

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

M.E-STRUCTURAL ENGINEERING

QUESTION BANK



SEMESTER-I

ST 3163 - ADVANCED CONCRETE STRUCTURES

Regulation: 2023

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Prepared by

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M.E-STRUCTURAL ENGINEERING

SUB. CODE : ST 3163

SUBJECT: ADVANCED CONCRETE STRUCTURES

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UNIT-1: DESIGN PHILOSOPHY

Limit state design - beams, slabs and columns according to IS Codes. Calculation of deflection and crack width according to IS Code.

PART - A

Q.No	Questions	BT Level	Competence
1.	What are the effects of large deflection?	BT-1	Remembering
2.	How can the deflection to be controlled?	BT-1	Remembering
3.	What you mean by Development Length?	BT-2	Understanding
4.	What do you mean by flanged beam? Explain with neat sketch?	BT-1	Remembering
5.	What is meant by Shrinkage and Thermal Cracking?	BT-1	Remembering
6.	How the effective length of column is determined?	BT-2	Understanding
7.	When we will opt for doubly reinforced beam? and why?	BT-1	Remembering
8.	Compare one-way slab and two-way slab.	BT-2	Understanding
9.	Illustrate 'cracking torque	BT-1	Remembering
10.	Summarize the codal provisions to control deflection and crackwidth of RC Slabs crack width of RC Slabs.	BT-1	Remembering
11.	Identify the factors affecting the crack width of RC beams and mention the limiting value of crack width as per IS code.	BT-1	Remembering
12.	Write a note on mechanism of flexural cracking.	BT-2	Understanding
13.	Calculate the effective length of a column if its unsupported length is 4m	BT-1	Remembering
14.	List out the factors that affecting Crack width in Beams.	BT-2	Understanding
15.	Differentiate and state why limit state method of design is superior from working stress method of design.	BT-2	Understanding
16.	List the factors affecting Crack width in beams.	BT-1	Remembering
17.	Compare long column and short column.	BT-3	Applying
18.	Explain the use of partial safety factors.	BT-1	Remembering
19.	Write a Expression for Short term deflection of beams due to applied loads?	BT-2	Understanding
20.	Discuss about balanced, under-reinforced and over-reinforced section? Judge which is more predominant section for design.	BT-2	Understanding

21.	Justify any two guidelines to select the cross sectional dimensions of RC beam.	BT-1	Remembering
22.	Select any two assumptions are made in elastic theory method.	BT-2	Understanding
23.	Define crack width under Long term loading.	BT-1	Remembering
24.	Write a Expression for crack width in beam as per IS 456.	BT-1	Remembering
25.	Define modular ratio.	BT-1	Remembering
PART - B			
1.	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-4	Analyzing
2.	Explain in detail about Estimation of crack width in beams by IS456.	BT-3	Applying
3.	Determine the Maximum probable crack width for the doubly reinforced beam the size is limited to 250 mm X 400 mm, and beam has to carry, in addition to its own weight a distributed LL of 10kN/m and DL of 5kN/m and a concentrated load of 30kN placed at the midspan point. Assume that the beam is subjected to moderate exposure conditions. Wall thickness 230mm and 6m apart (centre to centre).	BT-3	Applying
4.	Compare and explain detailed notes on under reinforced section and over reinforced section for LS method. also explain in detail type of slab and column	BT-4	Analyzing
5.	Develop the design and calculate the reinforcement of a RC beam to carry a load of 6kN/m inclusive of self-weight with an effective span of 6m and breadth to be $\frac{2}{3}$ rd of effective depth. The permissible stresses in concrete and steel are 5 N/mm ² and 140 N/mm ² . Take m=18.	BT-6	Creating
6.	A rectangular beam 200 mm wide and 400 mm deep up to the centre of reinforcement has to resist a factored moment of 40 kNm. Calculate the reinforcement of the section. Use M25 concrete and Fe 500 steel	BT-6	Creating
7.	Analyse and determine the short term deflection of a simply supported beam 250 mm x 400 mm in size for the following data: Span of the beam = 6 m Effective cover = 40 mm Area of tension steel = 3 Nos of 28 mm diameter bars Live load = 10 kN/m.	BT-6	Creating
8.	Compute the design parameters of a doubly reinforced beam to carry a super imposed load of 60kN/m. The overall depth and width of the beam are restricted to 840mm and 300mm respectively. The beam has a clear span of 5m and bearing of 50cm on each end. Use M20 grade concrete and M.S. grade-I bars.	BT-4	Analyzing

