SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

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DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

SEMESTER - V

1903501–DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS

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SUBJECT NAME: 1903501–DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS

UNIT I - INTRODUCTION

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC –Properties of Concrete and Reinforcing Steel - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods- Analysis and Design of Singly reinforced Rectangular beams by working stress method.

PART-A

S.No.	Questions	BT Level	Competence
1	Define a balanced section?	BT-1	Remembering
2	What are the different types of loads that have to be considered in the design of a building?	BT-1	Remembering
3	What are the three methods of design of reinforced concrete structural Elements? Which of the three methods is the best?	BT-1	Remembering
4	What is the formula used to find the critical neutral axis in working stress method?	BT-1	Remembering
5	Write down the values of partial safety factor for i) concrete ii) steel.	BT-1	Remembering
6	What are the advantages of elastic method or working stress method?	BT-1	Remembering
7	Explain modular ratio. Show the modular ratio of M20 & M25grade concrete.	BT-3	Applying
8	Summarize the main concept of working stress method/Elastic theory of reinforced concrete structures?	BT-2	Understanding
9	Explain about characteristic load and characteristic strength of material?	BT-3	Applying
10	Explain the term Modular ratio.	BT-3	Applying
11	Summarize the assumptions made for design of RC members in working stress method.	BT-2	Understanding
12	Identify and state the main concept of elastic method or working stress method.	BT-3	Applying
13	What is permissible bending stress in concrete?	BT-1	Remembering
14	Write down the advantages of limit state method over other methods.	BT-3	Applying
15	Enlist different factors that are influencing the durability of concrete as per BIS.	BT-3	Applying
16	Examine the assumptions made in limit state of collapse by flexure.	BT-3	Applying
17	Mention any two advantages of introducing compression steel in RC beam	BT-1	Remembering
18	Distinguish between under reinforced and over reinforced sections.	BT-1	Remembering
19	Difference between WSD and LSD?	BT-2	Understanding
20	List out the minimum and maximum area of tension reinforcement in beam?	BT-2	Understanding
21	Enumerate serviceability limit state.	BT-3	Applying
22	Select any two assumptions are made in elastic theory method.	BT-1	Remembering

23	Draw the stress strain curve for concrete in the limit state design of flexure.	BT-2	Understanding
24	Justify any two guidelines to select the cross sectional dimensions of RC beam.	BT-2	Understanding
25	What are the classifications available in serviceability limit state?	BT-2	Understanding

PART-B

1	Design a rectangular section for a simply supported RC beam of effective span of 4m carrying a concentrated load of 35kN at its mid span. The concrete to be used is of grade M20 and the reinforcement consists of Fe415 steel bars. i) Self weight of beam is ignored. ii) Self weight of beam is considered. Choose working stress method.	BT-5	Evaluate
2	A singly reinforced beam 250mmX500mm in section in reinforced with four bars of 16mm diameter with an effective cover of 50mm. effective span of the beam is 6m.assuming M20 grade of concrete and Fe415 grade of steel determine the central concentrated load that can be carried by the beam in addition to its self-weight.	BT-4	Analyze
3	A simply supported over an effective span of 8m carries a live load of 15KN/m. design the beam, using M20 concrete and Fe415 grade steel. Keep the width equal to half the effective depth. Use working stress method of design.	BT-4	Analyze
4	A beam of rectangular section of width 225mm and effective depth 500 mm is simply supported over a span of 5m is reinforced with four members of 20 mm dia mild steel bars in the tension side. Determine the position of neutral axis and the stresses in the top most compression fiber of concrete and tension steel. If the beam carries a UDL of 9KN/m (including self-weight) for the entire span. Use working stress method of design.	BT-4	Analyze
5	A rectangular RC section having a width of 350 mm is reinforced with 2 numbers of 28 mm diameters at an effective depth of 700mm. adopting M20 grade concrete and Fe415 HYSD bars. Determine the ultimate moment of resistance of the section.	BT-4	Analyze
6	Analyze a rectangular beam section of 300mm width and 500 mm effective depth to determine the moment of resistance and stress induced in top compression fibre of concrete and steel for beam is reinforced with 3-20mm diameter at tension zone. Consider concrete of grade M20 and steel of grade Fe415.	BT-4	Analyze
7	Ilustrate the various methods available for the design of RC Structural Elements in detail.	BT-4	Analyze
8	Identify the expression for the depth of neutral axis and moment of resistance of a singly reinforced beam section under flexure and obtain design constants K, j, Q for M20 concrete and Fe415 steel. Use working stress method.	BT-4	Analyze
9	A singly reinforced section having following details: breadth=200mm, effective depth=450mm and reinforced with 3 nos. of 16mm dia mild steel. Concrete grade M15 and effective cover=35mm, effective span=4m. Determine the maximum imposed load the beam and carry per meter length.	BT-4	Analyze
10	Analyze and design a rectangular beam section 300X500mm effective depth subjected to a moment of 60 KNm. Consider concrete of grade M20 and steel of grade Fe415.	BT-4	Analyze

