 **SEMBODAI RUKMANI VARATHARAJAN ENGINEERING COLLEGE**

**DEPARTMENT OF CIVIL ENGINEERING**

**QUESTION BANK**

**Sub.Code** **:** CE2404 **Year / Sem :** IV / VII

**Sub.Name**:PRESTRESSED CONCRETE STRUCTURES **Batch :** 2012-2016

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 **UNIT – I INTRODUCTION-THEORY AND BEHAVIOUR**

**PART – A (2 Marks)**

1. What are the advantages of limit state method over working stress and ultimate load methods?

2. How do you find the moment of resistance of a beam section?

3. Discuss the merits of working stress method?

4. What is modular ratio? Determine the modular ratio at M20 grade concrete.

5. What do you understand by limit state of collapse?

6. Draw stress-strain curve for various grades of steel.

7. State the assumptions made in working stress method.

8. What is modular ratio? Determine the modular ratio at M25 grade concrete.

**PART – B (16 Marks)**

1. A singly reinforced concrete beam is of width 450mm and effective depth 715mm. It is reinforced with 8Nos.20mm mild steel bars. Assuming M20 concrete, determine its moment of resistance according to the working stress method. Determine also the stress in steel when the beam is subjected to the above moment.

2. Determine the reinforcement for a T beam with flange width = 1500mm, web width = 300mm, thickness of slab = 100mm, effective depth 735mm, to carry a moment of 380kNm due to characteristic loads. Use M25 concrete and Fe 415 steel. Using Working Stress Design.

3. A singly reinforced concrete beam is of width 400mm and effective depth 615mm. It is reinforced with 8Nos.20mm mild steel bars. Assuming M25 concrete, determine its moment of resistance according to the working stress method. Determine also the stress in steel when the beam is subjected to the above moment.

4. Design a rectangular slab supported on its all four edges (600mm thick) over a classroom of size 4.8m x6.2m. Two adjacent edges of the slab are discontinuous and the remaining two edges are continuous. A finishing surface of cement concrete of 20mm shall be provided over the slab. The slab shall be used as classroom. M20 grade of concrete and HYSD bars shall be used. The unit weight of finishing surface concrete is 24KN/m3.

5. Design a rectangular beam section subjected to an ultimate moment of 120kNm. Use concrete M20 and steel Fe415. Adopt limit state method.

 **UNIT II DESIGN CONCEPTS**

 **Part A (2 Marks)**

1. Distinguish between one –way and two way slabs.

2. Explain the terms ‘balanced’, ‘over reinforced’ and ‘under reinforced’ sections in bending

3. Discuss the different limit state to be considered in reinforced concrete design?

4. Why is it necessary to provide transverse reinforcement in a one way slab?

5. What are the three basic methods using factor of safety to achieve safe workable structures?

6. Explain maximum depth of neutral axis.

7. Find the depth of neutral axis in terms of ‘d’ for a balanced section using Fe 415 steel, in limit state method.

8. What is the difference in the design of one way slab and two way slabs?

**PART – B (16 Marks)**

1. A rectangular beam has b=200mm, d=400mm if steel used is Fe 415 and grade of concrete is M25. Find the steel required to carry a factored moment of 12kNm.

2. Design of roof slab for an interior panel of size 5mx6m. Live load is 5.0KN/m2. Use M30 Concrete and Fe 415 Steel.

3. Design a simply supported R.C.C.SLAB for a roof of a hall 4mx10m (inside dimensions) with 230mm walls all around. Assume a live load of 4kN/m2 and finish 1KN/m2.Use grade 25 concrete and Fe 415 steel.

4. A T beam continuous over several supports has to carry a factored negative support moment of 1000kNm. Determine the area of steel at supports if bW = 400MM, bfy =1600mm, Df = 100mm, D=610mm, d’ = 60mm, fck = 30N/mm2, f = 415 N/mm2.

5. A doubly reinforced concrete beam is 250mm wide and 510mm depth the center of tensile steel reinforcement. The compression reinforcement consists of 4 Nos. of 18mm dia bars placed at an effective cover of 40mm from the compression edge of the beam. The tensile reinforcement consists of 4Nos. of 20mm diameter bar. If the beam section is subjected to a BM of 85kNm, calculate the stresses in concrete and tension steel.

6. Design a smallest concrete section of a RC beam to resist an ultimate moment of 62kNm, assuming width 230mm, concrete grade M20 and HYSD bars of grade Fe415.

