answer any five questions
All questions carry equal marks

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Note: Use of only IS 456: 2000 is allowed

1.a) Derive Stress Block Parameters as per the Limit State Method.
b) Compare 'Working Stress Method' and Limit State Design of RCC Structures. Explain the answer with suitable examples.
c) What is meant by Limit State? Mention different limit states to be considered in R.C.C design. [5+5+5]

2. The cross-section of an RCC beam of rectangular section is to be designed to resist a bending moment of 65 kNm. Assuming the width of beam as half the effective depth, determine the dimensions of the beam and the area of tension reinforcement for the balanced section .Use M20 grade Concrete and Fe 500 grade HYSD bars. Adopt Limit State Method of design. [15]

3. Design an R.C.Slab for a Hall 4m wide and 5m long. The Slab is simply supported on all four edges with corners held down and carries a superimposed load of $3kN/m^2$. Use M20 Concrete and Fe 415 Steel. Assume mild exposure condition. Sketch the Reinforcement details. [15]

4. Design an axially loaded circular tied column with an unsupported length of 3 m. The column is pinned at both the ends. The column has to carry a factored load of 2000 kN. Use M 25 Grade Concrete and Fe 500 Grade Steel. Sketch the Reinforcement details. [15]

5. Design a RC footing for a square RC column of 500 mm × 500 mm size which carries an axial load of 1500 kN including its self-weight. Use M20 grade Concrete and Fe 500 steel. The safe bearing capacity of soil may be taken as $220 kN/m^2$. Sketch the reinforcement details. [15]

6.a) Draw the cross-section of singly reinforced rectangular beam and show the strain and stress diagrams.
b) Explain the critical sections for design shear as per IS 456 with requisite sketches.
c) Explain the approaches for control of deflection in bending members as per IS 456. What are the measures for reducing deflection? [5+5+5]

7.a) Sketch edge and middle strips of a two way slab.
b) Explain the difficulty in estimating the short term deflection as per IS code procedure when the applied moments at service loads is marginally less than the cracking moment calculated using the modulus of rupture of concrete. [5+10]

8.a) Explain the procedure for design of columns with biaxial bending
b) Enumerate the steps for design of combined rectangular footing. [8+7]

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B. Tech III Year I Semester Examinations, September - 2021
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(Civil Engineering)

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Answer any five questions
All questions carry equal marks
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1. A hall has C/C dimensions of 21000mm × 8000mm with beam spacing of 3500mm c/c. Overall dimensions of web is 300mm × 475mm with tension steel 4#20 for end L - section. Thickness of slab = 125 mm. Calculate x_U, C_U, T_U, lever arm, MR at collapse and the safe superimposed load on the slab excluding the self weight of the slab. The beam is exposed to moderate condition. Grade of concrete and steel is M25 and Fe550 respectively. [15]

2. Illustrate characteristic strength of a material as applied to limit state design with normal distribution curve?. Outline the reasons for adopting partial safety factors for materials and loads in limit state design. [15]

3. At the limit state of collapse, RC beam subjected to flexural moment 150 kN-m, shear force 20 kN and torque 8 kNm. The beam is 230 mm × 450 mm. determine equivalent shear force and equivalent flexural moment for designing longitudinal tension steel.[15]

4. Determine the minimum effective depth and the corresponding area of tension reinforcement for the rectangular beam having width 230mm to resist ultimate moment of resistance 200 kN-m using M25 grade concrete and Fe500 HYSD bars. [15]

5. Design a slab over a room of internal dimensions 4 m × 5 m supported on 230 mm thick wall. All the edges of the slab are simply supported. The corners are free to lift. Use live load 2 kN/m^2, floor finish 1.5 kN/m^2, and light partition 1.5 kN/m^2. Adopt mild exposure with M20 grade concrete and Fe415 steel. [15]

6. Design a dog legged staircase for an office building, given the following data:
Height between floor = 3.2m; Riser = 160mm, Tread = 270mm; Width of flight = 1.25m; Live load = 5kN/m^2; Finishes load = 0.6kN/m^2. Assume the stairs to be supported on 230mm thick masonry walls at the outer edges of the landing, parallel to the risers. Adopt mild exposure with M20 grade concrete & Fe415 steel. Also sketch the reinforcement details. [15]

7. A rectangular column 300 mm wide and 600 mm deep is subjected to an axial load of 1000 kN and moments along the major and minor axis are 130 kNm and 80 kNm respectively. Assume M30 concrete and Fe 500 steel. Assume severe condition and sketch the details. [15]

8. Design a reinforced concrete footing for a rectangular column of section 300 mm by 500 mm supporting an axial factored load of 1500 kN. The SBC of the soil at site is 185kN/m^2. Adopt M20 grade concrete and Fe415 grade steel. [15]

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