9.	Calculate the reinforcement of a biaxial eccentrically loaded braced rectangular column for the following data Ultimate axial load = 2000kN Ultimate biaxial moments = $M_{ux}=250\text{kNm}$ and $M_{uy}=150\text{kNm}$ Unsupported length, $l=3.25\text{m}$ Effective length, $l_{ex}=3\text{m}$, $l_{ey}=2.75\text{m}$ Column section (b) in x-direction=400mm, $D=600\text{mm}$ Adopt M25 grade concrete and Fe415 grade steel	BT-6	Creating
10.	Calculate and check the beam for the serviceability limit state of cracking according to IS456-2000 code. A simply supported beam of rectangular section spanning over 6m has a width of 300mm and overall depth of 600mm. The beam is reinforced with 4 nos of 25mm dia on the tension side at an effective depth of 550mm spaced at 50mm centres. The beam is subjected to working load moment of 160kNm at the centre of span section using M25 grade concrete and Fe415 grade steel.	BT-6	Creating
11.	A simply support reinforced concrete beam of rectangular section 250mm wide by 450mm overall depth is used over an effective span of 4m. The beam is reinforced with 3 nos.20mm dia Fe415 at an effective depth of 400mm. Two hanger bars of 10mm dia are provided. The self-weight together with dead load on the beam is 4kN/m and service live load is 10 kN/m. Using M20 grade concrete and Fe415 grade steel. Compute (a) Short term deflection (b) Long term deflection (c)Maximum crack width at tension face directly under bar	BT-5	Evaluating
12.	A rectangular simply supported beam of span 5 m in 300 x 600 mm in cross section and is reinforced with 3 bars of 20 mm on tension side at an effective cover of 50 mm. Determine the shear reinforcement due to an limit state load of 175kN/m including self-weight, and live load. Assume grade of concrete M20 and grade of steel as Fe 500.	BT-4	Analyzing
13.	A rectangular beam section of width 250 mm and effective depth 500 mm is subjected to an ultimate moment of 50kNm, ultimate shear force of 60 kN and ultimate torsional moment of 20 kNm. Design the beam.	BT-6	Creating
14.	Design a RCC slab for a room measuring 5m x 6m size. The slab is supported on all the four edges, with corners held down and carries a superimposed load of 3 kN/m^2 , inclusive of floor finishes. Assume M20 concrete & Fe415	BT-6	Creating
15.	A rectangular beam 200 mm wide and 400 mm deep up to the centre of reinforcement has to resist a factored moment of 40 kNm. Calculate the reinforcement of the section. Use M25 concrete and Fe 500 steel	BT-6	Creating
16.	Evaluate and summarize the issues involved in designing for achieving control over thermal and shrinkage cracking in large RC structures	BT-6	Creating
17.	How you can control cracking of reinforced structural element? Describe it.	BT-2	Understanding

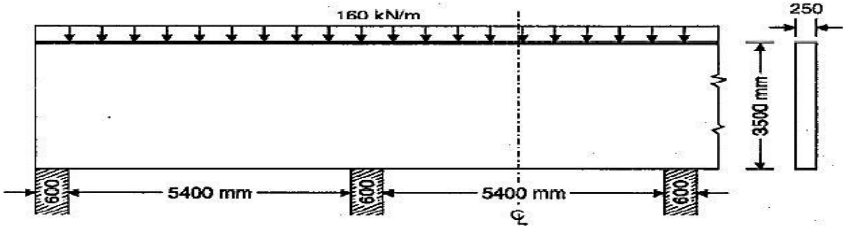
UNIT-2: DESIGN OF SPECIAL RC ELEMENTS

Design of slender columns - Design of RC walls. Strut and tie method of analysis for corbels and deep beams, Design of corbels, Deep-beams and grid floors.

