SRI VIDYA COLLEGE OF ENGINEERING & TECHNOLOGY

VIRUDHUNAGAR

CE6505 DESIGN OF REINFORCED CONCRETE ELEMENTS

UNIT- V

LIMIT STATE DESIGN OF FOOTINGS

QUESTIONS & ANSWERS

PART – A

1. What are the causes of failure of foundation?

Any one or more of the following may causes failure of foundation

- Unequal settlement of the subsoil
- Horizontal movement of the soil adjoining the structure
- Shrinkage due to withdrawal of moisture from the soil below the foundation
- Lateral pressure tending to overturn the structure
- Action of atmosphere

2. What are the assumptions made in the design of footings?

The following are made

1. Foundation is rigid
2. The distribution of pressure from soil on the base is uniform

3. Name the common types of foundations?

The various types of foundations commonly used

1. Spread footings
2. Combined footings
3. Eccentricity loaded footings
4. Raft or Mat foundation
5. Pile Foundation

5. What are the causes of structural distress?

The various reasons for serviceability distress are attributed to the following factor

1. Large deflections of the floor slab and beam affecting the partition walls
2. Insufficient cover leading to corrosion of reinforcement and spilling of concrete
3. Improper slopes on roofs resulting in ponding of water and dampness due to poor drainage.
4. Local cracking of beams and slabs
5. Growth of algae and moss of wet surface of roof slabs leading to discoloration dampness.

6. What are the causes for the failure of a structure?

The ultimate failure or collapse of the structural concrete elements is due to the following reasons.

1. Improper design and detailing leading to primary of load bearing members.
2. Lack of quality control during construction may significantly reduce the design strength of concrete leading to sudden collapse of the member.
3. Use of poor quality materials.
4. Failure may also occur due to overloading or due to natural calamities like earthquake etc
5. Improper maintenance may lead to progressive collapse of the structure.

8. What are the guidelines to be followed while lapping the bars?

The following guide lines to be followed while lapping the bars.

1. Lapping should be avoided at points of maximum tensile stress such as the center of beams and slabs.
2. In structural concrete members, no more than 50% of the bars should be lapped at one place.
3. The lap length provided should be sufficient to transfer the entire force from one bar to the other.
4. The lap length should be based on the basis of smaller bars when two bars of different diameters are lapped.

9. What are the common shapes of reinforcement?

Reinforcements used in structural concrete members may be in different shapes as straight or cranked bars, single or double legged stirrups or bundled bars.

PART – B

1. Design a plain concrete footing for a column, 300 mm × 300 mm, carrying an axial load of 330 kN (under service loads, due to dead and live loads). Assume an allowable soil bearing pressure of 360 kN/m^2 at a depth of 1.0 m below ground. Assume M 20 concreteand Fe 415 steel.

2. Design an isolated footing for a square column, 450 mm × 450 mm, reinforced with 8–25 φ bars, and carrying a service load of 2300 kN. Assume soil with a safe bearing capacity of 300 kN/m^2 at a depth of 1.5 m below ground. Assume M 20 grade concrete and Fe 415 grade steel for the footing, and M 25 concrete and Fe 415 steel for the column.

3. Design a reinforced concrete footing for a 230 mm thick masonry wall which supports a load (inclusive of self-weight) of 200 kN/m under service loads. Assume a safe soil bearing capacity of 150 kN/m2 at a depth of 1 m below ground. Assume M 20 grade concrete and Fe 415 grade steel.

4. Design an isolated footing for a column, 300 mm × 500 mm, reinforced with 6–25 φ bars with Fe 415 steel and M 25 concrete subject to a factored axial load *Pu* = 1000 kN and a factored uniaxial moment *Mux* = 120 kNm (with respect to the major axis) at the column base. Assume that the moment is reversible. The safe soil bearing capacity may be taken as 200 kN/m2 at a depth of 1.25 m. Assume M 20 concrete and Fe 415 steel for the footing.

5. Design a combined footing for two columns C_1 (400 mm × 400 mm with 4–25 φ bars) and C_2 (500 mm × 500 mm with 4–28 φ bars) supporting axial loads P_1 = 900 kN and P_2 = 1600 kN respectively (under service dead and live loads). The column C_1 is an exterior column whose exterior face is flush with the property line. The centre-to-centre distance between C_1 and C_2 is 4.5 m. The allowable soil pressure at the base of the footing, 1.5 m below ground level, is 240 kN/m^2. Assume steel of grade Fe 415 in columns as well as footing, and concrete of M 30 grade in columns and M 20 grade in footing.