QUESTION BANK

Name of the Department : Civil Engineering

Subject Code & Name : CE8501 & Design of Reinforced Concrete Elements

Year & Semester : III & V

UNIT I INTRODUCTION

PART-A

1 State the assumptions made for design of RC members in working stress method.

2 Write down the values of partial safety factor for i) concrete ii) steel.

3 On what circumstances doubly reinforced beams are to be adopted?

4 State the main concept of elastic method or working stress method.

5 What are the three methods of design of reinforced concrete structural Elements? Which of the three methods is the best?

6 Summarize the main concept of working stress method/Elastic theory of reinforced concrete structures?

7 What are the different types of loads that have to be considered in the design of a building?

8 What are the advantages of elastic method or working stress method?

9 Write down the advantages of limit state method over other methods.

10 Enumerate balanced section?

11 Enlist different factors that are influencing the durability of concrete as per BIS.

12 Define characteristic load and characteristic strength of material?

13 Justify any two guidelines to select the cross-sectional dimensions of RC beam.

14 What are the classifications available in serviceability limit state?

15 Enumerate serviceability limit state.

16 Select any two assumptions are made in elastic theory method.

17 Mention any two advantages of introducing compression steel in RC beam

18 Define modular ratio. Examine the modular ratio of M20 & M25grade concrete.

19 Difference between WSD and LSD?

20 Show the assumptions made in limit state of collapse by flexure.

21. Write short note on doubly reinforced section

22. Draw the stress strain curve for concrete in the limit state design of flexure.

23. What is the formula used to find the critical neutral axis in working stress method?

24. What is the formula used to find the actual neutral axis in working stress method?

25. List out the minimum and maximum area of tension reinforcement in beam?

PART-B

1. 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.
2. 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.
3. 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.
4. i).Discuss the terms of (a) Neutral axis (b) Moment of resistance (c) Lever Arm ii).A doubly reinforced beam with b =500 mm has to carry a dead load moment of 80,000 Nm and a live load moment of 100,000 Nm. Using M20 concrete and Fe415 grade steel, calculate the required steel using working stress method of design.
5. 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.
6. A reinforced concrete beam of span 5m has a rectangular section of 250 mm x 500 mm. the beam is reinforced with 3 bars of 16 mm diameter on the tension side at an effective depth of 450 mm and 2 bars of 16 mm diameter on the compression side at a cover of 50 mm from the compression face. Estimate the maximum permissible live load on the beam. Use M20 grade concrete and Fe250 grade steel by using working stress method.
7. 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
8. 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.
9. 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.
10. Compare and explain detailed notes on under reinforced section and over reinforced section for LS method.

11 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.

12 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.

13 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.

14 A doubly reinforced beam of size 250mmX550mm 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 460KNm.

UNIT II DESIGN OF BEAMS

PART-A

1. Enumerate the advantages of flanged beams.
2. List the important factors that influence bond strength.
3. Write the formula for effective flange width of isolated L-beam and T-beam?
4. Write down the formulae for calculating effective width of flanged beams.
5. What are the stresses produced by torsion?
6. Discuss the four components for which design are to be made in T-beams?
7. Write down the value of design bond stress for M 30 grade concrete.
8. Define development length.
9. What do you understand by the term anchorage?
10. When pure torsion is to created?
11. Give any two structural members subjected to torsion?
12. Differentiate bond and anchorage.
13. What are the types of reinforcement used to resist shear and write down expression for shear resistance offered by each type.
14. Enlist the types of shear failure in reinforced concrete beams?
15. Define torsional shear.
16. Define flexural bond
17. Draw sketches for different types of shear reinforcement.
18. What you mean by diagonal tension?
19. Define limit state of collapse in shear.
20. State minimum requirement of shear reinforcement?
21. Differentiate shear failure and bending failure.
22. What is the importance of anchorage value of bends?

23. Define shear friction
24. What is the formula used to find the spacing of inclined stirrups?
25. How to overcome torsion on beams?

PART-B

1. 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/m2. Design one of the intermediate beams. Using M20 grade concrete and Fe415 HYSD bars.
2. Determine the ultimate moment of resistance of t beam having width of the flange, bf= 800mm; depth of flange, Df=150mm; width of the web (bw)=300mm; effective depth, d=420mm Ast=1470mm2 , fck=25N/mm2 ; fy=415N/mm2 .
3. 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/m2 .
4. 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
5. 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.
6. 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
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.
8. 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.
9. Check for the development length at support of a doubly reinforced beam 400mmX750m (effective) the clear span of the beam is 5.25m. The beam carries UDL of 46KN/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 Fe415 HYSD bars.
10. A simply supported one way slab of 4 m span carries a live load of 3 N/m2 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.

11. 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.

12. 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 fck=20N/mm2 ; fy=415N/mm2 . Design the vertical stirrups.