PART - A

Q.No	Questions	BT Level	Competence
1.	Define Slender column	BT-1	Remembering
2.	What do you understand by RC walls?	BT-1	Remembering
3.	What is meant by punching shear?	BT-1	Remembering
4.	Classify RC walls according to their behavior.	BT-2	Understanding
5.	Compare the interaction between structural frame and shear wall.	BT-2	Understanding
6.	Distinguish the main difference between a braced wall and an un-braced wall	BT-2	Understanding
7.	Identify the difference between Slender Braced and slender Unbraced Concrete Walls	BT-2	Understanding
8.	Briefly explain about 'corbel' with a neat sketch.	BT-3	Applying
9.	Examine the function of horizontal steel in corbel	BT-2	Understanding
10.	Describe about the function of lateral ties in a RC column..	BT-3	Applying
11.	How a nib is different from cantilever beam? Draw a neat sketch.	BT-1	Remembering
12.	Explain the 'strut and tie method' of analysis for a corbel. Write the equation of lever-arm (z/d).	BT-1	Remembering
13.	How a deep beam differs from ordinary RC beam? Under what circumstances deep beams are preferred?	BT-1	Remembering
14.	What is the development length adopted for deep beams? Calculate it for 16 mm mild bars in M20 grade concrete	BT-1	Remembering
15.	How do you calculate the lever-arm for a deep beam?	BT-1	Remembering
16.	Why side face reinforcements are extremely important in deep beams?	BT-3	Applying
17.	Define shear wall	BT-1	Remembering
18.	Define Strut.	BT-2	Understanding
19.	Identify the structural action of grid floor system	BT-1	Remembering
20.	List the advantages of grid floors	BT-2	Understanding
21.	Discuss any two advantages of introducing compression steel in R.C beams.	BT-2	Understanding
22.	On what condition long column is more suitable?	BT-1	Remembering
23.	Name the two code requirements on slenderness limits.	BT-1	Remembering

24.	Distinguish between braced and un-braced columns.	BT-1	Remembering
25.	Explain the function of the traverse reinforcements in a reinforced	BT-1	Remembering
PART - B			
1.	(i) Briefly classify different types of walls (ii) Explain the following in detail a) Types of Load on wall b) Slenderness of walls c) Braced and unbraced walls	BT-2	Understanding
2.	A plain concrete wall of 4 m high, 6 m long and 200 mm thick is restrained against rotation at its base and unrestrained at the ends. Examine the load the wall can carry. Assume $f_{ck} = 25 \text{ N/mm}^2$, $f_y = 500 \text{ N/mm}^2$. Design the wall if it has to carry a factored load of 600kN/m.	BT-3	Applying
3.	Estimate and design the reinforcement in the slender column which is restrained against sway using the following data\ Size of the column = 400mmX400mm M20 grade of concrete and Fe415 HYSD bars. Effective Length of column L_{ex} & $L_{ey} = 6\text{m}$ Unsupported length of column (L) = 7m $P_u = 1500 \text{ kN}$, M_{ux} & $M_{uy} = 40 \text{ kNm}$ at top & 20 kNm at bottom	BT-3	Applying
4.	Explain about Deep beam, its application, types and behaviour at limit state in detail.	BT-3	Applying
5.	Design a reinforced concrete wall of 4.6m height to support a factored load of 650kN/m length and factored moment of 30kNm at right angles to the length of wall. the distance between cross walls is 4.0m. the materials to be used in constructions are M25 grade concrete and Fe 415 grade steel.	BT-3	Applying
6.	Explain about Design of Concrete walls for flexure and Rules for detailing of steel in concrete walls.	BT-3	Applying
7.	Develop a corbel design for a 350mm square column to support an ultimate vertical load of 600kN with its line of action 200mm from the face of the column. Use M20 grade concrete and Fe 415 grade steel.	BT-3	Applying
8.	Design a RC corbel to carry load of 350 kN acting at a distance of 250 mm from the face to face of a column of size 300 x 450 mm. the corbel is provided on the 300 mm face, sketch the reinforcement details.	BT-6	Creating
9.	Design a reinforced concrete wall of height 6.6m for a staircase to support a factored load of 525 kN/m length and factored moment of 21kNm at right angles to the plane of wall. the wall is restrained in position and direction at the bottom, and in position at the top. the materials to be used in constructions are M20 grade concrete and Fe 415 grade steel.	BT-3	Applying
10.	Explain in detail about Strut and tie method of analysis for concrete structures.	BT-6	Creating

