Course Code: 23CE0118 **R23**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: Design of reinforced concrete structures (23CE0118) **Course & Branch**: B.Tech - Civil

Year & Sem: III-B.Tech & I-Sem **Regulation:** R23

PART- A

1	A T-Beam slab floor of reinforced concrete has a slab 150 mm thick spanning between the T-Beams which are spaced 3 m apart. The beams have a clear span of 10 m and the end bearing are 450 mm thick walls. The live load on the floor is 4 kN/m². Using M20 grade concrete and Fe 415 HYSD bars, Design one of the Intermediate T-beams. Sketch the reinforcement details.	**[L4]**	**[CO2]**	**[28M]**
2	Design the L-beam for an office floor to suit the following data and sketch the layout of the reinforcement. Clear span L=8m Thickness of flange D_f =150mm Live load = 4kN/m^2 Spacing of beams =3m F_{ck} = 20 N/mm^2 F_y = 415 N/mm^2 L-beams are monolithic with RC columns Width of column=300mm	**[L4]**	**[CO2]**	**[28M]**
3	A simply supported RCC slab has to be provided for the roof of a room of clear dimensions 3 m × 8 m. Width of supporting wall is 300 mm. The weight of weathering course over the slab is 1 kN/m². Take the live load on the slab as 2 kN/m². Design and draw the reinforcement details of the slab using M20 grade concrete and HYSD bars.	**[L4]**	**[CO3]**	**[28M]**
4	Design and draw the reinforcement details of a two-way slab for a room 5.5 m x 4 m clear in size. If the super imposed load is 5 kN/m^2. Use M25 concrete and Fe 415 steel. Edges of simply supported – corners not held down.	**[L4]**	**[CO3]**	**[28M]**
5	Design a continuous one-way slab for an office floor. The slab is continuous over beams spaced at 3.5 m internals. The width of the beam is 230 mm. The super imposed load is 3kN/m^2 and floor finish is 1 kN/m^2. Use M20 concrete and Fe 415 steel. Sketch the reinforcement details.	**[L4]**	**[CO4]**	**[28M]**
6	Design a singly reinforced continuous RC rectangular beam for flexure for the following condition. Use M20 grade concrete and Fe 415 steel. No of spans=3 Clear distance between supports = 3600 mm Width of support = 300mm Imposed load (not fixed) = 5 kN/m^2 Imposed load (fixed) = 7.5 kN/m^2 (excluding self-weight) Partial fixity may be expected at the discontinuous edge. Sketch the reinforcement details.	**[L4]**	**[CO4]**	**[28M]**
7	Design the short, axially loaded rectangular column to support a load of 875 kN. One side of the column is restricted to 300 mm. Use M 25 concrete and Fe 415 steel. Draw the reinforcement details.	**[L4]**	**[CO5]**	**[28M]**
8	Design a footing of uniform thickness for a reinforced concrete column of 400 mm × 600 mm size carrying an axial load of 1500 kN using M20 grade concrete and Fe415 steel. The safe bearing capacity of soil is 200 kN/m^2. Draw the reinforcement details.	**[L4]**	**[CO5]**	**[28M]**

