ST7101 **CONCRETE STRUCTURES** **L T P C**

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QUESTION BANK

UNIT -1

DESIGN PHILOSOPHY

PART –A

1. Explain balanced, under-reinforced and over-reinforced section.
2. Differentiate oneway and twoway slab?
3. Explain the merits of limit state design?
4. What are the flanged beam?Explain neat sketch.
5. What is the use of partial safety factors?
6. What are slender columns?
7. Calculate the effective length of a column if its unsupported length is 4m when both ends arefixed?
8. What is meant by moment of resistance?
9. What is the necessity of doubly reinforced section?
10. What are the reason for cracks in structural concrete?
11. What are reinforcements provided required in a beam to support the combined effect of shear, bending moment, torsion?
12. List out the factors influencing the crack with reinforced concrete members?
13. Why is additional moment considered for long columns?
14. What is meant by cracking torque?
15. How does shrinkage of concrete lead to deflection in reinforced concrete flexural members?
16. What is the difference between short and long column?
17. What is meant by balanced failure?
18. What are the different options available to a designer with regard to control of cracking in flexural members?
19. What is the difference between deterministic design and probabilistic design?
20. What are the failures will occur in long column?

PART – B

1. 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. Design the section. Use M25 concrete and Fe 500 steel.\
2. Discuss the issues involved in designing for achieving control over thermal and shrinkage cracking in large RC structures.
3. 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.

4. A rectangular beam section of width 250 mm and effective depth 500 mm is subjected to an ultimate moment of 150 kNm, ultimate shear force of 60 kN and ultimate torsional moment of 20 kNm. Design the beam.
5. Briefly discuss torsion – shear interaction of reinforced concrete beams.
6. 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 short term deflection due to an imposed working load of 25 kN/m, excluding self weight of beam. Assume grade of concrete M20 and grade of steel as Fe 500.
7. A simply supported 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
8. Design a biaxial eccentrically loaded braced rectangular column for the following data
   Ultimate axial load = 2000kN
   Ultimate biaxial moments = Mux=250kNm and Muy=150kNm
   Unsupported length(l)=3.25m
   Effective length lex=3m, ley=2.75m
   Column section (b) in x-direction=400mm, D=600mm
   Adopt M25 grade concrete and Fe415 grade steel
9. Design a T- beam for the following data:
   b_f : 750 mm
   b_w : 300 mm
   Effective depth : 450 mm
   Thickness of flange : 90 mm
   Applied moment : 350 kNm.

   Adopt M20 concrete and Fe 415 steel.
10. Design a short square column for the following data : lateral dimension : 500 mm, axial load : $2x10^6$ N. Assume M20 concrete and Fe 415 steel.

UNIT II DESIGN OF SPECIAL RC ELEMENTS

PART – A

1. State the advantages of flat slabs.
2. What is meant by punching shear?

3. What are the modes of failure of deep beams?
4. Give any two characteristics of yield line.
5. What do you meant by coupled shear walls?
6. What is the main difference between a braced wall and an unbraced wall?
7. Why side face reinforcements are extremely important in deep beams?
8. Explain the arch action on the deep beam with the load transfer model?
9. What is a corbel? Explain with a neat diagram?
10. How do you calculate the lever arm for a deep beam?
11. What is a bracket? Where it is used?
12. Define shear wall.
13. Explain grid or coffered floor systems, with a neat sketch.
14. How a nib is different from cantilever? Draw a neat sketch.
15. What is the development length adopted for deep bemas? Calculate it for 16 mm mild bars in M20 grade concrete.
16. Explain the strut and tie method of analysis for a corbel, with the equation of lever arm (z/d).
17. What are the advantages of a flat slab over ordinary slab?
18. Explain the term drop and capital in flat slab.
19. What is a flat plate?
20. Explain the characteristic features of yield lines?

PART B

1. Design a corbel 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.
2. Design 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.
3. R.C. grid floor is to be designed to cover a floor area of 12mx18m.The spacing of ribs in mutually Perpendicular directions is 1.5mc/c. Live load on the floor is 2kN/m. Analyse the grid floor by IS-456 methods and design the suitable reinforcements with grid floor.
4. Design a single span deep beam with following data.

   a) Effective span =6m

   b) Over all depth=6m

   c) Width of support=0.6m

   d)width of beam =0.4m

   Total load on beam including self-weight 400kn/m .Use M20&Fe415.

