SNS COLLEGE OF TECHNOLOGY

COIMBATORE-35

DEPARTMENT OF CIVIL ENGINEERING

19CET302- DESIGN OF RC STRUCTURAL ELEMENT
Question Bank
Unit 4

1. **What are slender column?**

A column is said to be slender if its cross-sectional dimensions are small compared to its length

2.**Give the minimum number of steel rods for different types of columns**

As per IS 456: 2000 clause 26.5.3.1 minimum longitudinal steel reinforcement for the column is 0.8% of the gross area of the column section. And maximum longitudinal steel reinforcement for the column is 6 % of the gross column area.

- In rectangular column, a minimum of 4 longitudinal bars are required.
- In circular column, a minimum of 6 longitudinal bars are required.
- In octagonal column, a minimum of 8 longitudinal bars are required.

3.**Write down the expression for minimum eccentricity or what is the salient condition for minimum eccentricity of column.**

As per IS 456: 2000, clause 25.4, all columns shall be designed for minimum eccentricity, equal to the summation of the unsupported length of column divided by 500 and lateral dimensions divided by 30, subject to a minimum of 20 mm

4.**Write the basic assumption for the combined axial load and uniaxial bending on columns.**

Assumptions

1. The maximum compressive strain in concrete in axial compression is taken as 0.002.
2. The maximum compressive strain at the highly compressed extreme fibre in concrete subjected to axial compression and bending and when there is no tension on the section shall be 0.0035 minus 0.75 times the strain at the least compressed extreme fibre.In addition the following assumptions of flexure are also required
3. Plane sections normal to the axis remain plane after bending.
4. The maximum strain in concrete at the outermost compression fibre is taken as 0.0035 in bending.
5. The relationship between the compressive stress distribution in concrete and the strain in concrete may be assumed to be rectangle, trapezoid, parabola or any other shape which results in prediction of strength in substantial agreement with the results of test.
6. An acceptable stress strain curve is given in IS:456-200. For design purposes, the compressive strength of concrete in the structure shall be assumed to be 0.67 times the characteristic strength. The partial safety factor y of 1.5 shall be applied in addition to this.
7. The tensile strength of the concrete is ignored.
8. The stresses in the reinforcement are derived from representative stress-strain curve for the type of steel used. Typical curves are given in IS:456-2000. For design purposes the partial safety factor equal to 1.15 shall be applied.

5.**Write the pitch and diameter of lateral ties for columns as per IS 456**

1) Pitch-The pitch of transverse reinforcement shall be not more than the least of the following distances:

i) The least lateral dimension of the compression members;

ii) Sixteen times the smallest diameter of the longitudinal reinforcement bar to be tied; and

iii) 300 mm.

2) Diameter-The diameter of the polygonal links or lateral ties shall be not less than onefourth of the diameter of the largest longitudinal bar, and in no case less than 6 mm.

6. **How do you classify column as short column**

IS 456 clarifies rectangular column as short when the ratio of effective length (le) to the least dimension is less than 12 the ratio is called slenderness ratio of column if the column is of dimension b x d

Slenderness ratio about major axis =l_{ex}/d

Slenderness ratio about major axis =l_{ey}/d

If any of these two ratio is equal to or move than 12, it is called a slender column if both sides are less than 12, it is a short column

7. **Write short on braced column**

In tall buildings lateral supports like shear wall can be provided so that the lateral loads are taken by them such column are called braced column

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8. **Summarize the function of the traverse reinforcements in a reinforced concrete column.**

1. To prevent buckling of longitudinal bars.
2. To prevent longitudinal splitting of concrete.
3. To resist diagonal tension due to transverse shear.
4. To confine the concrete.
5. To hold the longitudinal reinforcement in position.
6. To prevent or delay sudden collapse and impart necessary ductility to the members.

9. **Summarize the function of the Longitudinal reinforcements in a reinforced concrete column**.

1. To assist concrete, in resting compression, so as to reduce the overall size, of the column.
2. To resist any tension that might develop due to bending caused by transverse load, eccentric load or the moments.
3. To reduce the effect of creep and shrinkage due to sustained loading.
4. To prevent or delay sudden brittle collapse.
5. To impart necessary ductility to the column.
6. To hold the transverse reinforcement.

10 **Summarize the function of lateral ties in a RC column.**

The role of lateral ties is to prevent premature buckling of bars, improve strength, to provide resistance against shear and torsion, to hold bars in position during construction etc.

11**. What is minimum longitudinal steel reinforcement for column , why it is restricted in column ?**

According to Clause 26.5.3.1 of IS 456: 2000, the **minimum longitudinal steel reinforcement for the column** is **0.8 % of the gross column area.**

Limit on the minimum reinforcement is specified due to the following reasons:

- Need to **ensure minimum flexural resistance** due to **unexpected eccentricities** that may occur in the column.
- To account for **creep under sustained loading** which is predominant in columns.