11	Analyze a rectangular beam section of 300mm width and 500 mm effective depth to determine the moment of resistance and stress induced in top compression fibre of concrete and steel for beam is reinforced with 3-16mm diameter at tension zone. Consider concrete of grade M20 and steel of grade Fe415.	BT-4	Analyze
12	Determine the position of neutral axis and the moment of resistance of a beam 300mm wide and 550mm effective depth. It is reinforced with 3 bars of 16mm diameter. Use M20 grade of concrete and Fe415 grade of steel. Adopt working stress method	BT-4	Analyze
13	Design a rectangular reinforced concrete beam simply supported on masonry walls 300mm thick with an effective span of 5m to support a service load of 8KN/m and a dead load of 4KN/m without its own weight. Adopt M20 grade concrete and Fe 415 HYSD bars width of support of beam=300mm.	BT-5	Evaluate
14	Discuss the terms of (a) Neutral axis (3) (b) Moment of resistance (4) (c) Lever Arm (3) (d) Modular Ratio (3)	BT-3	Applying
15	Differentiate between working stress method and limit state method.	BT-3	Applying
16	Explain in Details about types of loads and load combination in a structure	BT-4	Analyze
17	Determine the moment of resistance of a singly reinforced beam 160 x 300mm effective section, if the stress in steel and concrete are not to exceed 140N/mm^2 and 5N/mm^2.effectve span of the beam is 5m and the beam carries 4 nos of 16mm dia bars. Take m=18.find also the minimum load the bam can carry. Use working stress method.	BT-5	Evaluate

PART - C

1	A rectangular beam of span 7m (C/C of supports), 250mm wide by 550mm deep is to carry a uniformly distributed load (excluding self-weight) of 15 KN/m and LL of 20KN/m. using M20 grade concrete and Fe415 HYSD bars, Design the beam section at mid span, check the adequacy of the section for shear and perform a check for deflection control.	BT-5	Evaluate
2	Explain the detailed design procedure of singly reinforced rectangular beam by WSM.	BT-4	Analyze
3	Explain working stress method with limit state method and ultimate load methods of design of R.C structures.	BT-4	Analyze
4	A reinforced concrete beam of rectangular section has the cross section of 300mm X 500mm. 4 Nos of 20 mm diameter steel bars is provided as tension reinforcement. Assuming M20 grade concrete & Fe415 grade steel are used. Determine the stresses induced in the top compression fibre of the concrete and tension steel when it is subjected to a moment of 65 kNm.	BT-5	Evaluate
5	Explain the following terms: a. Characteristic strength and characteristic loads. (5) b. Partial safety factors. (5) c. Balanced section and under reinforced section. (5)	BT-3	Applying

UNIT II – DESIGN OF BEAMS

Analysis and design of singly and doubly reinforced rectangular and flanged beams– Use of IS codes and design aids for Flexure - Behaviour of rectangular RC beams in bond, anchorage, shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

PART-A

Q. No.	Questions	BT Level	Competence
1.	Write the formula for effective flange width of isolated L-beam and T-beam?	BT-1	Remembering
2.	What are the stresses produced by torsion?	BT-1	Remembering
3.	Write down the value of design bond stress for M 30 grade concrete.	BT-1	Remembering
4.	What do you understand by the term anchorage?	BT-1	Remembering
5.	On what circumstances doubly reinforced beams are to be adopted?	BT-1	Remembering
6.	What you mean by diagonal tension?	BT-1	Remembering
7.	Illustrate the advantages of flanged beams.	BT-2	Understanding
8.	Summarize any two general features of two way slab.	BT-2	Understanding
9.	Explain shortly about flexural bond	BT-3	Applying
10.	Draw sketches for different types of shear reinforcement.	BT-2	Understanding
11.	Write short note on doubly reinforced section	BT-2	Understanding
12.	What is the formula used to find the spacing of inclined stirrups?	BT-3	Applying
13.	Differentiate bond and anchorage.	BT-1	Remembering
14.	What are the types of reinforcement used to resist shear and write down expression for shear resistance offered by each type.	BT-1	Remembering
15.	What is the importance of anchorage value of bends?	BT-1	Remembering
16.	Differentiate shear failure and bending failure.	BT-4	Analyzing
17.	Write down the formulae for calculating effective width of flanged beams.	BT-1	Remembering
18.	Define development length.	BT-1	Remembering
19.	List the important factors that influence bond strength.	BT-1	Remembering
20.	How to overcome torsion on beams?	BT-2	Understanding
21.	State minimum requirement of shear reinforcement?	BT-2	Understanding
22.	Define limit state of collapse in shear.	BT-2	Understanding
23.	Discuss any two structural members subjected to torsion?	BT-3	Applying
24.	Enlist the types of shear failure in reinforced concrete beams?	BT-3	Applying
25.	Discuss the four components for which design are to be made in T-beams?	BT-3	Applying