5. Design a column of size 450 x 300 mm using M30 concrete and Fe 500 steel. Given l_{ex} = 6.0 m, l_{er} = 5.5 m, P_u = 1500 kN, M_{ux} = 45 kN-m at top and 30 kNm at bottom M_{ny} = 40 kNm at top and 25 kNm at bottom. The column is bent in double curvature and assume a cover of 50 mm.
6. A plain traced concrete wall of dimensions 8 m high, 6 m long and 200 mm thick is restrained against rotation at its base and unrestrained at the ends. If it has to carry a factored total gravity load of 200 kN and a factored horizontal load of 8 kN at top. Check the safety of the wall. Assume f_{ck} = 25, f_y = 500.
7. What is meant by shear wall? Write the step by step procedure for the design of rectangular shear wall with boundary element.
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.
9. Explain the basis for the simplified code procedure for analyzing the design strength components of a biaxially loaded column with rectangular section.
10. Design the longitudinal reinforcement for a braced column, 300 mm x 500 mm, subject to a factored axial load of 1500 kN and factored moments of 70 kNm and 50 kNm with respect to the major axis and minor axis respectively at the top end. Assume that the column is bent in double curvature (in both directions) with the moments at the bottom end equal to 50 percent of the corresponding moments at top. Assume an unsupported length of 6.0 m and an effective length ratio of 0.85 in both directions. Use M30 concrete and Fe 415 steel.

UNIT III FLAT SLAB AND YIELD LINE BASED DESIGN

PART-A

1. Advantages and disadvantages of flat slab?
2. Components of flat slab?
3. Assumptions of equivalent frame method?
4. What are the assumptions made in yield line theory?
5. What is meant by punching shear?
6. Give any two characteristics of yield line?
7. What are the limitations of yield line theory?
8. What are the limitations of Hillerborg’s strip method?
9. Differentiate b/w yield line and strip line?
10. Write down the steps in the design for spandrel beams.

PART – B

1. Estimate the dimensions of a flat slab system (with drops) for a four storey building with 5 spans of 8 m in the longer direction, 5 spans of 6 m in the shorter directions and a storey height of 3m.
2. A simply supported slab panel is 4 m x 6 m and carries a udl of 5 kN/m^2 at collapse. Determine the moment of resistance if it is the same in the two directions. Use yield line theory.
3. Design a RC grid floor to cover an area of 12m x 12m. The ribs are spaced at 1.5 m intervals. Line load on the floor is 2.0 kN/m^2.
4. Find the ultimate load for orthotropically reinforced rectangular slab, simply supported over all four edges and uniformly loaded.
5. A plain braced concrete wall of dimensions 10 m high, 6 m long and 200 mm thick is restrained against rotation at its base and unrestrained at ends. If it has to carry a factored total gravity load of 200 kN and a factored horizontal load of 8.5 kN at the top, check the safety of the wall. Assume f_{cn} = 20 and f_y = 415.
6. A reinforced concrete deep grider is continuous over spans of 10 m apart, from center to Centre. It is 4.5 m deep, 300 mm thick, and the supports are columns 900 mm in width. If the grider supports a udl of 200 kN/m including its own weight, design the necessary steel assuming M20 concrete and Fe415 steel.
7. Design an interior panel of a flat slab 6mby6m, for a live load of 7KN/m^2 .Use M20 &Fe415, provide two-way reinforcement.
8. The roof of a hall measures 26mby34m, and consists of flat slab construction dividing it into 16 panels. Design all the panels of the roof for a live load of 6.5$Kn/m^{2.}$.Use M20 &Fe415 provide two-way reinforcement
9. Design a simply supported slab of size 4m by 3m using yield line theory. The slab is subjected to a live load of 3.5kn/m^2.And floor finish of 1.5$kN/m^{2.}$. Use M20 &Fe415.
10. Design an interior panel of a flat slab in a building carrying a live load of 3kN/m^2. The weight of floor finishes on the slab may be taken as 2 kN/m^2. The panel is supported on 300 mm dia circular columns. Size of panel is 5m x 7m. Use M20 concrete and Fe 415 steel.