11.	Analyze and construct a simply supported deep beam with width = 250mm, overall depth (D) = 3500mm, width of supports = 500mm, clear span = 5m. Live load on the beam = 150kN/m at service state. Adopt M20 grade concrete and Fe415 steel.	BT-5	Evaluating
12.	Design pilecap foundation with the given data: Load $F_y = 800$ kN, $f_c = 25$ MPa, $f_y = 415$ MPa, Column Dimension = 250 mm x 250 mm. Pedestal ht= 500 mm Pile Data- Dia of pile= 400 mm. Vertical capacity = 250 kN, Horizontal capacity = 100 kN Uplift capacity = 80 kN and enumerate the suitable reinforcements with grid floor	BT-6	Creating
13.	Compare the interaction between shear wall and structural frame	BT-2	Understanding
14.	Illustrate the Various Methods of Analysis of Grid Floor Frame in detail.	BT-3	Applying
15.	Explain about shear wall. Write the step by step procedure for the design of rectangular shear wall with boundary element.	BT-4	Analyzing
16.	A beam 3500 mm deep and 250 mm wide continuous over three spans as shown below, carries UDL of 160kN/m. Estimate the reinforcement of the beam, using M20 concrete and Fe415 steel 	BT-4	Analyzing
17.	Explain about ordinary-moment shear walls and ductile-moment shear walls.	BT-4	Analyzing

UNIT-3 : FLAT SLABS AND YIELD LINE BASED DESIGN

Design of flat slabs and flat plates according to IS method – Check for shear - Design of spandrel beams - Yield line theory and Hillerborg's strip method of design of slabs.

PART - A

Q.No	Questions	BT Leve	Competence
1.	Explain about the components of flat slab with neat sketch.	BT-1	Remembering
2.	Write down the Advantages and disadvantages of flat slab?	BT-1	Remembering
3.	State the assumptions of equivalent frame method.	BT-1	Remembering
4.	Point out are the assumptions made in yield line theory	BT-1	Remembering
5.	Brief the concept of punching shear.	BT-1	Remembering
6.	Give the characteristics of yield line	BT-1	Remembering
7.	What are the limitations of yield line theory?	BT-2	Understanding

8.	Debate the limitations of Hillerborg's strip method	BT-2	Understanding
9.	Differentiate between yield line and strip line	BT-2	Understanding
10.	Define spandrel beams.	BT-2	Understanding
11.	Relate how to increase the shear capacity of flat slab with ordinary slab		
12.	Define the terms drop and column head.	BT-2	Understanding
13.	The yield line analysis is possible only for slabs and not possible for beams state the reasons. Justify.	BT-2	Understanding
14.	State the function of drop panel and column capital in a flat slab.	BT-1	Remembering
15.	Draw any 4 yield line patterns with various support conditions.	BT-3	Applying
16.	What are the forces to be considered in the design of spandrel beams?	BT-1	Remembering
17.	What are the types of shear action to be checked in the design of a flat slab?	BT-3	Applying
18.	List out the various methods available for the analysis of flat slab.	BT-1	Remembering
19.	Interpret lower bound theorem with upper bound theorem.	BT-2	Understanding
20.	Sketch the division of load paths in simply supported rectangular Rc slabs according to Hillerborgs pattern.	BT-2	Understanding
21.	List the assumptions made in yield line analysis of slabs.	BT-2	Understanding
22.	Define yield line theory	BT-1	Remembering
23.	State the principle of virtual work.	BT-1	Remembering
24.	Explain the concept of yield line method?	BT-1	Remembering
25.	What is the direction of yield line in two way slab?	BT-2	Understanding