7. A rectangular beam of width 300mm and effective depth 500mm reinforced with 4 bars of 12mm diameter. Find the moment of resistance and stresses in the top compression fiber of concrete and tension steel. Use concrete M20 and steel Fe415. A dopt working stress method.

8. Design the interior span of a continuous one way slab for an office floor continuous over tee beams spaced at 3 meters. Live load = 4kN/m, Floor finish = 1kN/m2.Use concrete M20 and steel Fe415. Adopt limit state method. Sketch the steel reinforcement.

 **UNIT – III CIRCULAR PRESTRESSING**

 **PART – A (2 marks)**

1. What are the types of reinforcements used to resist shear?

2. Explain the difference between primary and secondary torsion. Give two examples each.

3. Under what circumstances are doubly reinforced beams used?

4. Reinforced concrete slab are generally safe in shear and do not require shear reinforcement? Why?

5. What is modular ratio?

6. Mention the difference in design principles for L Beam and T Beam.

7. When shear reinforcement is necessary in a beam

8. What is bond stress? Write an expression for it.

 **PART – B (16 marks)**

1. A rectangular beam width b=350mm and d=550mm has a factored shear of 400kN at the critical section near the support. The steel at the tension side of the section consists of four 32mm bars which are continued to support. Assuming fck=25 and fy=415(N/mm2) design vertical stirrups for the section.

2. A reinforced concrete rectangular beam has a breadth of 350mm and effective depth of 800mm. It has a factored shear of 105kN at section XX. Assuming that fck=25, fy=415(N/mm2) and percentage of tensile steel at that section is 0.5percent, determine the torsional moment the section can resist if no additional reinforcement for torsion is provided. Workout the problem according to IS456 principles of design for torsion.

3. A simply supported beam is 5m in span and carries a characteristic load at 75kN/m. If 6Nos. of 20mm bras are continued into the supports. Check the development length at the supports assuming grade M20 concrete and Fe415steel.

4. A rectangular RCC beam is 400x900mm in size. Assuming the use of grade M25 concrete and Fe415 steel, determine the maximum ultimate torsional moment at the section can take it.

(i) No torsion reinforcement is provided and

(ii) Maximum torsion reinforcement is provided.

5. A rectangular beam width b = 250mm and effective depth 500mm reinforced with 4 bars of 20mm diameter. Determine the shear reinforcement required to resist a shear force of 150kN. Use concrete M20 and steel Fe415.

6. Design a rectangular beam section of width 250mm and effective depth 500mm, subjected to an ultimate moment of 160kNm, ultimate shear force of 30kN and ultimate torsional moment of 10kNm. Use concrete M20 and steel 415.

7. A RC beam 300x450mm in cross section in reinforced with 3 Nos. 20mm diameter of grade Fe250, with an effective cover of 50mm. The ultimate shear at the section of 138kn.Design the shear reinforcement (i)Using only vertical strips without bending any bar for resisting. (ii) Bending 1 bar dia 20mm at 45 degree to resist shear at the section. Assume concrete of grade M20.

8. A reinforced concrete beam 500mm deep and 230mm wide is reinforced with 8Nos.20mm diameter bars at mid span to carry a UDL of 22.5kn/m (inclusive of its own weight) over simple span of 8m. Assuming concrete grade M20, steel grade Fe415, load factor 1.5 and width of support 230mm (i) determine the minimum development length required for 20mm diameter bar to develop full strength (ii) apply check for flexural development length at support assuming all bar to continue at support (iii) determine the minimum number of bars required at support for development length of flexure.

**UNIT – IV COMPOSITE CONSTRUCTION PART – A (2 marks)**

1 What is the minimum and maximum percentage of steel allowed in R.C.Column? Explain why it is necessary to specify the minimum and maximum percentage.

2 Give example of columns that are in practice subjected to unaxial and biaxial bending.

3 Explain (a) Equilibrium torsion (b) Compatibility torsion

4 How do you classify a column as long?

5 What will be minimum and maximum area of tension reinforcement in a beam?

6 How shear reinforcement improves the strength of beam?

7 How do you classify a column as short or long?

8 Write the procedure for the design of an axially loaded short column.

 **PART – B (16 marks)**

1. A rectangular column of effective height of 4m is subjected to a characteristics axial load of 800kN and bending moment of 100kNm about the major axis of the n. Design a suitable section for the column so that the width should not exceed 400mm. Use the minimum percentage of longitudinal steel. Assume fy=415N/mm2 and fck=20N/mm2.