12. **Write the expression for eccentricity of columns**

$$\text{Minimum eccentricity} = \frac{L}{500} + \frac{B}{30}$$

13.**Define slenderness ratio**

Slenderness Ratio

In the Euler column formula, the quantity L/r is referred to as the slenderness ratio:

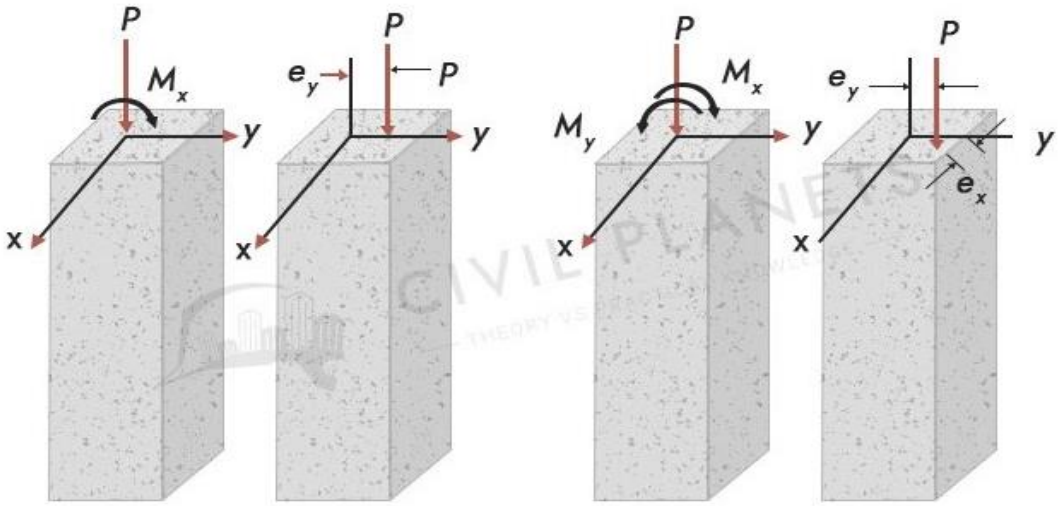
$$Rs = L/r$$

14. **Differentiate intermediate and long column**

- Columns with a high slenderness ratio are more susceptible to buckling and are classified as "long" columns. Long columns are analyzed with the Euler formula.
- Columns with a lower slenderness ratio are classified as "intermediate" columns and are analyzed with the Johnson formula.

15. **Differentiate between uniaxial and biaxial column.**

The eccentric load acts on either the X-axis or Y-axis is called the Uniaxial load column. The eccentric load acts on both axes called the Biaxial load column



16. **Write about effective length of different columns**

Column or strut is a compression member, the effective length of which exceeds three times the least lateral dimension. For normal usage assuming idealized conditions, the effective length of in a given plane may be assessed on the basis of Table 28 of IS: 456-2000.
Following terms are required.
Following are the end restraints:

• Effectively held in position and restrained against rotation in both ends
• Effectively held in position at both ends, restrained against rotation at one end
• Effectively held in position at both ends, but not restrained against rotation
• Effectively held in position and restrained against rotation at one end, and at the other restrained against rotation but not held in position
• Effectively held in position and restrained against rotation in one end, and at the other partially restrained against rotation but not held in position
• Effectively held in position at one end but not restrained against rotation, and at the other end restrained against rotation but not held in position
• Effectively held in position and restrained against rotation at one end but not held in position nor restrained against rotation at the other end

17.**Define Unsupported Length**

The unsupported length, l, of a compression member shall be taken as the clear distance between end restraints (visible height of column). Exception to this is for flat slab construction, beam and slab construction, and columns restrained laterally by struts (Ref. IS:456-2000),

18. **Write about Longitudinal reinforcement**

1. The cross-sectional area of longitudinal reinforcement, shall be not less than 0.8 percent nor more than 6 percent of the gross cross sectional area of the column.
2. NOTE - The use of 6 percent reinforcement may involve practical difficulties in placing and compacting of concrete; hence lower percentage is recommended. Where bars from the columns below have to be lapped with those in the column under consideration, the percentage of steel shall usually not exceed 4 percent.
3. In any column that has a larger cross-sectional area than that required to support the load, the

minimum percentage of steel shall be based upon the area of concrete required to resist the direct stress and not upon the actual area.

4. The minimum number of longitudinal bars provided in a column shall be four in rectangular columns and six in circular columns.