PART-B

1	A rectangular beam of 300mm wide is reinforced with 4nos.#25mm dia at an effective depth of 600mm. a beam has to resistant of factored shear force of 400KN @ support section. Assume f_{ck}=20N/mm^2; f_y=415N/mm^2. Design the vertical stirrups.	BT-5	Evaluate
2	A reinforced concrete beam of rectangular section has a width of 250mm and an effective depth of 500mm the beam is reinforced with 4 bars of 25 mm dia on the tension side. Two of the tension bars are bent up at 45^0 near the support section. In addition the beam is provided with two legged stirrups of	BT-5	Evaluate

	8mm dia at 150mm centers near the supports. If f_{ck}=25N/mm^2; f_y=415N/mm^2. Estimate the ultimate shear of the support section.		
3	Find the reinforcement required for a rectangular beam section for the following data. Size of the beam 300mmX600mm, factored moment=115KNm, Factored torsion=45 kNm, Factored shear=95kN. Use M 20 concrete and Fe 415 steel.	BT-4	Analyze
4	Determine the are of steel required for a T beam with following dimensions; Depth of slab=100mm Breadth of flange=750mm Width of web=250mm Total depth=600mm The beam is subjected to an ultimate moment of resistance of 525kNm. concrete grade M20 and steel grade Fe415 are used with cover 50mm	BT-5	Evaluate
5	A simply supported RC beam of size 300x500mm effective is reinforced with 4 bars of 16mm diameter HYSD steel of grade Fe415. Determine the anchorage length of the bars at the simply supported end if it is subjected to a factored fore of 350 kN at the Centre of 300mm wide masonry supports. The concrete mix of grade M 20 is to be used. Draw the reinforcement details.	BT-5	Evaluate
6	A simply supported beam is 6m is span and carries a characteristic load of 60kN/m. if 6 numbers of 20 mm bars are provided at the center of the span and 4 numbers of these bars are continued into the supports, check the development length at the supports assuming grade M15 concrete and Fe 415 steel.	BT-4	Analyze
7	Design a T beam section with a flange width of 1250mm,a flange depth of 100mm, a web width of 250mm and an effective depth of 500mm, which is subjected to a factored moment of 560 kNm. The concrete mix is to be used is of grade M20 and steel is of grade Fe415. Use limit state method.	BT-5	Evaluate
8	A simply supported one way slab of 4 m span carries a live load of 3 N/m^2 and the load of floor finish as 1.25 KN/m^2.the slab having a total depth of 150mm is reinforced with 8 mm dia bars @100 mm c/c at a nominal cover of 20 mm. assuming a permanent load equal to dead load plus 20% of live load, compute the total maximum deflection and check it as per code requirements. Use M 20 concrete and Fe 415 steel.	BT-5	Evaluate
9	A tee beam slab of an office comprise of a slab 150mm thick spanning between ribs spaced at 30 centers. The effective span of the beam is 8m. Live load on floor is 4KN/m$^{2.}$ Design one of the intermediate beams. Using M20 grade concrete and Fe415 HYSD bars.	BT-5	Evaluate
10	Analyze and Design a T- beam section with a flange width of 1200mm, a flange depth of 100 mm, a web width of 250 mm and an effective depth of 500 mm, which is subjected to a factored moment of 550 kNm. The concrete mix is to be used is of grade M20 and steel is of grade Fe415. Use LSM.	BT-4	Analyze
11	Check for the development length at support of a doubly reinforced beam 400mm x 750m (effective) the clear span of the beam is 5.25m. The beam carries UDL of 46 kN/m (including self-weight). The beam is reinforced with 8 bars of 20 mm diameter (4 bars are bent up near support) on tension side and 4 bars of 16 mm diameter on compression side. Adopt M20 grade of concrete and Fe 415 HYSD bars.	BT-4	Analyze

12	Recommend the Design value of reinforcement for a T-beam for the following data: Effective span : 8m Spacing of beam = 3m, Thickness of slab = 130 mm Total depth = 450 mm, Live load 10 kN/m^2.	BT-4	Analyze
13	Calculate the moment of resistance of a T beam having a flange width 1250mm, web width 300mm, flange thickness 125mm and an effective depth 550mm. the beam is reinforced with 8 bars of 25 mm dia on tension side, concrete grade M20 and steel grade Fe415 are used.	BT-4	Analyze
14	A doubly reinforced beam of size 250mm X 550mm is provided with a compression steel of 900mm ^{2} with an effective cover of 50mm at top and bottom. The neutral axis depth is equal to limiting neutral axis depth. Find the total area of steel provided. The concrete of beam is M 20 grade and Fe 415 HYSD bars are used and moment of resistance is 460 kNm.	BT-2	Understanding
15	Deign a rectangular beam of cross section 230 x 600 mm and of effective span 6m.imposed load on the beam is 40 kN/m. Use M20 concrete and Fe415 steel.	BT-4	Analyze
16	Design a simply supported RC beam having an effective span of 5m.the beam has to carry a load of 25 kN/m. sketch the reinforcement details	BT-4	Analyze
17	Describe the procedure for design of shear reinforcement.	BT-3	Applying