13 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 450 near the support section. In addition the beam is provided with two legged stirrups of 8mm dia at 150mm centers near the supports. If fck=25N/mm2 ; fy=415N/mm2 . Estimate the ultimate shear of the support section.

14. 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.

UNIT III DESIGN OF SLAB AND STAIRCASES

PART-A

1.Draw yield line pattern for one-way slab with simply supported edge condition

2. Write the various types of slab.

3.Mention the parameters governing slab moments co-effecients.

4 Write the different types of staircase

5 What is the importance of two way slabs over one way slab?

6 Enumerate structural requirement of slabs.

7 Which direction of slab takes maximum moments?

8 Distinguish between the behavior of one way slab and two way slabs.

9 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.

10 Why is secondary/distribution reinforcement provided in one way RC slab?

11 Why corner reinforcement are provided in a two way slab? And sketch the edge and middle strips of a two way slab.

12 Define tread and rise

13 Why is necessary to provide transverse reinforcement in one way slab?

14 Formulate the expressions recommended by IS 456 for Youngs modulus and flexural strength.

15 Show the formula used to find the spacing of inclined stirrups?

16 What is stair case?

17 Show the value of partial safety factor for (a) concrete (b) steel.

18 Outline the codal provisions for minimum reinforcement to be provided main and secondary reinforcement in slab and their maximum spacing.

19 What is the minimum rise and tread in residential and public building?

20 Justify the IS code provision for maximum strain in the tension reinforcement in the section at failure.

21 Enumerate the circumstances under dog- legged stair cases used.

22 Draw the moment distribution diagram for slab along length

23 Write the advantages of cantilever slab.

24 Enlist the advantages of deep beam.

25 Justify the different end conditions for slab with coeffecients

PART B

1 Design a cantilever slab projecting 1m from the support using M20 & Fe415 HYSD bars. Adopt live load of 3 KN/m2

2 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/m2 . The slab has a bearing of 150 mm on the supporting walls.

3 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/m2 and a finish 1KN/m2.Use M20 & Fe415

4 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/m2 . Adopt M20 grade concrete and Fe 415 HYSD bars.

5 Design a continuos one way having 3 equal span of 3m each having imposed load of 2.5 KN/m2.Use Fe415 & M15

6 Design a cantilever balcony slab projecting 1.2 m from a beam. Adopt live load of 2.5 KN/m2

7 Design a dog legged stair for a building in which vertical distance between floor is 3.6m.Assume any relevant data

8 Interpret the following details and design the one way slab: size=3m x 9m, width of the support =230mm, live load= 3kN/m2 , floor finish as 1kN/m2 use M20 concrete and Fe415 steel bars.

9 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/m2. Adopt limit state design. Use M20 grade concrete and Fe415 steel bars.

10 A simply supported one way slab of 4 m span carries a live load of 3 N/m2 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.

11 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/m2 . Adopt M20 grade and Fe 415HYSD bars.

12 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 Rise = 150mm Width of landing beams = 300mm

13 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/m2 Floor finish as 1 kN/m2 Use M20 concrete and Fe 415 steel.

14 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.

UNIT IV DESIGN OF COLUMN

PART-A

1 State the behaviour of slender column

2 Name the two code requirements on slenderness limits.

3 Sketch the salient points on a typical axial – moment interaction curve of a column.

4 Write the few points about specification of circular column

5 Enumerate compression members with helical reinforcement.

6 Differentiate between uniaxial and biaxial column.

7 Write the importance of column curves.

8 Write down the expression for minimum eccentricity

9 According to IS code all the columns shall be designed for minimum eccentricity. Justify the reasons for this statement.

10 Why specifications are limited in column?

11 Write the basic assumption for the combined axial load and uniaxial bending on columns.
12 On what condition intermediate column is more suitable?

13 What are the types of reinforcements used to resist shear force in columns?

14 Show the effective length of different columns

15 Describe about the function of the traverse reinforcements in a reinforced concrete column.

16 Write the pitch and diameter of lateral ties for columns as per IS 456

17 Write the expression for eccentricity of columns

18 Describe about the function of lateral ties in a RC column.

19 What is pedestal ?

20 Explain the function of the traverse reinforcements in a reinforced concrete column.

21 Give the minimum number of steel rods for different types of columns

22 Differentiate a circular column and rectangle column

23 Enumerate the behavior change on the account of height and shape

24 Outline the different end condition of column as per IS 456

25 Why minimum and maximum reinforcement id restricted in column ?

PART –B

1 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

2 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

3 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 350mm. Use M25 and Fe 500 grade.

4 Determine the ultimate load carrying capacity of rectangular column section 400x600mm reinforced with 10nos of 25mm dia. Use M25 concrete and Fe415 steel.