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PART-B

UNIT –I
METHODS OF DESIGN OF CONCRETE STRUCTURES

1	Draw the strain and stress distribution for singly reinforced beam and derive the expression for the position of neutral axis by two ways.	**[L3]**	**[CO1]**	**[14M]**
2	A Reinforced concrete beam 200 mm wide and 500 mm effective depth is reinforced with 3 nos of 16 mm diameter bars. Find the moment of resistance of the beam by using working stress method. Use M20 grade of Concrete and mild steel reinforcement.	**[L4]**	**[CO1]**	**[14M]**
3	Design a Reinforced concrete beam, having width 230 mm to resist a bending moment of 30 kN-m. Use M20 grade concrete and Fe 415 steel.	**[L4]**	**[CO1]**	**[14M]**
4	Explain the limit state method and write the assumptions for limit state of collapse.	**[L2]**	**[CO1]**	**[14M]**
5	Design a singly reinforced concrete beam of clear span 5 m to support a dead and live load of 10 kN/m. Adopt M20 grade concrete and Fe 415 HYSD bars.	**[L4]**	**[CO1]**	**[14M]**
6	Design a doubly reinforced concrete beam of effective span 8 m, to support a working live load of 30 kN/m. Effective depth of beam is 600 mm. Adopt M20 grade concrete and Fe 415 HYSD bars and effective cover of 50 mm.	**[L4]**	**[CO1]**	**[14M]**
7	Explain the different methods of design and write the advantages of limit state method over other methods.	**[L2]**	**[CO1]**	**[14M]**
8	Design a rectangular simply supported concrete beam over a clear span of 4m, carries a super imposed load of 20 kN/m and support width is 300 mm each. Use M20 grade concrete and Fe415 steel. Check the design for deflection.	**[L4]**	**[CO1]**	**[14M]**
9	Design a R.C. rectangular beam simply supported over an effective span of 6 m to support an imposed load of 24 kN/m inclusive of the self-weight. Use M25 grade concrete and Fe 415 steel. Provide width of the beam equal to half of the depth. Use working stress method.	**[L4]**	**[CO1]**	**[14M]**
10	A singly reinforced concrete beam section 300 mm × 550 mm is reinforced with 5 bars 0f 16mm diameter with an effective cover of 50mm. The beam is simply supported over a span of 5m. Find the safe uniformly distributed load the beam can carry. Use M20 grade concrete and Fe 415 steel.	**[L4]**	**[CO1]**	**[14M]**

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UNIT –II
LIMIT STATE METHOD –FLANGED BEAM, SHEAR & TORSION

1	A T-Beam of flange width 850 mm flange thickness 100 mm rib width 275 mm has an effective depth of 475 mm. The beam is reinforced with four bars of 20 mm diameter. Find the ultimate moment of resistance. Use M20 Concrete and Fe 415 steel.	**[L3]**	**[CO2]**	**[14M]**
2	A T-Beam slab floor of reinforced concrete has a slab 150 mm thick spanning between the T-Beams which are spaced 3 m apart. The beams have a clear span of 10 m and the end bearing are 450 mm thick walls. The live load on the floor is 4 kN/m². Using M20 grade concrete and Fe 415 HYSD bars, Design one of the Intermediate T-beams.	**[L4]**	**[CO2]**	**[14M]**
3	An R.C.C. beam 230 mm wide and 450 mm deep is reinforced with 4 bars of 16 mm diameter having shear force 60 kN. Design the shear reinforcement. If the grade of concrete and steel used is M20 and Fe 415.	**[L4]**	**[CO2]**	**[[14M]**
4	Design the L-beam for an office floor to suit the following data Clear span L=8m Thickness of flange D_f =150mm Live load = 4kN/m^2 Spacing of beams =3m F_{ck} = 20 N/mm^2 F_y = 415 N/mm^2 L-beams are monolithic with RC columns Width of column=300mm	**[L4]**	**[CO2]**	**[14M]**
5	An RCC beam 250 mm wide and 450 mm deep effective is reinforced with 6 bars of 16 mm diameter on tension side of which two bars are cranked up near the support. If the design shear force is 120 kN, design the shear reinforcement considering bent-up bars. Use M-20 grade concrete and Fe-415 steel.	**[L4]**	**[CO2]**	**[14M]**
6	Check the bond requirement of the continuous beam, if the factored shear force is 200 kN at the point of inflection. Assume M20 Grade of concrete, Fe 415 steel, breadth and depth of beam is 300 mm and 450 mm and 3 number of bars with 20mm diameter.	**[L3]**	**[CO2]**	**[14M]**
7	A simply supported beam is 6 m in span and carries a uniformly distributed load of 60 kN/m. If 6 number of 20 mm bars are provided at the Centre of the span and 4 number of these bars are continued in to the supports, check the development at the supports assuming M 20 grade concrete and Fe 415 steel.	**[L3]**	**[CO2]**	**[14M]**

8	A singly reinforced rectangular beam 300 × 600 mm effective depth carries a uniformly distributed load of 40 kN/m including its self-weight over a simply supported span of 6 m and is reinforced with 5 bars of 25 mm diameter of which 2 bars are cranked up near the support. Fe 415 grade steel and M 20 grade concrete are used. Design the beam for shear reinforcement at support.	**[L4]**	**[CO2]**	**[14M]**
9	a) A simply supported beam is 6 m in span and carries a uniformly distributed load of 60 kN/m. If 6 Nos of 20 mm bars are provided at the centre of the span and 4 nos of these bars are continued in to the supports, check the development at the supports assuming M20 grade concrete and Fe 415 steel.	**[L3]**	**[CO2]**	**[7M]**
	b) Calculate the spacing of two-legged 8 mm diameter vertical stirrups as per minimum shear reinforcement for a beam of 350 mm wide and 500 mm overall depth if Fe 415 bars are used. Effective cover is 35 mm.	**[L3]**	**[CO2]**	**[7M]**
10	What is meant by a bond? Explain the various types of bond in detail.	**[L2]**	**[CO2]**	**[14M]**