PART-C

1.	Design a doubly reinforced concrete beam of rectangular section using the following data: Effective span=5m Width of beam=250mm Over all data=500mm Service load (DL+LL) =40KN/m. Effective cover=50mm M20 grade of concrete and Fe415 HYSD bars	BT-5	Evaluate
2	Find the reinforcement required for a rectangular beam section for the following data. Size of the beam 300mmX500mm, factored moment=80KNm, Factored torsion=40 KNm, Factored shear force =70 KN. Use M 20 concrete and Fe 415 steel.	BT-5	Evaluate
3.	Design torsional reinforcement in a rectangular beam section, 350mm wide 750mm deep, subject to an ultimate twisting moment of 140 KNm combined ultimate shear force of 110KN. Assume M-25 grade concrete, Fe415 grade steel and mild exposure condition.	BT-5	Evaluate
4.	A rectangular beam is to be simply supported on supports of 230mm thick; the clear span of the beam is 6m. the beam is to have a width of 300mm. the characteristic super imposed load of 12KN/m. Using M20 concrete and Fe415 steel, design the beam adopt limit state design method	BT-5	Evaluate
5.	(i) Explain the use of IS codes on design aids for Flexure. (ii) Explain the following a. Bond	BT-4	Analyze

	b. Anchorage c. Shear d. Torsion		

UNIT III DESIGN OF SLABS AND STAIRCASES

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two way slab- Design of simply supported and continuous slabs using IS code coefficients- Types of Staircases – Design of dog-legged Staircase.

PART A

1	Write the various types of slab.	BT-1	Remembering
2	Write the different types of staircase	BT-1	Remembering
3	Why is secondary/distribution reinforcement provided in one way RC slab?	BT-1	Remembering
4	What is stair case?	BT-1	Remembering
5	What is the expressions recommended by IS 456 for Young's modulus and flexural strength?	BT-1	Remembering
6	List the advantages of cantilever slab.	BT-1	Remembering
7	Explain shortly tread and rise	BT-4	Analyze
8	Show the formula used to find the spacing of inclined stirrups?	BT-2	Understanding
9	Show the value of partial safety factor for (a) concrete (b) steel.	BT-2	Understanding
10	Outline the codal provisions for minimum reinforcement to be provided main and secondary reinforcement in slab and their maximum spacing.	BT-2	Understanding
11	Draw the moment distribution diagram for slab along length	BT-2	Understanding
12	Identify the circumstances under which dog- legged staircases can be used.	BT-3	Applying
13	What is the importance of two way slabs over one way slab?	BT-1	Remembering
14	Why corner reinforcement are provided in a two way slab? And sketch the edge and middle strips of a two way slab.	BT-3	Applying
15	Identify the parameters governing slab moments co effecients.	BT-3	Applying
16	Enumerate structural requirement of slabs.	BT-2	Understanding
17	Which direction of slab takes maximum moments?	BT-2	Understanding
18	List the IS code provision for maximum strain in the tension reinforcement in the section at failure.	BT-2	Understanding
19	Justify the different end conditions for slab with co effecients	BT-1	Remembering
20	State the approximate value of total shrinkage strain of concrete to be taken for the design purpose and mention the relevant clause no. of IS code.	BT-3	Applying
21	Draw yield line pattern for one way slab with simply supported edge condition	BT-3	Applying
22	What is the minimum rise and tread in residential and public building?	BT-1	Remembering
23	Distinguish between the behavior of one way slab and two way slabs.	BT-1	Remembering
24	Enlist the advantages of deep beam.	BT-1	Remembering
25	Why it is necessary to provide transverse reinforcement in one way slab?	BT-1	Remembering