PART - B

1.	An exterior panel of a flat slab floor is 6m x 6m along column center lines. Live load on floor is 3kN/m ² . Supporting column diameter is 500 mm. Choosing the thickness of the slab (from stiffness criteria) and appropriate dimensions for column head and drops, Examine the design moments and shear forces. Use direct design method	BT-1	Remembering
2.	Explain the following in Detail. i. Yield line theory ii. Equilibrium work method iii. Virtual work method	BT-2	Understanding
3.	An interior panel of a flat slab floor is 6m x 6m along column center lines. Live load on floor is 3kN/m ² . Supporting column diameter is 500 mm. Choosing the thickness of the slab (from stiffness criteria) and appropriate dimensions for column head and drops, Examine the design moments and shear forces. Use direct design method.	BT-1	Remembering
4.	Calculate the reinforcement and design of square slab for a live load of 5kN/m ² Show the reinforcement details in the Square slab. Use M20 concrete and Fe415 steel. Assume Suitable data.	BT-4	Analyzing

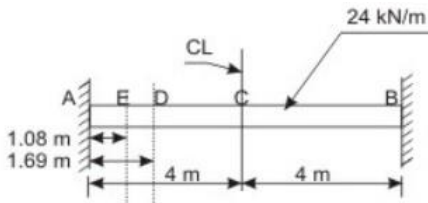
5.	Identify the ultimate load for isotropic of the following profiles simply supported on all edges carrying distributed load throughout the slab. (a) Square slab and (b) Circular slab	BT-3	Applying
6.	Explain the following about flat slab: (a) Types of flat slab (b) Panel divisions (c) Direct design method (d) Equivalent frame method	BT-3	Applying
7.	A square interior panel of an intermediate floor is of effective dimension 5 m x 5 m. The live load on the floor is 2.5 kN/m ² . Finishes is 1 kN/m ² . Analyse the slab using yield line approach and design the slab. Use M20 concrete and Fe 415 steel.	BT-2	Understanding
8.	Explain the Guidelines for design of Square slab & Rectangular slab with different boundary conditions subjected to UDL and concentrated loads	BT-2	Understanding
9.	Design a circular slab of 4.5 meter diameter, simply supported along the edges, to carry a service load of 5 kN/m ² . Adopt M20 Grade concrete and Fe 415 Grade steel. Use yield line method for analysis.	BT-6	Creating
10.	Calculate the ultimate load carrying capacity of a 4 m x 6 m slab continuous on all edges if yield moments are 25 kN m/m for positive and negative moments respectively, they being uniformly loaded.	BT-5	Evaluating
11.	Explain step by step procedure for design of RC Spandrel beam in detail.	BT-5	Evaluating
12.	Explain Hillerborg's simple strip method of analysis	BT-5	Evaluating
13.	An interior panel of a flat slab floor is 4.5m x 4.5m along column centre lines. Live load on floor is 4kN/m ² . Supporting column diameter is 450 mm. Choosing the thickness of the slab (from stiffness criteria) and appropriate dimensions for column head and drops, Examine the design moments and shear forces. Use direct design method.	BT-4	Analyzing
14.	A square interior panel of an intermediate floor is of effective dimension 3 m x 3 m. The live load on the floor is 2 kN/m ² . Finishes is 1.5 kN/m ² . Analyse the slab using yield line approach and design the slab. Use M25 concrete and Fe 415 steel.	BT-3	Applying
15.	Design the edge beam of size 250 mm x 250 mm with slab thickness of 150 mm of a flat slab if the analysis show that it is subjected to a maximum moment of 37.3 kNm. assume $f_{ck} = 25 \text{ N/mm}^2$.	BT-4	Analyzing
16.	Explain spandrel beams. And list the advantages and disadvantages of spandrel beam.	BT-3	Applying
17.	Design a interior panel of flat slab floor system for a warehouse 24m x 24m divided into panels of 6m x 6m , live load = 5KN/m ² , column size 400mm diameter and M20 grade concrete Fe415 HYSD bars.	BT-4	Analyzing