5 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 M20 grade concrete and Fe415 steel bars.

6 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.

7 Design of short column subjected to biaxial bending. Determine the reinforcement for a short column for the following data. Column size: 400mmx600mm, Pu=2000kN Mux= 160kN, Muy=120kN.Use M20 grade concrete and Fe415 grade steel.

8 Discuss various assumptions used in the limit state methods of design of compression members.

9 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.

10 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.

11 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

Mux1=178 kNm and at top Mux1= 128kNm.Ultimate moment in shorter direction at bottom Muy1=108 kNm and at top Muy2= 88kNm. Unsupported length of column = 9m.Effective length in long direction lex=8m.Effective length in shorter direction ley= 5.8m.Diameter of column = 550mm.Use M25&Fe415 grades.

12 Design a short column subjected to biaxial bending. Determine the reinforcement fora short column for the following data. Column size: 450mmx600mm, Pu=100kN Mux=260kN, Muy=120kN.Use M25 grade concrete and Fe250 grade steel.

13 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.

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 diameter is restricted to 450mm. Use M20 and Fe415 grades.

UNIT V DESIGN OF FOOTING

PART-A

1. What are the factors that influence the selection of number of lifting and hoisting locations of a long beam during its erection process?
2. Compare punching shear and normal shear in RCC footing.
3. Define punching shear.
4. Write any two situations in which combined footings are preferred to isolated footings.
5. What is the main advantage of combined footing?
6. When you need a combined footing?
7. Why check for transfer of load at the base of the column over footing is done?
8. How is the main steel distributed in wall footings and two way rectangular footings?
9. Explain about eccentric loading on a footing.
10. Sketch the placement of steel in rectangular footing with a noncentral load
11. On what circumstances combined rectangular footings are suitable?
12. Draw a neat sketch of a wall footing.
13. Under what circumstances a trapezoidal footing become necessary?
14. What is slenderness ratio in masonry wall? State the maximum values
15. Compare the behaviour of tied and spirally reinforced column.
16. List out the different types of footing
17. Sketch the reinforcement detailing of footing.
18. What is meant by proportioning of footing?
19. Why dowel bars are provided in footing?
20. Compare one way and two way shear in footing.
21. Why punching shear is not encouraged in design of footing?
22. Draw the cross section of strip footing.
23. Enlist the different condition for usage of footing.

24. State the behavior of wall footing
25. Give the different types of combined footing.

PART –B

1. 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/m2 .Design a suitable footing. Use M25 concrete and Fe415
2. Design the 20 mm diameter bars as top steel for maximum hogging moment for a RC rectangular combined footing using the following data: Centre to centre distance between the columns is 4m.Each column is square in shape with 400 mm side. Each column carries an axial load at service state = 1200kN.The projection of footing parallel to the length beyond the axis of each column is 1m.The limiting bearing capacity of soil is 440kN/m2 .Use M20 grade and Fe 415 steel bars.
3. 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/m2 .Use M20 concrete and Fe415 steel. Adopt limit state design method.
4. A square column of size 400mm carries a service load of 600kN. Design an isolated footing for the column by limit state method, if the safe bearing capacity of the soil is 250kN/m2 . Use M20 concrete and Fe415 steel.
5. Design a rectangular isolated footing of uniform thickness for R.C. column bearing a vertical load of 600kN, and having a base size of 400 x 600 mm. The SBC of soil is 120kN/m2 . Use M25grade concrete and M.S grade-I bars. Draw the reinforcement details.
6. Sketch the standard detailing of the following: (i) Two spans one-way continuous slab with curtailment details (ii) Curtailment details in a tapered cantilever beam.
7. (i) Write down the different types of footings and their suitability. (ii) Enumerate the procedure for the design of combined rectangular footing for two columns only.
8. A rectangular column of size 300x450mm transmits a limit state load of 600kN at an eccentricity of 150mm about the major axis. Design a suitable isolated footing for the column by the limit state concept. Safe capacity of soil is 200kN/m2 . Use M30 grade of concrete and Fe415 grade of steel
9. 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/m2 . Adopt M20 grade of concrete and Fe415 grade of steel. Sketch the details at reinforcements in footings.
10. Design a combined footing for the two columns at a multi-storey building. The columns of size 400mmx400mm transmit a working load of 300kN each and they are spaced at 5m c/c .The safe bearing capacity of soil at site is 200kN/m2 . Adopt M20 grade concrete and Fe415 grade steel. Sketch the details of reinforcements in the combined footing.
11. 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/m2 Angle of repose of soil = 30 degree Unit weight of soil = 20 KN/m3

12. 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 1230kN/m2 . Use M20 grade concrete and M.S. grade –I bars. Draw the reinforcement details.

13. 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/m2 , 17.5kN/m3 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.

14. 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/m2.Use M20 & Fe415