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Hall Ticket Number:

CE312 (R20)

B.TECH. DEGREE EXAMINATION, NOVEMBER-2024

Semester V [Third Year] (Regular & Supplementary)

DESIGN OF RC STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What is minimum reinforcement in tension and compression zones in a simply supported beam? CO1
   (b) Define modular ratio. CO1
   (c) What is maximum strain in concrete and minimum strain in steel allowed in limit state method? CO1
   (d) What is the minimum percentage of steel in RCC beams? CO2
   (e) What is development length in beams? CO2
   (f) What do you mean by short term deflection? CO2
   (g) Write minimum percentage of steel in slabs. CO3
   (h) Draw neatly the plans showing torsion reinforcement at different corners in two way slabs. CO3
   (i) Draw reinforcement detailing in cantilever slab. CO3
   (j) What is bending moment at fixed end of a cantilever slab? CO4
   (k) Define slenderness ratio of an RCC column. CO4
   (l) How do you find diameter of lateral tie? CO4
   (m) What is the minimum reinforcement percentage in columns? CO4
   (n) Distinguish between short column and long column. CO4

UNIT – I

2. (a) What are the assumptions in Limit State Design of beams? Also write the expressions for total compression, tension and bending moment. (7M) CO1

(b) A RCC beam of 200 mm x 450 mm in size is placed over a span of 3 m simply supported with a live load of 12 kN/m. What is the steel required in tension side? Assume M20 and Fe415 materials. (7M) CO1

(OR)

3. Find moment of resistance of a doubly reinforced concrete beam section of 230 mm x 400 mm effective depth. The reinforcement consists of A_{sc} = 402 mm^2, A_{st} = 1256 mm^2. Material grades are M25 concrete and Fe 415 steel. CO1

UNIT – II

4. (a) Explain the need to provide development length for reinforcing bars. (4M) CO2
   (b) An RC simply supported beam of section 300 mm width and 500 mm effective depth is subjected to an udl of 50 kN/m over a span of 8 m. Check the section for shear and design the shear reinforcement. Consider the M20 concrete and Fe 415 steel. (10M) CO2

(OR)

5. (a) A simply supported beam is 300 mm and 550 mm depth has 2#20 mm dia. bars going into the support. If the shear force at the centre of the support is 100 kN at working loads, determine the anchorage length. Assume M20 concrete and Fe415 steel. (7M) CO2
   (b) What are the cracking control measures? Explain. (7M) CO2

UNIT – III

6. Design a slab for a hall of 4.0 m x 10.0 m clear in size, resting on 400 mm thick brick walls. The live load on the slab is 2.5 kN/m^2. Assume M20 concrete and Fe415 steel. CO3

(OR)

7. Design a one way slap having simply supported span of 3.5 m and carries a live load of 3 kN/m^2. Use M25 concrete and Fe415 steel. CO3

UNIT – IV

8. A short column of size 300 mm x 450 mm subjected to a factored axial load of 1800 kN and bending moment of 150 kN-m. Design suitable reinforcement on four sides. Use M20 & Fe415 materials. CO4

(OR)

9. Design a column subjected to service load of 800 kN and a uniaxial moment of 80 kN-m. Use M25 concrete and Fe415 steel. CO4

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CE312 (R20)

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Hall Ticket Number:

CE312 (R20)

B.TECH. DEGREE EXAMINATION, APRIL-2024

Semester V [Third Year] (Supplementary)

DESIGN OF RC STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a)	Mention the role of structural engineer in design of RCC structures.	CO1
(b)	List various loads in RCC.	CO1
(c)	State different modes of failure.	CO1
(d)	Define Neutral axis.	CO2
(e)	Define diagonal tension.	CO2
(f)	How to check development length?	CO2
(g)	Define anchorage bond.	CO3
(h)	Differentiate deflection and cracking.	CO3
(i)	Define two way slab.	CO3
(j)	Mention the condition when one way slab will construct.	CO4
(k)	Define short column.	CO4
(l)	What is the mode of failure in case of short columns?	CO4
(m)	Mention Rankine's formula.	CO4
(n)	State assumptions in design of columns.	CO4

UNIT – I

2. (a)	Distinguish between under reinforced and over reinforced sections in reinforced concrete beams.	(7M)	CO1
(b)	A simply supported R.C. beam of rectangular cross section is required to resist a bending moment of 100 kN-m at service state. Design and detail the suitable dimensions of the cross		

section and reinforcement for the balanced sections. Take the effective depth as twice the width. Assume M20 grade concrete and Fe 415 grade steel, adopt working stress method. (7M) CO1

(OR)

3. (a) Compare Working Stress Method and Limit State Methods of design. (7M) CO1

   (b) Design and draw reinforcement detailing of an L-beam for an office floor to suit the following data: (7M) CO1

   Clear span = 8 m
   Thickness of flange = 150 mm
   Live load = 4 kN/m^2
   Spacing of beams = 3 m
   Adopt M20 grad concrete and Fe 415 HYSD bars.