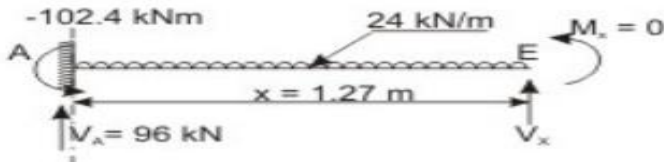
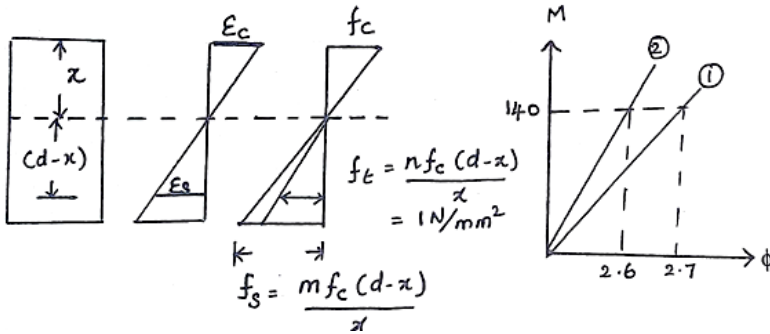
UNIT-4: INELASTIC BEHAVIOUR OF CONCRETE BEAMS AND COLUMNS

Inelastic behavior of concrete beams and Baker's method, moment - rotation curves

PART - A

Q.No	Questions	BT Level	Competence
1.	What are the assumptions of baker's method?	BT-1	Remembering
2.	Define allowable rotation for inelastic analysis.	BT-1	Remembering
3.	Indicate the conditions to be satisfied for redistribution of moments as	BT-1	Remembering
4.	Generalize and write short note on "Tension stiffening effect" in concrete.	BT-1	Remembering
5.	Summarize about plastic hinge.	BT-1	Remembering
6.	Discriminate about confined concrete?	BT-2	Understanding
7.	Give an outline about moment redistribution?	BT-2	Understanding
8.	Outline the advantages of moment redistribution?	BT-1	Remembering
9.	Draw a typical moment rotation curve for simply supported beam under	BT-2	Understanding
10.	Write down the moment rotation curvature relationship for balanced	BT-1	Remembering
11.	Draw the stress-strain curves for un confined concrete.	BT-3	Applying
12.	List the major factor which influence the formation of plastic hinge	BT-1	Remembering
13.	State true or false and justify your answer. Moment redistribution to be applied to reduce bending moments in column.	BT-1	Remembering
14.	Formulate the ordinates of the bending moment diagram of a SS beam subjected to the UDL of 2kN/m.	BT-2	Understanding
15.	Generalize the effect of shear cracking on zone of plasticization.	BT-2	Understanding
16.	Why moment redistribution is limited when percentage of steel is higher.	BT-3	Applying
17.	Describe what do you meant by point of contra flexure?	BT-1	Remembering
18.	List the uses of moment rotation curves.	BT-1	Remembering
19.	Sketch the distribution of stresses along the corner diagonal in opening and closing joints.	BT-1	Remembering
20.	Write the difference between elastic analysis and In elastic analysis.	BT-3	Applying
21.	Draw the stress strain curve for concrete in the limit state design of flexure	BT-1	Remembering
22.	Write the types of shear failure in reinforced concrete beams?	BT-1	Remembering
23.	Write the formula for effective flange width of isolated L-beam and T beam.	BT-2	Understanding
24.	Differentiate between uniaxial and biaxial column.	BT-1	Remembering

25.	Sketch the salient points on a typical axial – moment interaction curve of a column	BT-1	Remembering
PART - B			
1.	Describe about moment rotation curvature relationship for balanced, over, under reinforced beams with neat sketches?	BT-3	Applying
2.	Estimate the salient points on the stress-strain curve of concrete in bending of a unconfined concrete member if cylinder strength of concrete used is 25 N/mm^2 . If such concrete is confined in a section of breadth 300mm, total depth 500mm and clear cover 50mm with 10mm stirrups at 100mm c/c, determine the stress-strain curve for inelastic analysis of the structure. Use the relation $f_{c'} = 0.8f_{ck}$	BT-6	Creating
3.	A reinforced concrete section is 200mm X 550mm depth. If the applied moment is 140kNm, Locate the instantaneous curvature assuming a tensile stress in concrete at level of steel of 1 N/mm^2 . Assume $E_c = 28 \text{ kN/mm}^2$ $m = 7.14$. Use M20 grade concrete.	BT-6	Creating
4.	A T- beam ABC is continuous over two spans of 8 m each and it carries uniformly distributed factored load of 75 kN/m . Assuming $f_{ck} = 25$ and $f_y = 500$ (with bilinear stress – strain curve) check whether we can reduce the maximum moment by 30 % and redistribute the spans. Width of flange = 1000 mm, width of web = 300 mm, thickness of slab = 150 mm, $D = 800 \text{ mm}$ and $d = 750 \text{ mm}$ are given.	BT-4	Analyzing
5.	A T-beam ABC is continuous over two spans of 8m each and it carries uniformly distributed factored load of 75 kN/m . Check whether we can reduce the maximum moment by 30% and redistribute to the spans. Take width of web = 300mm, thickness of slab = 150mm. $D = 820 \text{ mm}$ and $d = 770 \text{ mm}$.	BT-4	Analyzing
6.	A reinforced concrete slab is 120 mm thick with 30mm cover. If the positive reinforcement is $420 \text{ mm}^2/\text{m}$. Predict the approximate moment-curvature diagram and also determine the ductility factor. Use M25 and Fe 415 grade of concrete and steel.	BT-2	Understanding
7.	Sketch the design bending moment diagram of the beam shown below, clamped at both ends and carrying ultimate uniformly distributed load of 24 kN/m with full redistribution of 30 per cent as per IS 456	BT-2	Understanding
8.	Illustrate the Bakers method of plastic analysis of RCC frames stating the assumptions made. 	BT-4	Analyzing