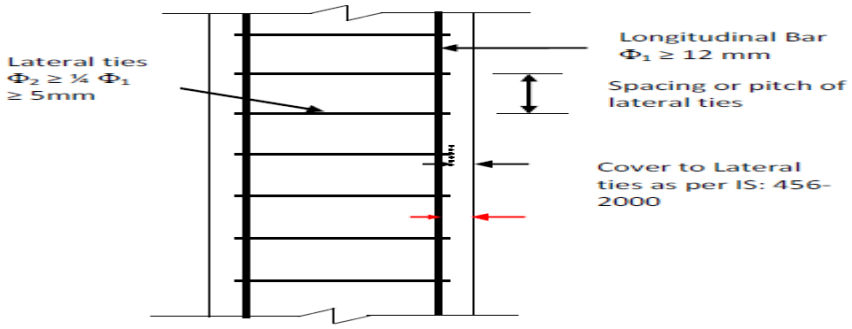
5. The bars shall not be less than 12 mm in diameter

6. A reinforced concrete column having helical reinforcement shall have at least six bars of longitudinal reinforcement within the helical reinforcement.

7. In a helically reinforced column, the longitudinal bars shall be in contact with the helical reinforcement and equidistant around its inner circumference.

8. Spacing of longitudinal bars measured along the periphery of the column shall not exceed 300 mm.

9. In case of pedestals in which the longitudinal reinforcement is not taken in account in strength calculations, nominal longitudinal reinforcement not less than 0.15 percent of the cross-sectional area shall be provided.



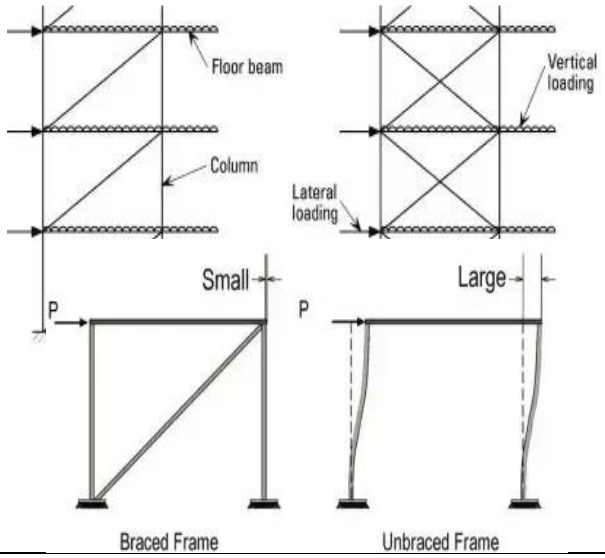
19. **What is braced and unbraced column?**

BRACED COLUMN;

In tall buildings lateral supports like shear wall can be provided so that the lateral loads are taken by them such column are called braced column

UNBRACED COLUMN

When relative transverse displacement between the upper and lower ends of a column is not prevented the frame is said to be unbraced column

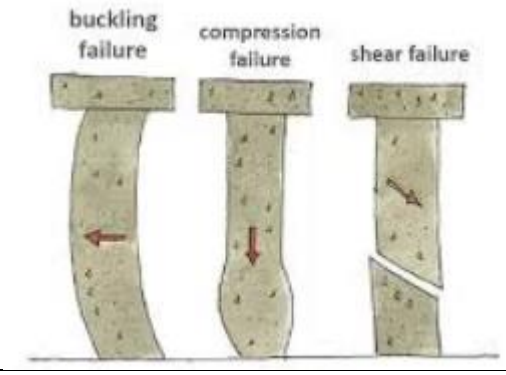


20. **What is axially loaded column? (or) write short notes on axially loaded column.**

When the line action of load passes through from centre of gravity of column it is called as axially loaded

21. **What are the types of column failure?**

1.Compressive Failure
2.Buckling Failure
3.Shear Failure



Part B

1. Design the reinforcement in a circular column with helical reinforcement to carry an axial load of 1200kN.The effective length of the column is 3m.

2. Design an axially loaded square column 400 x 400mm hinged at both ends with an unsupported length of 3m for carrying an ultimate load of 2300kN, Assume f_{ck} = 20 N/mm^2 and F_e = 415 N/mm^2.

3. Design a rectangular column to carry an axial load 1600kN. Effective length of column is 3.5m.

4. Design a short column subjected to biaxial bending to the following data
Size of the column = 400 x 400mm
Factored load = 1200kN
Factored moment, M_{ux}= 85kNm
Factored moment, M_{uy}= 45kNm

5. Design the reinforcement for the column of size 250mm x 300mm if it is subjected to P_U= 500kN, M_{ux} = 50kNm and M_{uy}=30kNm