UNIT – II

4. (a) Briefly explain about limit state of serviceability. (7M) CO2

   (b) Design a rectangular simply supported beam over a clear span of 6 m, if the super imposed load is 15 kN/m and the support width is 230 mm. Use M20 grade concrete and Fe 415 steel. The beam is to have width of 300 mm. Design the shear reinforcement and check for deflection. (7M) CO2

(OR)

5. Design the reinforcements required for a rectangular beam section with following data: CO2

   Size of the beam = 300 x 600 mm
   Factored Shear force = 100 kN
   Factored bending moment = 120 kNm
   Factored twisting moment = 50 kNm
   M20 grade of concrete and Fe 415 grade of steel
   Sketch the reinforcements details.

UNIT – III

6. (a) Compare the design of one-way slab and two-way slabs. (7M) CO3

   (b) Design a reinforced concrete slab to carry a live load of 2.5 kN/m^2 on an effective span of 3.5 m. Use M20 grade concrete and Fe 415 steel reinforcement. Sketch the reinforcement details. (7M) CO3

(OR)

7. Design an RCC slab for a room 3 m x 4 m clear in size. Use M20 concrete and Fe 415 steel. The live load is 2 kN/m^2. The edges are simply supported and the corners are held down. Draw top plan and bottom plan to show the reinforcement detailing. CO3

UNIT – IV

8. (a) Explain the function of lateral tie in a column. (7M) CO4

   (b) Design the reinforcements in a circular column of diameter 300 mm to support a service axial load of 800 kN. The column has unsupported length of 3 m and is braced against side sway. The column is reinforced with helical ties. Adopt M20 grade concrete and Fe 415 HYSD steel. (7M) CO4

(OR)

9. A corner column 400 x 400 mm, is subjected to the factored loads P_u = 1400 kN, M_{ux} = 200 kN-m and M_{uy} = 110 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. CO4

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(OR)

9. (a) What is interaction diagram? Narrate importance of it in design of columns? (5M) CO4
   (b) Design a slender column for the following data: Column size 600 mm x 450 mm; Materials Grade: M20 & Fe415; Loads: P_u = 1000 kN; M_{ux} = 70 kN-m; M_{uy} = 54 kN-m. Assume given moments are greater than moment due to minimum eccentricity. (9M) CO4

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CE312 (R20)

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Hall Ticket Number:

CE312 (R20)

B.TECH. DEGREE EXAMINATION, DECEMBER-2023

Semester V [Third Year] (Regular & Supplementary)

DESIGN OF RC STRUCTURAL ELEMENTS

Time: Three hours Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) What is a singly reinforced and doubly reinforced beam? CO1
   (b) What is the limiting neutral axis depth for various steels in limit-state design method? CO1
   (c) Write the limiting moment of resistance formula for a T-beam section when neutral axis lies in flange for balanced section. CO1
   (d) When the given section of a beam is modified in shear design? CO2
   (e) What do you mean by long term deflection? CO2
   (f) Write the expression to calculate effective moment of inertia in calculating short term deflection of a beam. CO2
   (g) Differentiate between one way and two-way slabs. CO3
   (h) What is maximum spacing of bars in slabs? CO3
   (i) In a two-way slab of If l_x = 4 m, l_y = 6 m and total load (LL + DL) w = 12 kN/m^2 then the shear force value is_____kN. CO3
   (j) What is the percentage increment of axial load when used spiral reinforcement instead of lateral ties in circular columns? CO4
   (k) What is minimum eccentricity e_{min} of RCC column? CO4
   (l) Write the conditions for spacing of ties in columns. CO4
   (m) What is minimum number of bars in circular column? CO4
   (n) What is the minimum diameter of longitudinal reinforcement in columns? CO4

UNIT – I

2. (a) What is under reinforced, over reinforced and balanced sections in RCC beam analysis? (7M) CO1
   (b) Calculate the moment of resistance of a 230 mm x 500 mm effective depth of beam section, if 3 no of 20 mm diameter bars placed in tension side only. Assume M20 concrete and Fe415 Steel materials. (7M) CO1

(OR)

3. (a) An RC simply supported beam of section 300 mm width and 450 mm effective depth is subjected to an udl of 40 kN/m over a span of 8 m. What is maximum safe udl that can be placed for a balanced section? Assume M20 concrete and Fe415 steel materials. (7M) CO1
   (b) Find the moment of resistance of a T-beam to take uniformly distributed load (Including self-weight) with the following data: Flange width 1200 mm and thickness 150 mm, web breadth 300 mm and effective depth of T-beam is 500 mm. 2-25 mm bars are provided in web. Assume M20 concrete and Fe415 Steel materials. (7M) CO1

