

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES
(Civil Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **ONE** Question from **Part-A**, and any **THREE** Questions from **Part-B**
Please specify the IS codes to be allowed to the student in the Examination hall.

PART-A**(1x28=28 Marks)**

- 1 A simply supported roof slab for room of 6.5m x 5m clear dimension is resting on RC beam 230 mm of width. Design the slab if it carries live load of 5 kN/m^2 . Use M20 grade concrete and Fe 500 grade steel. Apply necessary design checks and neatly sketch the detailing of slab reinforcement. (Use limit state method). [28M]

(OR)

- 2 Design a R.C circular column and circular footing of column subjected to axial load 300 kN and moment 12 kN-m. Assume safe bearing capacity of soil at a depth 1.5 m below ground is 250 kN/m^2 . Assume size of column size restricted to 300 mm diameter, and its effective length 4m. Check the design for both column and footing for shear, bending and anchorage requirements. Neatly sketch the reinforcement details for column and footing. Use M25 grade concrete and HYSD steel Fe415. [28M]

PART-B**(3x14=42 Marks)**

- 3 A reinforced concrete beam of size 250mmX 450mm effective depth is reinforced with 2no. 16mm diameter bars at top and 3no. 16mm diameter bars at bottom. Find out the moment of resistance of the section. The materials are M20 concrete and Fe415 HYSD bars using working stress method. [14M]
- 4 A R.C. beam of rectangular section 250mm wide and 600mm deep is reinforced on tension side by 4bars of 20mm diameter. The characteristic strengths of concrete and steel used are 25 N/mm^2 and 460 N/mm^2 . a) Calculate the ultimate moment of resistance of the section, b) determine the maximum uniformly distributed load a simply supported beam of this section can carry over a span of 6m. [14M]
- 5 Design the stairs for a public building, supported on wall on one side and stringer beam on the other side. The horizontal span of stairs is 1.4m. The risers are 120mm and tread are 300mm. Use M20 mix and Fe415. [14M]
- 6 Design a short column to carry a working load of 100kN and uniaxial moment of 250kN. Use M20 concrete and Fe415. [14M]
- 7 Design a rectangular isolated footing of uniform thickness for R.C column bearing a vertical load of 600kN, and having a base size of 400mm X 600mm. The safe bearing capacity of soil may be taken as 120 kN/m^2 . Use M20 concrete and Fe415. [14M]



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PART-A**(1x28=28 Marks)**

- 1 Design the reinforcements in a short column 230 mm by 300 mm subjected to an ultimate axial load of 340 kN together with ultimate moments of 30 kN.m and 18 kN.m about the major and minor axis respectively. Adopt M-20 grade concrete and Fe-415 HYSD bars. Sketch the reinforcement details. [28M]

(OR)

- 2 Design the roof slab for a building of clear dimensions 4 m x 7.5 m with wall thickness 300 mm. The slab is assumed that access is provided to the roof. A weathering course of thickness 120 mm and unit weight 15 kN/m^3 is to be provided over the slab. Use M20 and Fe 415 steel. Take edge conditions as two edges continuous two discontinuous. Draw the cross section and elevation of the slab showing the reinforcement details. [28M]

PART-B**(3x14=42 Marks)**

- 3 A reinforced concrete beam having a rectangular section 300mm wide is reinforced with 2 bars of 12mm diameter at an effective depth of 550mm. The section is subjected to a service load moment of 40kN-m. Assuming M20 grade concrete and Fe415 HYSD bars, estimate the stresses in concrete and steel. [14M]
- 4 A R.C. T-beam having total depth 380mm, width 230mm is cast monolithically with slab 110mm thick. The beam is simply supported over a span of 4.44m and spaced 2m c/c. concrete mix M20 and steel of grade Fe500 have been used. Calculate the maximum uniformly distributed imposed load the beam can carry and the corresponding area of steel. [14M]
- 5 A rectangular simply supported beam of span 5m is 300mm X 650mm in cross section and is reinforced with 3 bars of 20mm on tension side at an effective cover of 50mm. Determine the short term deflection due to an imposed working load of 20kN/m, excluding self weight. Assume grade of concrete M20 and grade of steel as Fe415. [14M]
- 6 Design a short axial column of effective length 3m to carry an axial load of 1600kN. Use M25 concrete and Fe415. [14M]
- 7 Design an isolated footing for a column 500mm X 500mm, transmitting an axial load of 1200kN. The column is reinforced with 8 bars of 20mm diameter. The safe bearing capacity of soil is 120 kN/m^2 . Use M20 concrete and Fe415. [14M]