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UNIT –III
LIMIT STATE DESIGN OF SLABS AND STAIR CASE

1	A simply supported RCC slab has to be provided for the roof of a room of clear dimensions 3 m × 8 m. Width of supporting wall is 300 mm. The weight of weathering course over the slab is 1 kN/m². Take the live load on the slab as 2 kN/m². Design the slab using M20 grade concrete and HYSD bars.	**[L4]**	**[CO3]**	**[14M]**
2	Describe the step-by-step procedure involved in the design of a one way slab and two way slab according to IS 456-2000.	**[L3]**	**[CO3]**	**[14M]**
3	Design a cantilever balcony slab projecting 1.5 m from a beam using M20 grade concrete and Fe 415 steel. Adopt a live load of 2kN/m^2 and floor finish of 1kN/m^2	**[L4]**	**[CO3]**	**[14M]**
4	Design a two way slab for a room 5.5 m x 4 m clear in size. If the super imposed load is 5 kN/m^2. Use M25 concrete and Fe 415 steel. Edges of simply supported – corners not held down.	**[L4]**	**[CO3]**	**[14M]**
5	Design the two way slab for a room 4 m x 3.5 m clear in size, if super imposed load is 3 kN/m^2 and floor finish of 1 kN/m^2. The edges of the slab are simply supported and corners are not held down. Use M 20 grade concrete and Fe 415 grade steel.	**[L4]**	**[CO3]**	**[7M]**
6	The floor slab of a class room of 3m x 5m is discontinuous on all its four sides.The corners of the slab are prevented from lifting. 50mm thick floor finish of unit weight 20 kN/m^2 is to be provided over the slab Live load on the slab is 3 kN/m^2. Width of the support is 250mm. Design the slab using M20 grade concrete and Fe 415 steel. Design the torsion reinforcement also.	**[L4]**	**[CO4]**	**[14M]**
7	Design the floor slab for a hall 4m x 5m to carry a live load of 3 kN/m^2 and floor finish of 1 kN/m^2. The slab is continuous over two adjacent walls of the hall. Walls are 300 mm wide. Use concrete of grade M20 and steel of Fe 415.	**[L4]**	**[CO4]**	**[14M]**
8	Design a continuous one way slab for an office floor. The slab is continuous over beams spaced at 3 m internals. The width of the beam is 200mm. The super imposed load is 2 kN/m^2 and floor finish is 1 kN/m^2. Use M20 concrete and Fe 415 steel.	**[L4]**	**[CO4]**	**[14M]**
9	Design a continuous one way slab for an office floor. The slab is continuous over beams spaced at 3.5 m internals. The width of the beam is 230mm. The super imposed load is 3kN/m^2 and floor finish is 1 kN/m^2. Use M20 concrete and Fe 415 steel.	**[L4]**	**[CO4]**	**[14M]**
10	Explain the concept of a flat slab. Discuss its advantages compared to conventional slab systems.	**[L2]**	**[CO4]**	**[14M]**

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UNIT –IV
LIMIT STATE DESIGN OF COLUMNS
LIMIT STATE DESIGN OF FOOTINGS