2. An R.C.Column 500x400mm is subjected to an axial ultimate load of 2500kN and bent in single curvature about the minor axis with My(top)=90knm and My(bottom)=120knm as ultimate moments. If L0=7.2m and Le=5.75m on both axes, calculate the design moments for the column.

3. Design the reinforcement in a spiral column of 400mm diameter subjected to a factored load of 1500kN.The column has an supported length of 3.4m and is braced against side way. Use M20 concrete and Fe415 steel.

4. A column 300x400mm has an unsupported length of 3m and effective length of 3.6m.If it is subjected to pu=1100kNm and Mu=230kNm about the major axis, determine the longitudinal steel using fck=25N/mm2.

5. Calculate the ultimate strength in axial compression of column 400mm in diameter and reinforced with 8Nos. of 20mm dia. of grade Fe250 when the column in helically reinforced by 8mm dia at (i) 60mm pitch, (ii) 30mm pitch. Assume concrete of grade M20. Assume clear cover equal to 40mm.

6. Design an axially loaded tied column 400mmx400mm pinned at both ends with an unsupported length of 3m for carrying a factored load of 2300kN.Use M20 concrete and Fe415 steel.

7. Design a circular column with helical reinforcement of 400mm diameter and 4m in length to carry factored load of 1000kN.The column is hinged at both ends. Use concrete M25 and steel Fe415.

8. A column 300mmx400mm has an unsupported length of 4m and fixed at both ends. It is subjected to a factored load of 1000KN and an ultimate moment of 200kNm about the major axis. Determine the longitudinal reinforcement and lateral ties. Use concrete M25 and steel Fe415 d’=60mm

**UNIT – V PRESTRESSED CONCRETE BRIDGES**

**PART – A (2 marks)**

1. Sketch the placement of steel in rectangular footing with a non-central load.

2. What are the situations in which combined footings are preferred over isolated footings?

3. Draw a neat sketch of a masonry footing.

4. What is slenderness ratio for a masonry wall? State the maximum values?

5. Compare the behavior of tied and spirally reinforced column.

6. How do you classify one-way footing and two-way footing in foundation?

7. Under what circumstances a trapezoidal footing become necessary?

**PART – B (16 marks)**

1. A rectangular column 300mmx400mm reinforced with 20mm diameter bars carries a load of 1400kN. Design a suitable footing for the column. The safe bearing capacity of the soil is 200kN/m2.Use concrete M20 and steel Fe415.

2. Design a combined rectangular footing for two columns spaced at 5 centers. The first column 400mmx400mm carries a load of 1200kN and the second column 450mmx450mm carries a load of 1800kn at service state. Weight of Soil = 20kN/m2, angle of repose=300 and safe bearing capacity of soil = 150kN/m2. Use concrete M20 and steel Fe415.

3. Design a interior wall of a single storied workshop of height 5.4m surrounding a RCC roof. The bottom of the wall rests over a foundation block. Assume roof load equal to 45kN/m. A pier provided at a spacing of 3.6m along length of wall.

4. Design a compound wall of height 1.8m to the top of 100mm thick coping. Assume wind pressure is equal to 1kN/m2 and is UDL. The safe bearing pressure of soil is 120kN/m2.

5. A solid footing has to transfer a dead load of 1000kn and an imposed load of 400kn from a square column 400mmx400mm. Assuming fck=20N/mm2 and fy=415N/mm2 and safe bearing capacity to be 200KN/m2, Design the footing.

6. Design a combined rectangular footing for two columns spaced at 500cm centers. The first column 300mmx300mm carried load of 1000kn.and second column 300mmx300mm carries a load of 1500kn at service state. Weight of Soil = 20kN/m2, angle of repose=300 and safe bearing capacity of soil = 150kN/m2. Use concrete M25 and steel Fe415.

7. A solid footing has to transfer a dead load of 1000kN and an imposed load of 400kN from a square column 400x400mm (with 16mm bars.) Assuming fy=415 and fck=20N/mm2 and safe bearing capacity to be 200kN/m2. Design the footing.

8. Design a plain concrete footing for a 450mm wall carrying 300kN per meter length. Assume grade 20 concrete and the bearing capacity of soil to be 200kN/m2.