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PART-A**(1x28=28 Marks)**

- 1 A simply supported one way slab 3.5m span carries live load of 4kN/m^2 and floor finish of 1.5kN/m^2 . Concrete and steel grades used are M25 and Fe415. The depth of the slab provided is 160mm with a clear cover of 30mm. the steel consists of 8mm dia. @90mm c/c. assume permanent load equal to dead load plus 20% of live load. Calculate the total maximum deflection and check by allowable L/d approach. [28M]

(OR)

- 2 Design a short column 450mm square in section to carry an axial load of 800kN with moments of 60kN-m about axis at working loads. Assume M20 concrete and Fe415 steel. Use of SP-16 permitted. Sketch the details of reinforcements. [28M]

PART-B**(3x14=42 Marks)**

- 3 Find the steel reinforcement required to resist bending moment 28kN-m and shear 16kN of rectangular simply supported R.C beam 250mm X 400mm. Give the curtailment of reinforcement, shear and anchorage requirements of bars. Use M 25 grade concrete and Fe 415 steel HYSD. (Use working stress method). Assume the following data: Steel young's modulus $E_s=2.0 \times 10^5$ MPa, modular ratio $m=8$, clear cover=40 mm. [14M]
- 4 A simply supported beam with clear span 6000mm, $b=400\text{mm}$, $d=560\text{mm}$ carries a limit state load of 175kN/m (including self weight, dead load and live load). It is reinforced with 4 bars of 28mm diameter tension steel ($A_{st}=2464\text{mm}^2$) which continue right into the support. Take M20 concrete and Fe415 steel. Design the shear reinforcement. [14M]
- 5 A reinforced concrete beam of size 250mm X 500mm is provided with 4 bars of 20mm with an effective cover of 40mm. The section has to resist a bending moment of 60kN-m. Determine the crack width at point A which is the midpoint of tension edge and at a point B, which is on tension edge just below bar. Take grade of concrete mix M20 and grade of steel as Fe415. [14M]
- 6 Design a short R.C.C. column to carry an axial load of 1600 kN. It is 4 m long, effectively held in position and restrained against rotation at both ends. Use M20 concrete and Fe 415 steel. [14M]
- 7 Design a footing for circular column 560 mm diameters, transmitting an axial load of 1200kN. The column is reinforced with 8 bars of 10mm diameter. The safe bearing capacity of soil is 120kN/m^2 . Use M20 concrete and Fe415. [14M]



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PART-A

(28 Marks)

- 1 Design a continuous RC slab for a hall 7m and 14m long. The slab is supported on RCC beams each 300mm wide which are monolithic. The ends of the slab are supported on walls. 300mm wide. Design the slab for a live load of 3 kN/m^2 . Assume the weight of roof finishing equal to 1.0 kN/m^2 . Use M20 concrete and Fe 415 steel. a) Draw the reinforcement of the slab in plan view. b) Draw cross section of the slab including beams with reinforcement details. [28M]

(OR)

- 2 Design a square isolated footing of uniform thickness for a reinforced concrete square column of size 450 mm transmitting an axial service load of 1500 kN. The safe bearing capacity at the site is 160 kN/m^2 and the materials to be used are M20 grade concrete and HYSD steel bars of grade Fe415. Draw reinforcement details. [28M]

PART-B

(42 Marks)

- 3 A reinforced concrete beam 200mm X 400mm effective depth is used over an effective span of 5m. it is subjected to a uniformly distributed load of 7 kN/m inclusive of its own weight. Find the necessary steel reinforcement at the centre of the span. Take allowable stresses in steel and concrete as 130 N/mm^2 and 4 N/mm^2 respectively and $m = 16$. [14M]
- 4 A rectangular section with width of section as 300mm and depth as 500mm is subjected to a limit state of shear of 80kN and B.M of 30kN/m. Design the torsional reinforcement if in addition to above forces, a torsional moment of 8kN-m are also acting on the member. Take M20 concrete and Fe415 steel. [14M]
- 5 A simply supported floor beam has a span of 10.2m it supports a continuous one way slab of span 4m. The live load is 4 kN/m^2 and floor finish 1.5 kN/m^2 . The thickness of the slab is 130mm. Design the section of the beam situated in the moderate exposure condition and calculates the surface crack width. A) directly under a bar on tension face, b) at the bottom corner of the beam, c) at a support on tension face mid-way between two bars. [14M]
- 6 A short column, 600 mm x 600 mm in section, is subjected to a factored axial load of 1650 kN. Determine the area of longitudinal steel to be provided, assuming M20 concrete and Fe415 steel. [14M]
- 7 Design a rectangular footing of uniform thickness for an axially loaded column of size 300mm X 600mm load on column is 1150 kN. Safe bearing capacity of the soil is 200 kN/m^2 . Use M20 & Fe415 steel. [14M]

