SNS COLLEGE OF TECHNOLOGY
COIMBATORE-35
DEPARTMENT OF CIVIL ENGINEERING

19CET302- DESIGN OF RC STRUCTURAL ELEMENT

Question Bank

Unit 2

1. On what circumstances doubly reinforced beams are to be adopted?

- This type of beam will be considered necessary when, due to the consideration of headroom or architecture, the depth of the beam is restricted.
- And when the singly reinforced section is insufficient to resist the bending moment on the section additional tension and compression reinforcement are designed based on steel beam theory.
- The doubly reinforced beam (DRB) section is used where the span is more, where cross section will also be increased.
- Depth can be reduced and the Ast can be increased.
- In DRB, the top and bottom reinforcement must be designed

2. List functions of Stirrups

- Carries a portion of flexural factored shear force.
- Restricts the growth of diagonal cracks.
- Holds the longitudinal reinforcement bars in place.
- Provides some confinement to the concrete in the compression zone if the stirrups are in the form of closed ties.

3. List Types of Shear Reinforcement

The following three types of shear reinforcement are used

- Vertical stirrups
- Bent up bars along with stirrups.
- Inclined stirrups.

4. List Types of vertical stirrups

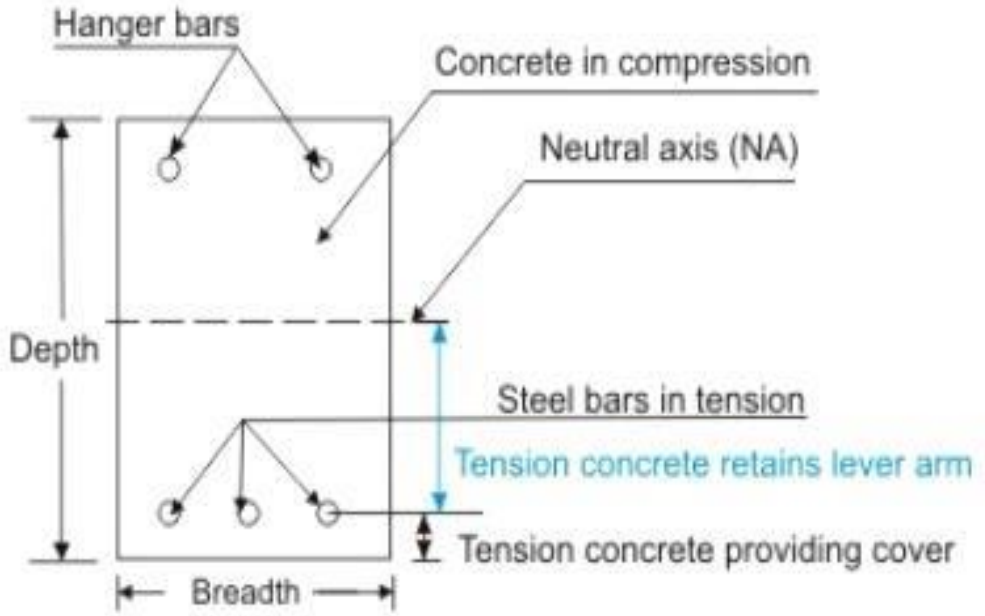
- Single Legged Stirrup
- Two Legged Stirrup
- Four Legged Stirrup
- Six Legged Stirrup

5. Name the modes of failure or their combination occur

- Flexural failure in which cracks are mainly vertical in the middle third of the beam span.
- Diagonal tension failure, where the strength of the beam in diagonal tension is lower than its strength in flexure.
- Shear compression failure, where the beam has a small shear span/depth ratio of the magnitude of 1-2.5 for concentrated loading and less than 5 for distributed loading.

6. What is singly Reinforced beam?

- The beam that is longitudinally reinforced only in tension zone, it is known as singly reinforced beam.
- In such beams, the final bending moment and the stress because of bending are carried by the reinforcement, while this compression is carried by the concrete.
- ØBut it is not possible to provide reinforcement only in the tension zone, because we need to tie the stirrups.
- Therefore, two rebars/ holding bars are used in the compression zone to tie the stirrups, and the rebars act as false members only to hold the stirrups



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8. What are the types of shear failure in reinforced concrete beams?

