Midterm Exam 2007:   Concrete in Plasticity

1) Concrete can be assumed as Mohr-Coulomb Material of two parameters in terms of friction angle and cohesion. Explain how to determine these two parameters if you need test concrete.

2) Explain the following terms
    a) Normality rules
    b) Rankine field
    c) Prandtl solution
    d) Yield lines in the form of hyperbola

3) What is the yield criteria applied to set up yield surface for disk elements in the textbook in which concrete is assumed as a Coulomb material and reinforcing bar as the maximum tension-compression material? You may explain the yield criteria showing the procedure for the derivation of yield surfaces for disk.

4) Explain the followings
    a) The maximum shear strength of disk is limited by 0.5 fc.
    b) The principal direction of total stress is usually different from the principal direction of concrete for disk.

5) Sketch a possible shape of strut which shows the following crack if the principal strains coincide with those of principal stresses.
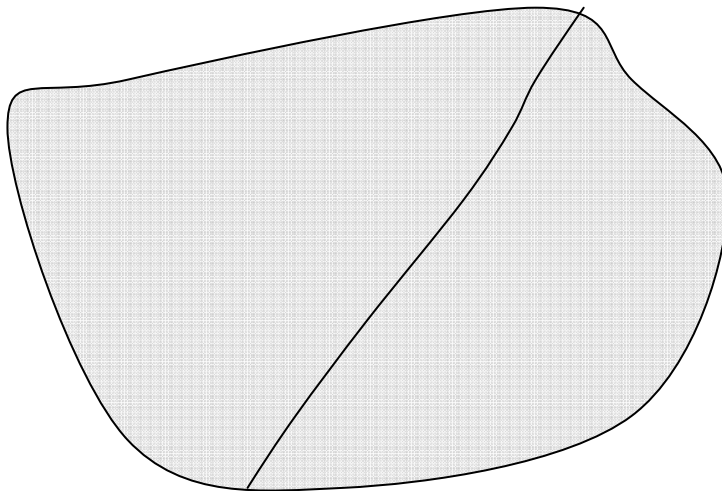
6) Propose an approximate formula for the loading capacity in case of a point load on a circular cylinder.
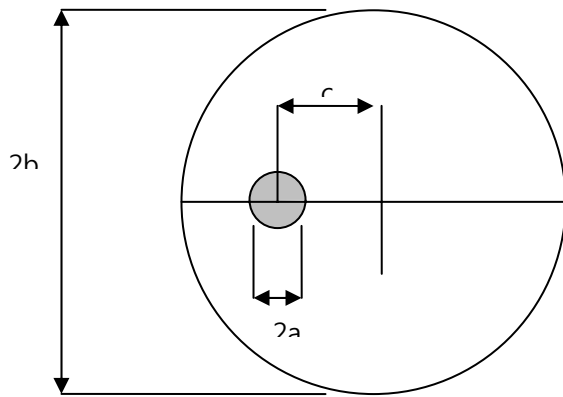
7) For given stresses condition $\sigma_x = -50\text{MPa}, \sigma_y = 30\text{MPa}, \tau_{xy} = 20\text{MPa}$ determine steel ratios in the vertical and horizontal directions using fc=40 MPa and fy=400MPa.