PART B

1	Design a R.C. slab for a room measuring 5m x 6m size. The slab is simply supported on all the four edges, with corners held down and carries a superimposed load of 30 N/m2. Inclusive of floor finishes etc. use M20 mix, Fe415 steel and IS code method. Draw the reinforcement details.	BT-5	Evaluate
2	Calculate the reinforcement details of a one way slab for an office floor which is continuous over tee beam spaced 3.5m intervals. Assuming a live load of 4 kN/m^2. Adopt limit state design. Use M20 grade concrete and Fe415 steel bars.	BT-4	Analyze
3	A simply supported one way slab of 4 m span carries a live load of 3 N/m^2 and the load of floor finish as 1.25 kN/m2.the slab having a total depth of 150mm is reinforced with 8 mm dia bars @100 mm c/c at a nominal cover of 20 mm. assuming a permanent load equal to dead load plus 20% of live load, compute the total maximum deflection and check it as per code requirements. Use M20 concrete and Fe415 steel.	BT-4	Analyze
4	Design a two way slab for an office floor size 3.5m x 4.5m with discontinuous and simply supported edges on all the sides with the corners prevented from lifting and supporting a service live load of 4.4kN/m^2. Adopt M20 grade and Fe 415HYSD bars.	BT-5	Evaluate
5	Design and draw the reinforcement details of a two way slab for the following data: Size = 7 m x 5 m Width of the support = 300 mm Edge condition = two edges are discontinuous, live load =5 kN/m^2 Floor finish as 1 kN/m^2 Use M20 concrete and Fe 415 steel.	BT-5	Evaluate
6	Design a continuous one way having 3 equal span of 3m each having imposed load of 2.5 KN/m^2.Use Fe415 & M15	BT-5	Evaluate
7	Design a simply supported RCC slab for a roof of a hall 4m x 10m width 230mm wall thickness all around. Assume a live load of 4 KN/m^2 and a finish 1KN/m2.Use M20 & Fe415	BT-5	Evaluate
8	Design a dog legged stair for a building in which vertical distance between floor is 3.6m.Assume any relevant data	BT-5	Evaluate
9	Design a one way reinforced concrete slab - simply supported at the edges for a public building with a clear span of 4 m supported on 200 mm solid concrete masonry walls. Live load on slab is 5 kN/m^2. Adopt M20 grade concrete and Fe 415 HYSD bars.	BT-5	Evaluate
10	Design a slab over a room 5 m x 7 m as per I.S. code. The slab is supported on masonry walls all round with adequate restraint and the corners are held down. The live load on the slab is 330 N/m^2. The slab has a bearing of 150 mm on the supporting walls.	BT-5	Evaluate
11	Design a cantilever balcony slab projecting 1.2 m from a beam. Adopt live load of 2.5 KN/m^2	BT-5	Evaluate
12	Interpret the following details and design the one way slab: size=3m x 9m, width of the support =230mm, live load= 3kN/m^2, floor finish as 1kN/m^2 use M20 concrete and Fe415 steel bars.	BT-4	Analyze
13	Design one of the flight of a dog-legged stairs spanning between landing beams using following data Number of steps in a flight = 10 Tread = 300 mm	BT-3	Applying

	Rise = 150mm Width of landing beams = 300mm		
14	Design a cantilever slab projecting 1m from the support using M20 & Fe415 HYSD bars. Adopt live load of 3 KN/m^2	BT-5	Evaluate
15	Design a one way slab for a clear span 4m simply supported on 230mm thick wall. Subjected to a live load of 4kN/m² and floor finish of 1kN/m².use M20 concrete and F415 steel.	BT-5	Evaluate
16	Design a one way slab with a clear span of 5m, simply supported on 230mm thick masonry walls and subjected to a live load of 4kN/m² and a surface finish of 1kN/mm².Assume Fe 415 steel. Assume that the slab is subjected to moderate exposure conditions.	BT-5	Evaluate
17	Design a dog-legged stair case for floor to floor height of 3.2 m, stair case clock of size 2.5m×4.75m. Subjected to live load of 3kN/m^2 and floor finish 1.25kN/m^2. Design flights from plinth beam to mid landing and mid landing to floor landing. Draw reinforcement details for both flights.	BT-5	Evaluate

PART C

1.	Write about structural classification of slab and staircase	BT-3	Applying
2	Design a floor slab for an interior room with interior dimension of 3.5 x 9 m for a building located in Chennai. The slab is resisting on 230mm thick masonry walls	BT-5	Evaluate
3.	Design a cantilever portico slab of 5m width and 2m clear span. Assume moderate environment with M25 &Fe415	BT-5	Evaluate
4.	Explain about continuous slab with neat diagram	BT-4	Analyze
5.	Design a Dog legged stair for a building in which the vertical distance between the floors is 3.6 meter. The stair hall (Staircase) dimension is 2.5 X 5 meter.	BT-5	Evaluate

UNIT IV - DESIGN OF COLUMNS

Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns –Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves

PART-A

Q. No.	Questions	BT Level	Competence
1	State the behaviour of slender column	BT-1	Remembering
2	Sketch the salient points on a typical axial – moment interaction curve of a column.	BT-1	Remembering
3	Give the minimum number of steel rods for different types of columns	BT-1	Remembering
4	Write down the expression for minimum eccentricity	BT-1	Remembering
5	Write the basic assumption for the combined axial load and uniaxial bending on columns.	BT-1	Remembering
6	Write the pitch and diameter of lateral ties for columns as per IS 456	BT-1	Remembering
7	Explain compression members with helical reinforcement.	BT-2	Understanding
8	Explain any two code requirements on slenderness limits.	BT-2	Understanding
9	Summarize the function of the traverse reinforcements in a reinforced concrete column.	BT-2	Understanding
10	Summarize the function of lateral ties in a RC column.	BT-2	Understanding
11	Explain the function of the traverse reinforcements in a reinforced concrete	BT-2	Understanding

	column.		
12	Why minimum and maximum reinforcement id restricted in column ?	BT-3	Applying
13	Write the expression for eccentricity of columns	BT-3	Applying
14	Why specifications are limited in column?	BT-3	Applying
15	On what condition intermediate column is more suitable?	BT-3	Applying
16	Differentiate between uniaxial and biaxial column.	BT-3	Applying
17	Write the few points about specification of circular column	BT-3	Applying
18	Enumerate the behavior change on the account of height and shape	BT-1	Remembering
19	Differentiate a circular column and rectangle column	BT-1	Remembering
20	Explain about pedestal ?	BT-3	Applying
21	Conclude the different end conditions of column as per IS 456.	BT-1	Remembering
22	According to IS code all the columns shall be designed for minimum eccentricity. Justify the reasons for this statement.	BT-2	Understanding
23	Compile the importance of column curves.	BT-2	Understanding
24	Show the effective length of different columns	BT-2	Understanding
25	List the types of reinforcements used to resist shear force in columns?	BT-3	Applying

PART –B

1	Design of short column subjected to biaxial bending. Determine the reinforcement for a short column for the following data. Column size: 400mmx600mm, P_u=2000 kN M_{ux}= 160kN, M_{uy}=120 kN. Use M20 grade concrete and Fe 415 grade steel.	BT-5	Evaluate
2	A circular column, 4.6m high is effectively held in position at both ends and restrained against rotation at one end only to carry an axial load of 1200kN, if its diameter is restricted to 450mm. Use M20 and Fe415 grades.	BT-3	Applying
3	Design a rectangular column, 5m long restrained in position and direction at both ends, to carry an axial load of 120 kN. Use M20 and Fe415 grades.	BT-5	Evaluate
4	Determine the ultimate load carrying capacity of circular column of section500mm diameter reinforced with 8 nos of 25mm diameter bars adequately tied with lateral ties. Use M25 and Fe415 steel.	BT-5	Evaluate
5	Design the reinforcement in a circular column of diameter 350mm with helical reinforcement of 8mm diameter to support a factored load of 1400kN. The column has an unsupported length of 3.5 m and is braced against side sway. Adopt M20 grade concrete and Fe415 steel bars.	BT-5	Evaluate
6	Design a uniaxial spiral circular short column with details as given below. (i) Factored axial load = 300kN (ii) Factored bending moment = 80kNm (iii) Column size = 400mm Use M20and Fe415 combination	BT-5	Evaluate
7	Discuss various assumptions used in the limit state methods of design of compression members.	BT-3	Applying
8	Design the reinforcement in short column 400x600mm subjected to an ultimate axial load of 1600kN together with ultimate moments of 120kNm and 90kNm about the major and minor axis respectively. Use M20 grade concrete and Fe415 grade steel.	BT-5	Evaluate

9	Design a biaxial eccentric loaded braced circular column deforming in single curvature for the following data: Ultimate load=200kN. Ultimate moment in longer direction at bottom Mux_1=178 kNm and at top Mux_1= 128kNm.Ultimate moment in shorter direction at bottom Muy_1=108 kNm and at top Muy_2= 88kNm. Unsupported length of column = 9m.Effective length in long direction l_{ex} =8m.Effective length in shorter direction l_{ey} = 5.8m.Diameter of column = 550mm.Use M25&Fe415 grades.	BT-5	Evaluate
10	A circular column, 3m high is effectively held in position and restrained against rotation at both ends. Design the column, to carry an axial load of 750kN, if its diameter is restricted to 350 mm. Use M25 and Fe 500 grade.	BT-5	Evaluate
11	Design an axially loaded tied column 400 mm x 400 mm pinned at both ends with unsupported length of 3m to carry a factored load of 2300KN.Use M 20 & Fe 415	BT-5	Evaluate
12	Design a short column subjected to biaxial bending. Determine the reinforcement for a short column for the following data. Column size: 450mmx600mm, Pu=100kN Mux=260kN, Muy =120kN.Use M25 grade concrete and Fe250 grade steel.	BT-5	Evaluate
13	Design the longitudinal reinforcement in a short column 400mm x 600mm subjected to an ultimate axial load of 1600 kN together with ultimate moments of 120 kN-m and 90kN-m about the major and minor axis respectively. The reinforcements are distributed equally on all four sides. Adopt M_{20} grade concrete and Fe415 steel bars.	BT-5	Evaluate
14	Determine the ultimate load carrying capacity of rectangular column section 400x600mm reinforced with 10nos of 25mm dia. Use M25 concrete and Fe415 steel.	BT-5	Evaluate
15	Design the reinforcement required for a circular column of 450 mm dia subjected to a factored load of 1000 kN and a factored moment of 100 kNm.M20 grade concrete and Fe 415 steel were used. (d'/D = 0.10).	BT-5	Evaluate
16	Explain in Detail in about types of RCC Column.	BT-5	Evaluate
17	Design RCC column which is subjected to the axial load of 600 KN and the concrete used is of M-20 grade and steel Fe-500. Provide 1% steel and the factor of safety 1.5	BT-5	Evaluate