UNIT – II

4. (a) What is diagonal tension and diagonal compression? What is development length? (7M) CO2
   (b) An RC simply supported beam of section 300 mm width and 450 mm effective depth is subjected to an udl of 40 kN/m over a span of 8 m. Check the section for shear and design vertical shear reinforcement. Consider M25 concrete and Fe 415 steel. Assume $P_t = 0.75$. (7M) CO2

(OR)

5. (a) Find the ultimate shear capacity of the cross section with the following data: Cross section is of 250 mm x 500 mm, tension steel consists of 5#20 mm and out of which two bars are cranked at 60^0. 8 mm two legged stirrups are spaced at 150 mm c/c. Concrete is of M35 and Fe415 steel (use LSM). (7M) CO2
   (b) A RCC simply supported beam of section 300 mm width and 500 mm effective depth is subjected to a udl of 50 kN/m over a span of 8 m. Check the section for shear and design the shear reinforcement. Consider the M20 concrete and Fe 415 steel. (7M) CO2

UNIT – III

6. (a) What is one way and two way slabs? What are the steps involved in design of one way slab design? (7M) CO3
   (b) Design a slab for a room supported on 300 mm brick wall of size 8 m x 3 m clear size. The live load on the slab is 3 kN/m^2 including floor finishes. Use M20 and Fe415 steel. (7M) CO3

(OR)

7. (a) What are requirements and bar spacings of steel to be provided in slabs as per IS 456-2000. (4M) CO3
   (b) Design a cantilever slab of span 2.1 m, attached to a rectangular beam of 230 mm x 400 mm. Assume a live load of 2 kN/m^2. Use M20 concrete and Fe415 steel. (10M) CO3

UNIT – IV

8. Design a column subjected to a service load of 800 kN and an uniaxial moment of 80 kN-m. Use M25 concrete and Fe415 steel. CO4

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Hall Ticket Number:

CE312 (R20)

B.TECH. DEGREE EXAMINATION, JUNE-2023

Semester V [Third Year] (Supplementary)

DESIGN OF RC STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:
   (a) List the advantages of R.C.C. over other construction materials. CO1
   (b) Explain different methods of designing R.C.C. structures. CO1
   (c) What do you understand by limiting depth of N.A.? CO1
   (d) How do you check whether a beam is to be designed as singly or doubly reinforced section? CO1
   (e) What is control of deflection? Write down the IS 456 provisions regarding deflection. CO2
   (f) What is doubly reinforced beam? CO1
   (g) What do you understand by the term economical depth of T beam? CO1
   (h) What is one-way slab and two-way slab? CO3
   (i) What is a cantilever chajja? Give the points to be considered while designing a cantilever chajja. CO3
   (j) Why τ_{cmax} is imposed while designing the beam for shear? CO2
   (k) What is a two-way slab? What are the types of two-way slab? CO3
   (l) Give the classification of columns. CO4
   (m) What is the function of transverse reinforcement in a column? CO4
   (n) What is minimum eccentricity? CO4

UNIT – I

2. (a) Determine ultimate moment of resistance of a section having width 230 mm and depth 550 mm. Section is reinforced with 5 bars of 16 mm φ on tension side. Use M20 grade of concrete and Fe 500 steel. Assuming effective cover 40 mm. (7M) CO1

   (b) Doubly reinforced section size 230 mm x 540 mm overall is reinforced with 2 nos. 12 mm diameter bars on compression side and 4 nos. 20 mm diameter bars on tension side. If effective cover on both side is 40 mm and M20 Fe 415 materials are used. Find M.R. (7M) CO1

(OR)

3. Find the area of tension reinforcement for a flanged section to resist ultimate moment 675 kNm. Sectional properties of flanged section are; b_f =1200 mm; D_f = 120 mm; b_w = 300 mm; d = 600 mm. Material properties of flanged sections are: M20 grade of concrete and Fe 415 steel. CO1

UNIT – II

4. A rectangular R.C.C. beam simply supported over a span of 5 m is 230 mm x 450 mm effective is reinforced with 0.75% tension steel. Design the shear reinforcement using 6 mm diameter two legged vertical stirrups use M20 and Fe 415. CO2

(OR)

5. Design reinforcement required for a rectangular RC beam section for following data:
   Size of beam = 300 mm x 450 mm
   Factored shear, V_u = 50 kN
   Factored bending moment M_u = 85 kN-m
   Factored torsional moment T^u = 35 kN-m
   Grade of concrete = M20, Grade of Steel = Fe 415
   Draw the detail of reinforcement. CO2