1. Shear – tension (or) Diagonal tension
2. Flexure – shear
3. Shear compression
4. Shear – bond

9. How do you prevent minimum shear reinforcements?

- Brittle shear failure cracks which can occur without shear reinforcements
- Sudden failure due to bursting of concrete of concrete cover and bond to the

tension reinforcements

- The shear reinforcements help to hold the main reinforcement while concreting forming an effective cage
- Formation of cracks due to the thermal and shrinkage stresses are minimized.
- Shear reinforcement act as effective ties for the compression steel and make them Effective

10. **How do you develop bond mechanisms between concrete?**
    - Chemical adhesion is the grip developed due to the gum like property of the gum like property of the hydration products of cement in concrete.
    - Frictional resistance developed due to the relative movements between concrete and steel bars depending upon the surface characteristics on f the bars and the grip developed due to shrinkage of concrete.
    - Shearing resistance or dilatancy due to mechanical interlock developed as a consequence of surface protrusion as ribs in deformed bars.

11. Define Torsion.

Equal and opposite moments applied at both ends of structural element (Member) or its part about its longitudinal axis is called Torsion. Also termed as torsional moment or twist or
torque.

12. **What is compatibility torsion? Give an example**

Compatibility torsion is the torsion induced in the member due to compatibility of rotations at the joint of interconnected members.
Examples:
Spandrel beam rigidly connected to cross beam, inter connected bridge girder and grids in horizontal plane.

13. **Give the property of good a bond between concrete reinforcement.**
    1. Sufficient cover for reinforcement
    2. Richness of concrete
    3. using twisted bars, welding the stirrup bars with the main bars
    4. Roughness of steel

14. What is meant by end anchorage?

Mild steel bars embedded in concrete are sometimes hooked so as to have proper anchorage with concrete. If bars are provided with hooks, the necessary grip or bond length can be reduced. The anchorage value of the hook alone is considered as 16d where d is the diameter of the bar

15. Write short note on splices in tensile reinforcement.
    - Splices at point of maximum tensile stress shall be avoided wherever possible, splices where used shall be welded, lapped or otherwise fully developed. In any case the splice shall transfer the entire computed stress from bar to bar.
    - Lapped splices in tension shall not be used for bars of sizes larger than 36mm diameter and such splices shall preferably be welded.

16. **Define bond. (Or) What is bond?**

Bond is defined as grip between concrete and steel.

(Or)

The force that prevents the relative movement between concrete and steel is known as bond.

(Or)

Bond in reinforced concrete beams is the adhesive force developed between concrete and steel bars embedded in concrete, which resists any force that tends to push or pull the bars.

17. **List out the different types of bond.**

The different types of bond are

- Flexure bond
- Anchorage bond

18. **Define flexure bond**

In flexure member on account of shear of a variation in bending moment, which inturn causes a variation in axial tension along the length of bar.

19. **What is meant by Anchorage bond?**

Over the length of anchorage provided for a bar or near the end (or cutoff point) of a reinforcing bar.

Part B

1. A RCC beam of rectangular section,300mm wide is reinforced with four bars of 25mm diameter at an effective depth of 600mm. The beam has to resist a factored shear force of 400kN at support section, Assume fck = 20 N/mm2 and Fe = 415 N/mm2, design vertical stirrups

2. A RC beam of rectangular section 350mm wide is reinforced with 4 bars of 25mm diameter at an effective depth of 55mm out of which 2 bars are bent up near the support section when a factored shear force of 4kN is acting. Use M20 concrete, Fe415 steel, design suitable shear reinforcement at the support section.

3. An RCC section of 200 mm x 400mm is subjected to a torsional moment of 2.5knm and transverse shear of 60kN, fck = 20 Nmm2 and Fe = 415 N/mm2 ,determine the reinforcements required according to IS:456 code

4. A reinforced concrete bean of rectangular section with width 350mm and overall depth 800mm is subjected to factored moment of 215kNm and ultimate torsional moment of 105kNm. Use M20 grade concrete and Fe415 HYSD bars and side, top and bottom cover of 50mm, design suitable reinforcement in section.

5. A RCC beam of rectangular section with a width of 350mm and overall depth of 700mm is subjected to an ultimate torsional moment of 100kn together with an ultimate bending moment of 200kNm, Use M20 grade concrete and Fe415 HYSD bars. Assume top and bottom covers of 50mm and side cover 25mm. Design suitable longitudinal and transverse reinforcement for the section.