9.	Draw envelope of the design moments for the beam shown in figure when the redistribution is limited to 20 per cent. 	BT-3	Applying
10.	a) Explain the concept of redistribution of moments in statically indeterminate reinforced concrete structures. (3) b) Mention three advantages of considering the redistribution of moments for the design of statically indeterminate reinforced concrete structures. (3) c) State the assumptions of considering the redistribution of moments in the design of statically indeterminate reinforced concrete structures. (3) d) What are the recommendations of IS 456 regarding the redistribution of moment in the design of statically indeterminate structures employing working stress and limit state methods? (4)	BT-3	Applying
11.	Draw the design bending moment diagram of the beam clamped at both ends and carrying two point loads of 30 kN each at distances of 3 m from the supports. Over all span measures 9m. Assume full redistribution of 30 per cent as per IS 456.	BT-3	Applying
12.	Write detailed notes on moment curvature relation of reinforced concrete sections.	BT-3	Applying
13.	A Reinforced concrete beam section is 200 mm x 550 mm depth. if the applied moment is 140 kNm. Determine the instantaneous curvature assuming a tensile stress in concrete at level of steel of 1 N/mm². assume $E_c = 28,000 \text{ N/mm}^2$ and $2,00,000 \text{ N/mm}^2$ ($m = E_s/E_c = 7.14$) $f_{ck} = 20$. Refer fig below. 	BT-6	Creating
14.	Explain the step by step procedure for the design of RC flexural members by Baker's method of limit analysis and design.	BT-3	Applying

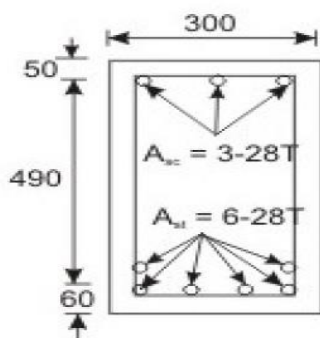
15.	A four span continuous T beam ABCDE of 4 m in which span is subjected to a characteristics load of 40 kNm including its self weight. Design the beam so that it fails by plastic failures at the support at an ultimate load with a load factor 1.5.	BT-3	Applying
16.	Explain in Detail in about types of RCC Column.	BT-3	Applying
17.	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-3	Applying

UNIT-5: DUCTILE DETAILING

Concept of Ductility – Detailing for ductility – Design of beams, columns for ductility -Design of cast-in-situ joints in frames.

