R20

SET - 1

III B. Tech I-Semester Regular Examinations, Dec/Jan – 2022-23
DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES
(Civil Engineering)

Time: 3 hours   Max. Marks: 70

Note: Answer any ONE question from PART-A and THREE questions from PART-B
Use of IS: 456-2000 and design charts from SP-16 is allowed.
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PART–A   **(1x28=28 Marks)**

1   Design a reinforced concrete footing for a rectangular column of   [28M]
     section 300 mm x 500 mm supporting an axial factored load of
     1600kN. The safe bearing capacity of the soil at site is 200kN/m^2.
     Adopt M20 grade concrete and Fe 415 HYSD bars.
     Sketch the details of reinforcement.

(OR)

2   Design a two-way slab for an office floor of size 3m x 4m with   [28M]
     discontinuous and simply supported edges on all the sides with
     corner prevented from lifting and supporting a service live load
     4kN/m^2. Adopt M20 grade concrete and Fe 415 HYSD bars. Sketch
     the details of reinforcement.

PART–B   **(3x14=42 Marks)**

3 a) Mention the basic principles of elastic or working stress theory of   [7M]
      reinforced concrete flexural members.
   b) List the main reasons for the evolution of limit state method of   [7M]
      design for RC structures.

4 a) What is the necessity of evaluating the ultimate flexural strength of   [6M]
      reinforced concrete sections?
   b) A doubly reinforced concrete beam having a rectangular section   [8M]
      300 mm wide and 750 mm overall depth is reinforced with 2 bars
      of 12 mm diameter on the compression face and 4 bars of 20 mm
      diameter on the tension side. The effective cover to the bars is 40
      mm. Using M20 grade concrete and Fe 415 HYSD bars, estimate
      the flexural strength of the section using IS: 456-2000 code
      specifications.

5 a) What are shear failures? Under what conditions you would expect   [7M]
      this type of failures in reinforced concrete structures?
   b) Explain the Indian standard code method of designing   [7M]
      reinforcements in concrete members subjected to combined flexure
      and torsion?

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6   A square column 500 mm x 500 mm is reinforced with 2.5% steel. [14M]
     It is subjected to a factored load of P_u = 1800 kN and moment s
     M_{ux}= M_{uy} = 220 kN/m². Check the adequacy of the section adopting
     M20 concrete and Fe – 415 steel. The effective cover to steel may be
     taken as 40 mm and steel is to be provided equally on all four
     sides.

7   A reinforced concrete beam of rectangular section, 300mm wide is [14M]
     reinforced with four bars of 25mm diameter at an effective depth of
     600mm. The beam has to resist a factored shear force of 400kN at
     support section. Assuming f_{ck}= 25N/mm² and fy=415 N/mm²,
     design vertical stirrups for the section.

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PART–A   **(1x28=28 Marks)**

1   Design a one-way reinforced concrete slab simply supported at the   [28M]
    edges for a public building with a clear span of 3.5 m supported on
    230 mm solid concrete masonry walls. Adopt M20 grade concrete
    and Fe 415 HYSD bars. Sketch the details of reinforcement.

(OR)

2   Design a reinforced concrete circular footing for a circular column   [28M]
    of 300 mm diameter supporting a factored axial load of 900 kN.
    Adopt the safe bearing capacity of the soil as 200 kN/m^2 and use
    M20 grade concrete and Fe 415 HYSD bars. Sketch the details of
    reinforcement.

PART–B   **(3x14=42 Marks)**

3   a) What are salient assumptions made in the elastic theory of   [7M]
       reinforced concrete sections?
    b) What are the various serviceability states and why they should be [7M]
       considered as design?

4   a) How do you compute the flexural strength of T-section in which the [6M]
       neutral axis lies outside the flange?
    b) A T-beam has an effective flange width 2500 mm, depth 150 mm,   [8M]
       width of rib 300 mm, effective depth 800 mm. Using M20 grade
       concrete and Fe 415 HYSD bars, estimate the area of tension steel
       required if the section has to resist a factored moment of 1200
       kN.m.

5   a) Briefly outline the various types of sheer failure mechanisms   [7M]
       encountered in reinforced concrete structures.
    b) How do you design transverse reinforcements in reinforced concrete [7M]
       members subjected to torsion and shear?

6   A corner column 400× 400 mm, is subjected to the factored loads   [14M]
     P_u = 1350 kN, M_{ux} = 200 kN-m and M_{uy} = 120 kN-m. Design the
     reinforcement in the column, assuming M25 concrete and Fe 415
     steel and effective cover of 60 mm. Assume it is a short column.

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7   Design the shear reinforcements in a beam of rectangular section,   [14M] having a width 300mm and effective depth of 600mm. The ultimate shear at the section is 100kN. Use f_{ck} =20N/mm^2 and f_y=415N/mm^2. The beam is reinforced with 4 bars of 25mm diameter in the tensile zone.