UNIT IV INELASTIC BEHAVIOUR OF CONCRETE STRUCTURES

PART – A

1. What are the assumptions of baker's method?
2. Define allowable rotation for inelastic analysis.
3. Define spandrel beams.
4. Explain the use of a crosstie with a sketch.

5. What are the types of cast in situ joints?
6. What do you understand by confined concrete?
7. What is meant by moment redistribution?
8. What are the advantages of moment redistribution?
9. Draw a typical moment rotation curve for simply supported beam under flexure.
10. Write down the moment rotation curvature relationship for balanced section.

PART – B

1. 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 fck = 25 and fy = 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 mm and d = 750 mm are given.
2. A circular column is 350 mm diameter. Find the diameter and spacing of hoops to be used for confident assuming that the concrete used is M20 and the steel is Fe 500. What will be the lateral reinforcements if the column is rectangular of 600 x 500 mm in size?
3. Write detailed notes on moment curvature relation of reinforced concrete sections.
4. What are the assumptions made and steps involved in Baker's method of limit analysis of redundant RC frames? Explain.
5. A flat slab floor has panels 6 m x 5 m in X and Y directions between centres of columns which are 400 x 400 mm in size. It has an edge beam all around the periphery of 200 x 400 mm in which carrier an external wall of weight 6 kN/m. the slab thickness is 150 mm and the characteristic live load it has to carry is 5 kN/m^2. The height of each storey is 3m. Analyze the exterior frame in 6 m direction and determine the distribution of moments.
6. A flat plate with 7.5 m x 6 m panels on 500 x 500 mm columns has a slab thickness of 165 mm, design for a characteristic load (DL+LL) of 9.3 kN/m^2. Check the safety of slab in shear if M25 concrete and Fe 415 steel are used for its construction. How can we increase the shear capacity of the slab?
7. Explain moment rotation curvature relationship for balanced, over, under reinforced beams with neat sketches?
8. A continuous beam has two spans each of 8m. The characteristic dead load is 15KN/m and live load is 25KN/m.Draw the bending moment envelope after maximum redistribution.
9. Determine the moment-curvature diagram for the flanged T-beam section.

10. A T-beam ABC is continuous over two spans of 8m each and it carries uniformly distributed factored load of 75kN/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 = 820mm and d = 770mm.

UNIT V DUCTILE DETAILING

PART – A

1. What is meant by ductility?
2. What are the precaution to be taken to avoid spalling of concrete?
3. What are the basic assumptions in earthquake resistant design of structures?
4. Define average cover.
5. Define ductile detailing.
6. Write a short note on the placement of steel in ductile detailing.
7. Define ductility factor.
8. Write short notes on fire resistance of reinforced concrete members.
9. What are the variables affecting the ductility?
10. Draw the ductile detailing of a beam.

PART – B

1. A block of 8 storeyed flats has its lower most columns 500 x 600 mm in size. In order to use the ground floor for car parking the lower columns are made free standing. Comment on the considerations to be given for detailing of these free standing columns. Assume fck = 25, fy = 500 and height of free bay is 4 m.
2. Discuss the effect of high temperature on different types of structural members.
3. Discuss the need for the provision of ductility in RC framed structures when subjected to earthquake loads and state the methods of providing ductility in RC framed structures.
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. Design the column as per IS 13920. The main reinforcement consists of 6 numbers of 20 mm diameter bars.
5. A reinforced concrete slab is 125 mm thick with 25 mm cover to centre of steel. If the positive steel reinforcement is 425 mm^2/m determine the approximate moment – curvature diagram. Determine the ductility factor assuming M25 and Fe 415 steel for reinforcements.

6. A circular column is 300 mm in diameter. Find the diameter and spacing of hoops to be used for confinement assuming that the concrete used is M20 and the steel is Fe 415. What will be the lateral reinforcements if the column is rectangular 600 x 500 mm in size?
7. What are the devices used to improve the ductility performance with seismic loading. Also mention the methods used for achieving these objectives as laid in IS-13920.
8. What are the design rules to be applied to concrete members under fire test under ISO834 with respect to the following:

   i) cover to steel

   ii) size of members(minimum thickness for a given fire rating)

   iii) other factors like detailing practice

9. a) Explain the effect of high temperature on steel and concrete.

   b) What are the factors that influence fire resistance ratings of reinforced concrete members?

10. What are the main design requirement in ductile shear walls in earthquake resistant design?