BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
BE (Civil) Seventh Semester Final Examination, December 2011

Advanced Structural Design (CE 705)

*Answer six questions taking **any three from each half***
All questions carry equal marks and Two marks are reserved for neatness
Take material grade as M25 for concrete Fe415 for steel, if not mentioned otherwise
Design must conform to Indian Standard Code of Practice. Assume data suitably, if not given
Examinees are **allowed** to consult any type of text materials in hard/soft form
Examinees are **not allowed** to consult with Co-examinees

Full marks: 70 Time: 3 hours

FIRST HALF

1. A beam of size 800mm deep by 400mm wide is pre-stressed with a linearly bent tendon having 100mm downward eccentricity at mid-span and 100mm upward eccentricity at both simply supported ends. The beam is subjected to a UDL of 10kN/m in addition to its self weight and pre-stressed with 1200kN of force at working stage. Calculate the extreme fibre stresses at support and mid-span applying stress concept and load balancing concept.

2. A beam of size 500mm deep and 300mm wide has an effective span of 5.0m and supports a cantilever projection 1000mm beyond the beam width throughout its span. Design the reinforcement of the section assuming a total uniformly distributed load of 5kN/m^2 on the cantilever projection. Assume fixity at the ends of the beam against torsion as well as flexure.

3. Design suitable thickness against flexure and shear for an interior panel of a flat slab construction of grid size 7500mm by 6000mm supported on 400mm by 400mm columns. Take live load as 5kN/m^2.

4. Design a RC rectangular water tank of size 10m long, 4.8m wide and 4m deep. The tank is open at top and walls are rigidly fixed to the base which rests on firm ground. Use approximate analysis.

5. A circular RC chimney of 80m height, have an internal diameter of 5m throughout its height. The thickness of the chimney shell is 500mm at base and linearly varying to 200mm at top. The chimney is subjected to a uniform static wind pressure of 1600N/m^2. Assume 1% vertical steel with 50mm cover. Calculate the extreme compressive and tensile stresses at the base of the chimney for self weight and wind load. Take modular ratio as 11.

SECOND HALF

6. A circular RC silo is to store food grains having unit weight of 6870 N/m^3. It has 6m internal diameter with cylindrical wall of height 15m and conical hopper of slope 45^0 with horizontal with 500mm opening. Design suitable thickness for the hopper wall of the silo. Take $\mu = 0.521$ and $\mu' = 0.432$.

7. Design suitable dimensions of a cantilever retaining wall, which is required to support a bank of earth 4.0m high above the ground level. Consider the backfill surface to be inclined at an angle of 15^0 with the horizontal. Take the safe bearing capacity of soil at a depth of foundation 1.25m as160kN/m^2. Take the unit weight of backfill soil as 16kN/m^3 and angle of shearing resistance as 30^0. Assume the coefficient of friction between soil and concrete to be 0.5.

8. For the circular RC chimney, stated in Q.5, calculate the extreme compressive and tensile stresses at windward and leeward shell of the chimney and also the same at neutral axis section of the chimney at its base. Take coefficient of expansion of concrete and steel as 11×10^{-6} per ^{0}C and Young's modulus of steel as 2×10^5 N/mm^2. Assume drop of temperature through shell as 70^{0}C and extreme compressive and tensile stresses at base as 4N/mm^2 and 40N/mm^2 respectively.

9. Design the thickness of the wall of a conical shaped elevated water tank having bottom diameter (internal) 10m and the wall making an angle of 60^0 with the horizontal up to a height of 6m. Take the load from top dome as 60kN/m and unit weight of water as 10kN/m^3.

10. A post-tensioned concrete beam, 100mm wide and 300mm deep, spanning over 10m, is stressed by successive tensioning and anchoring of three cables 1, 2 and 3 respectively. The cable 1 is parabolic with a downward eccentricity of 50mm at mid-span and upward eccentricity of 50mm at supports. The cable 2 is parabolic with a downward eccentricity of 50mm at mid-span and zero eccentricity at support. The cable 3 is straight with a downward uniform eccentricity of 50mm. Estimate the percentage loss of stress in each cable. Take cross sectional area of each cable as 200mm^2, initial pre-stress in each cable as 1200N/mm^2 and modular ratio as 6.