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PART–A   (1x28=28 Marks)

1   Design a suitable footing for a 400 mm x 600 mm column   [28M]
     transferring 1200 kN axial load and a moment of 40kNm. SBC of
     the soil is 200 kN/m². Use M20 concrete and Fe 415 steel. Sketch
     the details of reinforcement.

(OR)

2   Design a two-way RCC slab for a room of size 4 m x 6 m with   [28M]
     continuous edges all round at supports. Assume a live load
     3kN/m². Concrete of M20 grade and Fe 415 HYSD bars are
     available for use. Sketch the details of reinforcements in the slab.

PART–B   (3x14=42 Marks)

3   a) Why do you prefer to design under-reinforced or balanced sections   [7M]
       instead of over-reinforced sections?
    b) What are the various limit states to be considered in the design of   [7M]
       structural concrete members?

4   a) What is the necessity for selecting doubly reinforced concrete   [6M]
       sections while designing reinforced concrete beams?
    b) A doubly reinforced concrete beam has a width 300 mm and overall   [8M]
       depth 700 mm. The beam is reinforced with tension steel of area
       1964 mm² at an effective cover of 40 mm. The beam has to be
       designed to have a flexural strength of 450 kNm. Assuming M20
       grade concrete and Fe 415 HYSD steel reinforcements, calculate
       the area of compression steel required at an effective cover of 40
       mm.

5   a) Explain briefly the various types of shear failure modes   [7M]
       encountered in reinforced concrete structures subjected to loads.
    b) Explain the significance of the term equivalent shear in concrete   [7M]
       members subjected to shear and torsion.

6   A column of size 300 mm × 400 mm has effective length of 4 m and   [14M]
     is subjected to P_u = 1100 kN and M_u =160 kN-m about the major
     axis. Design the column using M25 concrete and Fe 415 steel,
     providing the steel.   (a) On two sides   (b) On four sides.
      Assume cover of 50 mm.

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7   An RCC section 200mmX400mm is subjected to a characteristic   [14M]
     load torsional moment of 3kNm and a transverse shear of 80kN.
     Assuming the use of M25 grade concrete and Fe415 HYSD bars,
     determine the reinforcement required according to the IS:456 code
     provisions.

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PART–A   (1x28=28 Marks)

1   Determine the reinforcement required for a short column subjected   [28M]
     to biaxial bending, using the following data:
         Cross section of the column : 400 mm x 600 mm
         Concrete Mix : M 20
         Steel: Fe 415
          Factored load P_u = 2000 kN
     Factored moment acting parallel to the larger dimension M_{ux} = 180
     kN/m.
     Factored moment acting parallel to the shorter dimension M_{uy} =
     130 kN/m.
      Sketch the details of reinforcement.

                                    (OR)

2   Design a one-way slab with a clear span of 3.5m, simply supported   [28M]
     on 230mm thick concrete masonry walls to support a live load of
     3.5kN/m². Adopt M20 grade concrete and Fe 415 HYSD bars.
     Sketch the details of reinforcement.

PART–B   (3x14=42 Marks)

3 a) Explain the terms: under-reinforced, balanced and over-reinforced   [7M]
      sections as applied to reinforced concrete sections?
   b) Differentiate between safety and serviceability with respect to   [7M]
      structural concrete members.

4 a) How do you compute the ultimate flexural strength of a doubly   [6M]
      reinforced concrete section using the IS code recommendations.
   b) A reinforced concrete beam is required to resist an ultimate   [8M]
      moment of 300 kNm. The width of the beam is restricted to 300
      mm. Effective cover is 40 mm. Adopting M20 grade concrete and Fe
      415 grade HYSD bars, determine the overall depth of the beam.

5 a) What are the different types of reinforcements used to resist the   [7M]
      shear forces developed in reinforced concrete members?
   b) What is torsional shear stress? How do you estimate the torsional   [7M]
      shear stress in concrete rectangular sections?

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6　　Design a footing for a 250-mm thick reinforced concrete wall which　[14M]
supports a load (inclusive of self – weight) of 250kN/m under
service loads. Assume a safe soil bearing capacity of 200kN/m^2 at a
depth of 1.5 m below ground. Assume M 20 grade concrete and Fe
415 grade steel for both wall and footing. Assume the longitudinal
reinforcement of the wall to comprise 0.25 percent of the gross
cross-sectional area.

7　　A T- beam has flange dimensions of 1500 × 120 mm. The width of　[14M]
rib is 250 mm and rib depth is 350 mm. If the beam is reinforced
with 2000 mm^2 of steel in tension zone with an effective cover of
40mm, determine the maximum allowable uniformly distributed
load　inclusive of self weight over a simply supported span of 6m.
M20 grade concrete and Fe 415 steel is used.

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