1	Design the short axially loaded rectangular column to support a load of 875 kN. One side of the column is restricted to 300 mm. Use M25 concrete and Fe 415 steel.	**[L4] [CO5]**	**[14M]**
2	Design a circular column of diameter 400 mm, with lateral ties subjected to a working load of 1200 kN. Use M20 grade concrete and Fe 415 steel. The column is 3 m long effectively held in position and direction at both the ends.	**[L4] [CO5]**	**[14M]**
3	Design the reinforcements in a rectangular column of size 300mm × 500mm to support a design ultimate load of 500kN, together with a factored moment of 200 kN-m. Adopt M20 concrete and Fe 415 steel.	**[L4] [CO5]**	**[14M]**
4	A short circular column of diameter 400 mm is reinforced with 6 numbers of 16 mm diameter. Find the axial factored load on the column if M20 grade concrete and Fe 415 grade steel is used.	**[L3] [CO5]**	**[14M]**
5	Explain in detail the different types of columns used in building construction with diagrams.	**[L2] [CO5]**	**[14M]**
6	Design the reinforcements in a circular column of diameter 400 mm to support a factored load of 800 kN together with a factored moment of 80kN-m. Adopt M20 grade concrete and Fe 415 HYSD bars..	**[L4] [CO5]**	**[14M]**
7	Design a reinforced concrete footing for a rectangular column of section 300 mm × 500 mm supporting an axial factored load of 1500 kN. The safe bearing capacity of the soil at site is 185 kN/m^2. Adopt M20 grade concrete and Fe 415 HYSD bars.	**[L4] [CO5]**	**[14M]**
8	Explain in detail the different types of footings used in building construction with diagrams.	**[L2] [CO5]**	**[14M]**
9	Design a footing of uniform thickness for a reinforced concrete column of 400 mm × 600 mm size carrying an axial load of 1500 kN using M20 grade concrete and Fe415 steel. The safe bearing capacity of soil is 200kN/m^2.	**[L4] [CO5]**	**[14M]**
10	A reinforced concrete wall 250 mm thick carries a load of 500 kN/m inclusive of its self weight. Design a reinforced concrete footing on soil having safe bearing capacity of 160 kN/m^2. Use M20 concrete and Fe 415 steel.	**[L4] [CO5]**	**[14M]**

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UNIT –V

LIMIT STATE OF SERVICEABILITY AND MISCELLANEOUS (Aspect of Deflection Cracking aspects)

1	Explain the serviceability requirements in RC structures. Discuss the importance of limiting deflection and cracking.	**[L2] [CO6]**	**[14M]**
2	A simply supported beam of the effective span 6m is rectangular in section 250 mm wide with an effective depth of 500 mm. The beam is reinforced with 4 bars of 20 mm diameter on the tensile face and 2 bars of 16mm diameter at the compression face. The effective cover is 50mm. Using Fe 415 HYSD bars, check the limit state of deflection using the empirical method.	**[L4] [CO6]**	**[14M]**
3	A simply supported beam of rectangular section spanning over 6m has a width 300 mm and over all depth 600 mm. The beam is reinforced with 4 bars of 25mm diameter on the tension side at an effective depth of 550 mm spaced at 50mm centers. The beam is subjected to a working load moment of 160 kN-m at the center of span section. Using M25 grade concrete and Fe 415 HYSD bars. Check the beam for the serviceability limit state of cracking according to IS: 456-20000 code method.	**[L4] [CO6]**	**[14M]**
4	What are the different types of staircases? Explain with neat sketches and highlight the merits and demerits of a dog-legged staircase.	**[L2] [CO6]**	**[14M]**
5	Design a doglegged staircase for a building in which the height of floor is 3.3 m. Adopt rise and tread of each step are 150 mm and 225 mm respectively. The stair hall is 2.5 m × 4.5 m. Live load may be taken as 3 kN/m². Use M20 grade concrete and Fe 415 grade steel. Assume the stairs are supported on 230 mm walls at the ends of outer edges of landing slabs.	**[L4] [CO6]**	**[14M]**
6	Discuss in detail the factors affecting crack formation and crack control in RC structures.	**[L2] [CO6]**	**[14M]**
7	Design a dog legged stair case for an office building in a room measuring 3 m x 6 m clear dimensions. Floor to Floor height is 3.5 m. The building is a public building liable to overcrowding. Stairs are supported on brick wall 230 mm thick at the ends of the landing. Use M20 concrete and Fe415 steel.	**[L2] [CO6]**	**[14M]**
8	Differentiate between limit state of collapse and limit state of serviceability with examples.	**[L2] [CO6]**	**[14M]**

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9	Design one of the flights of a dog legged stairs spanning between landing beams using the following data. Type of stair case: Dog legged with waist slab, treads and risers Number of steps in the flight = 10 Tread T = 300mm Rise R = 150mm Width of landing beams = 300mm M20 grade concrete and Fe 415 HYSD bars.	**[L4] [CO6]**	**[14M]**
10	10. Write short notes on: a) Shrinkage deflection b) Creep deflection c) Serviceability criteria for RC beams and slabs	**[L2] [CO6]**	**[14M]**