UNIT – III

6. Design simply supported slab for a room 3 m x 7 m. The slab is supported by beam of width 230 mm along the edges The slab is subjected to floor finish 1 kN/m^2. Use M20 and Fe 500. Draw details of reinforcement and take necessary check. CO3

(OR)

7. Design a simply supported two-way slab panel having effective dimensions as 4.0 m x 3.5 m. Take live load of 3.50 kN/m^2 and floor finish of 1.50 kN/m^2. Use M20 concrete and Fe 415. CO3

UNIT – IV

8. Design an axially loaded column to carry a working load of 850 kN. The unsupported length of column is 3.5 m. The column is held in position and not restrained against the rotation at both ends. CO4

(OR)

9. A column 3.8 m long is of size 300 mm x 400 mm. It is subjected to factored load of 1300 kN and a factored moment of 60 kNm about the axis bisecting smaller dimension of column. Design the column if it is fixed at both ends. Use M20 concrete and Fe 415 steel. CO4

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CE312 (R20)

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Hall Ticket Number:

CE312 (R20)

B.TECH. DEGREE EXAMINATION, MARCH-2023

Semester V [Third Year] (Regular)

DESIGN OF RC STRUCTURAL ELEMENTS

Time: Three hours | Maximum Marks: 70

Answer Question No.1 compulsorily. (14 x 1 = 14)
Answer One Question from each unit. (4 x 14 = 56)

1. Answer the following:

(a)	Define RCC.	CO1
(b)	List various structural elements in RCC.	CO1
(c)	Define partial safety factor.	CO1
(d)	Differentiate shear and torsion.	CO2
(e)	Define diagonal compression.	CO2
(f)	How do you check development length?	CO2
(g)	Define cracking.	CO3
(h)	Differentiate short and long term deflections.	CO3
(i)	Define one way slab.	CO3
(j)	Mention the condition when two way slab will construct.	CO4
(k)	Define column.	CO4
(l)	What is the mode of failure in case of long columns?	CO4
(m)	Mention Euler's formula.	CO4
(n)	State assumptions in design of columns.	CO4

UNIT – I

2. (a) Explain under reinforced, balanced and over reinforced sections. (7M) CO1
   (b) State the conditions when a doubly reinforced beam is preferred. (7M) CO1

(OR)

3. Design a singly reinforced rectangular concrete beam simply supported on masonry walls 300 mm thick with an effective span of 5 m to support a service load of 8 kN/m and a dead load of 4 kN/m in addition to its self weight. Adopt M20 grade concrete and Fe 415 HYSD bars. Width of support of beams of 300 mm. Adopt working stress method. CO1

UNIT – II

4. (a) What are the different types of shear reinforcement in a beam as per code? (7M) CO2
   (b) A simply supported R.C.C. beam 200 mm x 400 mm effective depth is reinforced with 4 bars of 22 mm diameter on tension side. The beam is carrying a load of 10 kN/m over a clear span of 8 m. Design the shear reinforcement. Use M20 concrete and Fe 415 steel bars. (7M) CO2

(OR)

5. Design the reinforcements required for a rectangular beam section with following data: CO2
   Size of the beam = 300 x 600 mm
   Factored Shear force = 96 kN
   Factored bending moment = 110 kNm
   Factored twisting moment = 48 kNm
   M20 grade of concrete and Fe 415 grade of steel
   Sketch the reinforcements details.

UNIT – III

6. (a) Explain the load pattern distribution of one way slab and two way slab with a diagram. (7M) CO3
   (b) Design a slab for a room 3 m x 7 m clear in size. Use M20 concrete and Fe 415 steel. The live load is 2 kN/m^2. Draw top plan and bottom plan to show the reinforcement detailing. (7M) CO3

(OR)

7. Design a reinforced concrete slab for a room of clear dimension 4 m x 5 m. The slab is supported on walls of width 300 mm. The slab is carrying a live load of 4 kN/m^2 and floor finish is 1 kN/m^2. Use M20 concrete and Fe 415 steel. The corners of the slab are held down. Sketch the layout of the reinforcement. CO3

UNIT – IV

8. (a) Differentiate between short and long columns. (7M) CO4
   (b) Design a square column to carry an axial load of 1000 kN. Use M20 concrete and Fe 415 steel. Draw a longitudinal section and a cross section showing the reinforcement. (7M) CO4

(OR)

9. A corner column 400 x 400 mm, is subjected to the factored loads P_u = 1200 kN, M_{ux} = 180 kN-m and M_{uy} = 100 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. CO4

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CE312 (R20)