BTCLEVI

Term-End Examination

June, 2012

BICE-013: STRUCTURAL DESIGN AND DRAWING - I

*Time : 3 hours*   *Maximum Marks : 70*

Note : *Answer any seven, questions IS : 456 - 2000 code is allowed; IS : 800, 2007 code is allowed. Use of calculator is permitted.*

1. A rectangular beam 230 mm wide and 520 mm   **10**
    effective depth is reinforced with 4-16φ bars. Find
    out the depth of neutral axis and specify the type
    of beam. The materials are M20 grade concrete
    and Fe415 reinforcement. Also find out the depth
    of neutral axis if the reinforcement is increased to
    5-16φ bars.

2. Design a simply supported slab to cover a room   **10**
    with internal dimensions 4.0 m X 5.0 m and
    230 mm thick wall all round. Assume live load
    of 3kN/m² and a finish load of 1kN/m². Use M20
    concrete and Fe 415 steel. Assume that slab corners
    are free to lift up.

3. Design a (waist slab type) dog - legged staircase   **10**
    for an office building, given the following data :
          height between floor $= 3.2$ m
          riser $= 160$ mm, tread $= 270$ mm
          width of flight $=$ landing width $= 1.25$ mm
          live load $= 5$ kN/m^2
          finishes load $= 0.6$ kN/m^2

    Assume the stairs to be supported on 230 mm thick
    masonry walls at the outer edges of the landing,
    parallel to the risers. Use concrete M20 and Fe415
    steel. Assume mild exposure condition.

4. Design the reinforcement in a column of size   **10**
    450 mm X 600 mm, subjected to an axial load of
    2000 kN. under service dead and live loads. The
    column has an unsupported length of 3.0 m and
    is braced against sideway in both direction. Use
    M20 concrete Fe415 steel.

5. Write the different structural components of a   **10**
    cantilever retaining wall. Show with suitable
    sketch the reinforcement detailing of a cantilever
    retaining wall.

6. Figure - 1 shows an eccentric welded connection   **10**
    with 6 mm fillet weld. Determine the maximum
    load 'P' per bracket plate which can be applied
    on the connection if the shear stress in the weld is
    not to exceed 108 MPa.
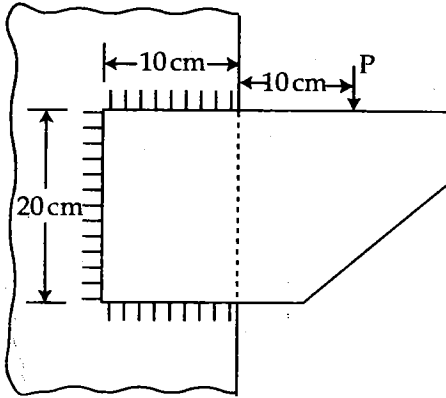
(Figure - 1)

7. Design a T - section to act as an tension member carrying an axial tension of 220 kN. **10**

8. Design a built up battened column to carry an axial compressive load of 2490 kN. The length of column is 4.85 m. It is effectively held in position at both ends but restrained against rotation at one end only. Take $fy = 250$ N/mm^2 **10**

9. Design the web and flanges of a plate girder for an effective span of 18 m. It is to carry two concentrated load of 400 kN at 6 m from both ends with super imposed uniformly distributed load of 50 kN/m. The girder is effectively supported laterally and the steel available conforms to IS : 226 - 1975. **10**

10. Write short notes on *any two*:   **2x5=10**

    (a)   Grillage foundation

    (b)   Efficiency of a joint

    (c)· Difference between working stress method of design and limit state method of design.