PART-C

1.	Design a square column subjected to an ultimate axial load of 1000kN.Consider concrete grade M20and steel of grade Fe415.	BT-5	Evaluate
2.	Design the reinforcement required for a column which is restrained against sway using the following data. Size of column=530x450mm, l eff=6.6m, unsupported length=7.70m. Factored load =1600kN. Factored moment about major axis =45kNm at top and 30kNm at bottom. Factored moment about minor axis=35kNm at top and 20kNm at bottom. Use M_{25} grade concrete and Fe 500 grade HYSD bars. Column is bent in double curvature and reinforcement is distributed equally on all the four sides of the section.	BT-5	Evaluate

3.	Design the reinforcements required for a column which is restrained against sway using the following data. Size of column=530mm. Axial load=1600kN.Factored moment about major axis= 45kNm at top and 30knm at bottom. Factored moment about minor axis =35kNm at top and 20kNm at bottom. Use M25 grade concrete and Fe500 grade HYSD bars. Column is bent in double curvature and reinforcement is distributed equally on all the four sides of the section.	BT-5	Evaluate
4.	Explain the design procedure of column and give specification on the same	BT-3	Applying
5.	Design an axially loaded short square tied column to support a maximum factored load of Pu=2600 KN. Material strength: fc'= 28 MPa and fy= 420 MPa.	BT-5	Evaluate

UNIT V - DESIGN OF FOOTING

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings– Design of Combined Rectangular footing for two columns only.

PART – A

Q. No.	Questions	BT Level	Competence
1.	What are the factors that influence the selection of number of lifting and hoisting locations of a long beam during its erection process?	BT-1	Remembering
2.	Define punching shear.	BT-1	Remembering
3.	What is the main advantage of combined footing?	BT-1	Remembering
4.	When you need a combined footing?	BT-1	Remembering
5.	What is slenderness ratio in masonry wall? State the maximum values	BT-1	Remembering
6.	What is meant by proportioning of footing?	BT-1	Remembering
7.	Classify the different types of combined footing.	BT-2	Understanding
8.	Enlist the different condition for usage of footing.	BT-2	Understanding
9.	Explain the behavior of wall footing	BT-3	Applying
10.	Outline why the check for transfer of load at the base of the column over footing is done?	BT-2	Understanding
11.	On what circumstances combined rectangular footings are suitable?	BT-2	Understanding
12.	Draw a neat sketch of a wall footing.	BT-3	Applying
13.	Sketch the placement of steel in rectangular footing with a non-central load.	BT-3	Applying
14.	Sketch the reinforcement detailing of footing.	BT-3	Applying
15.	Draw the cross section of strip footing.	BT-3	Applying
16.	Compare the behaviour of tied and spirally reinforced column.	BT-2	Understanding
17.	Explain about eccentric loading on a footing.	BT-3	Applying
18.	Why punching shear is not encouraged in design of footing?	BT-2	Understanding
19.	Why dowel bars are provided in footing?	BT-2	Understanding
20.	List any two situations in which combined footings are preferred to isolated footings	BT-2	Understanding
21.	List the circumstances a trapezoidal footing become necessary?	BT-2	Understanding
22.	How is the main steel distributed in wall footings and two way rectangular footings?	BT-1	Remembering

23.	List out the different types of footing	BT-1	Remembering
24.	Compare one way and two way shear in footing.	BT-1	Remembering
25.	Compare punching shear and normal shear in RCC footing.	BT-1	Remembering