PART - A

Q.No	Questions	BT Level	Competence
1.	Point out the precaution to be taken to avoid sapling of concrete	BT-2	Understanding
2.	Summarize ductility property of steel.	BT-1	Remembering
3.	List basic assumptions in earthquake resistant design of structures	BT-2	Understanding
4.	Discus about average cover & ductility factor.	BT-1	Remembering
5.	Give the advantages of ductile detailing.	BT-2	Understanding
6.	Write a short note on the placement of steel in ductile detailing.	BT-1	Remembering
7.	Show the factors influencing ductility of a reinforced concrete	BT-1	Remembering
8.	Write short notes on fire resistance of reinforced concrete members.	BT-2	Understanding
9.	What are the various factors affecting the ductility?	BT-2	Understanding
10.	Draw the ductile detailing of a beam – column joint.	BT-1	Remembering
11.	How the RCC elements are made ductile?	BT-1	Remembering
12.	Differentiate between ordinary-moment shear wall and ductile – moment shear wall?	BT-2	Understanding
13.	What is curvature ductility? and rotational ductility.	BT-2	Understanding
14.	Define rotational ductility.	BT-3	Applying
15.	Write any two ways of improving ductility of beams	BT-2	Understanding
16.	Analyze strong column-weak beam design.	BT-2	Understanding
17.	Narrate the effect of ductility on steel structure.	BT-3	Applying
18.	Discuss about the basic objective of form work.	BT-2	Understanding
19.	What is a ductile-moment shear wall?	BT-3	Applying
20.	Sketch the detailing of reinforcement in columns for ductility.	BT-1	Remembering
21.	List out the factors that increase the ductility of a member.	BT-2	Understanding

22.	Draw the stress strain relationship for unconfined concrete	BT-1	Remembering
23.	What is meant by special confining reinforcement in columns of ductile frames ?	BT-1	Remembering
24.	Define Ductility.	BT-1	Remembering
25.	State the advantages of Ductility.	BT-2	Understanding
PART-B			
1.	Define and explain ductility with respect to a) Displacement b) Curvature c) Rotation of a reinforced concrete structure	BT-1	Remembering
2.	Summarize the design of the column in a multistoreyed building for ductility with M 25 and Fe 415 subjected to an axial force of 3000 kN and bending moment of 800 kNm	BT-1	Remembering
3.	Compare the ductility with respect to curvature of the cross-section of the beam of Fig. using (a) M 25 and Fe 250, and (b) M 25 and Fe 415. 	BT-1	Remembering
4.	The size of bottom column of five storeyed building located in Chennai is 300 x 500 mm. the height of the column is 3m. The end moments from the beam are 85 kNm and 65 kNm. Sketch the reinforcement of the column as per IS 13920. The main reinforcement consists of 6 numbers of 20 mm diameter bars.	BT-1	Remembering
5.	Explain a) What are the devices used to improve the ductility performance with seismic loading. b) Also mention the methods used for achieving these objectives as laid in IS-13920.	BT-2	Understanding
6.	Determine the ductility with respect to curvature of the beam of $b = 300$ mm, $d = 540$ mm, $D = 600$ mm, $A_{st} = 942$ mm ² (3-20T), $f_{ck} = 20$ N/mm ² and $f_y = 250$ N/mm ²	BT-1	Remembering

7.	In an eight storied building, a typical column of 3.36m clear height carries an axial force 3200kN and BM of 750kN.m. The building is subjected to seismic loads and located in zone III. Use M25 and Fe415 grade of materials and design the beam for ductility	BT-2	Understanding
8.	Explain the following: a) The design rules to be applied to concrete members under fire test. b) Effect of fire on RCC beam, slab and columns	BT-1	Remembering
9.	Write explanatory notes on a) Quality control of concrete b) Dimensions of RC members for fire resistance c) Spalling of concrete and the methods to avoid the spalling of concrete	BT-3	Applying
10.	Explain the steps involved in the design of cast-in-situ joints in frames	BT-6	Creating
11.	What are the main design requirement in ductile shear walls in earthquake resistant design.	BT-2	Understanding
12.	a) State the effect of high temperature on steel and concrete. b) What are the factors that influence fire resistance ratings of reinforced concrete members?	BT-3	Applying
13.	Sketch the various types of shear reinforcements normally provided in practice?	BT-3	Applying
14.	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 dia is restricted to 450mm. Use M ₂₀ and Fe415 grades.	BT-2	Understanding
15.	Discuss the behavior of RC members under sustained high temperature and the methods to improve the performance.	BT-3	Applying
16.	Enumerate the ductile detailing requirements of beams, columns and frames as per IS : 13920 code procedures.	BT-3	Applying
17.	Design the reinforcement required for a circular column of 450 mm diameter 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-2	Understanding