PART –B

1.	(i) Write down the different types of footings and their suitability. (ii) Enumerate the procedure for the design of Isolated footing for two columns only.	BT-3	Applying
2.	Design a footing for 250 mm thick masonry wall which supports a load of 130 kN/m at service state for the following Safe bearing capacity of soil = 150 kN/m^2 Angle of repose of soil = 30 degree Unit weight of soil = 20 kN/m^3	BT-5	Evaluate
3.	Design an isolated square footing for a column 500mm x 500m transmitting a load of 600kN and a moment of 30 kN-m. The SBC of soil is 1230 kN/m^2. Use M20 grade concrete and M.S. grade –I bars. Draw the reinforcement details.	BT-5	Evaluate
4.	A 230 mm thick masonry wall is to be provided with reinforced concrete footing on a site having soil with SBC, unit weight and angle of repose of 125kN/m^2, 17.5$kN/m^3$and 30˚ respectively. Use M20 grade of concrete and HYSD steel bars of grade Fe415. Design the footing when the wall supports at service state, a load of 150 kN/m length.	BT-5	Evaluate
5.	Design a suitable footing for a 500 mm x 500 mm square column transferring 100kN axial load and a moment of 35kN-m.The safe bearing capacity of soil is 190 kN/m^2.Use M20 concrete and Fe415 steel. Adopt limit state design method.	BT-5	Evaluate
6.	7. Sketch the standard detailing of the following: (i) Two spans one-way continuous slab with curtailment details (7) (ii) Curtailment details in a tapered cantilever beam.(6)	BT-5	Evaluate
7.	Design a suitable footing for a R.C. column of size 300x500mm. Supporting a factored axial load of 1500kN. Assume safe bearing capacity of soil as 200kN/m^2. Adopt M20 grade of concrete and Fe415 grade of steel. Sketch the details at reinforcements in footings.	BT-5	Evaluate
8.	A rectangular RCC column of size 400 mm x 600 mm carrying an axial load of 1800kN.If the safe bearing capacity of the soil is 150kN/m^2.Design a suitable footing. Use M25 concrete and Fe415	BT-5	Evaluate
9.	A square column of size 400mm carries a service load of 600 kN. Design an isolated footing for the column by limit state method, if the safe bearing capacity of the soil is 250kN/m^2. Use M20 concrete and Fe415 steel.	BT-5	Evaluate
10.	Design an isolated square sloped footing for a column 500 x 500 mm, transmitting an axial load of 1200 KN. The column is reinforced with 8 bars of 20 mm diameter. The safe bearing capacity of soil is 120 KN/m^2. Use M 20 & Fe415	BT-5	Evaluate
11.	Design a rectangular isolated footing of uniform thickness for R.C. column bearing a vertical load of 600 kN, and having a base size of 400 x 600 mm. The SBC of soil is 120 kN/m^2. Use M25grade concrete and M.S grade-I bars. Draw the reinforcement details.	BT-5	Evaluate

12.	Design a square footing for a short axially loaded column of size 300 mm x 300 mm carring 600 kN load. Use M20 concrete and Fe415 steel. SBC of soil is 180 kN/m^2. Sketch the details of reinforcement.	BT-5	Evaluate
13.	A rectangular column 600 x 400 mm carries a load of 800 kN. Design a rectangular footing to support the column. The safe bearing capacity of soil is 200 kN/m^2. Use M20 grade concrete.	BT-5	Evaluate
14.	Design a combined column footing with a strap beam for two reinforced concrete columns 300 mm x 300 mm size spaced 4m apart and each supporting a fractured axial load of 750 kN. Assume the ultimate bearing capacity of soil at site is 230 kN/m^2. Adopt M20 grade concrete and Fe 415 HYSD bars.	BT-3	Applying
15.	A Square footing has to transfer a dead load of 900 kN and an imposed load of 500 kN for a square column of size 400mm.assume the safe bearing capacity of the soil as 200 kN/m^2.Design a square footing to support the above column. Use M20 concrete and Fe415 steel	BT-5	Evaluate
16.	Design a plain concrete footing for a column, 300 mm × 300 mm, carrying an axial load of 330 kN (under service loads, due to dead and live loads). Assume an allowable soil bearing pressure of 360 kN/m^2 at a depth of 1.0 m below ground. Assume M 20 concrete and Fe 415 steel.	BT-5	Evaluate
17.	Design RCC isolated footing for 400mm X 400mm column size which carries load of 1200kN on the column, take Soil bearing capacity of soil (SBC) is 200kN/m . Assume M20 grade concrete and Fe 415 grade steel.	BT-5	Evaluate

PART-C

1	A reinforced concrete column of 500 x 650 carries the axial dead load of 670 kN, axial imposed load of 330 kN and dead load moment of 66 kNm, imposed load of 34kNm. If the SBC of soil is 150 kN/$m^2$and use concrete grade of M25 and steel grade of Fe 415. The foundation has to be designed to resist the ultimate moment and shear resulting from these loads.	BT-5	Evaluate
2	Design a reinforced concrete footing for a 345 mm thick masonry wall which supports a characteristic load of 250 kN/m including self-weight. Assume safe bearing capacity of soil is 150 kN/m^2at a depth of 1.2m below ground level. Assume M20and Fe415 steel used.	BT-5	Evaluate
3	A solid footing has to transfer a dead load of 900kN and an imposed load of 500kN for a square column of size 400mm.Assume safe bearing capacity of soil as 200kN/m^2. Design a square footing to support the above column.	BT-5	Evaluate
4	Explain about proportioning of footings and foundations based on soil properties with suitable example	BT-3	Applying
5	Explain in detail the procedure for the design of combined rectangular footing for two columns only.	BT-3	Applying