M.TECH. DEGREE EXAMINATION

Model Question Paper - I

Branch: Civil Engineering

Specialization: Geomechanics and Structures

First Semester

MCEGS 102 THEORETICAL GEOMECHANICS

(Regular – 2013Admissions)

Time : 3 Hours Maximum: 100 Marks

1.a) The stress components at a point are σ_x=50, σ_y=30, σ_z=15, τ_{xy}=20, τ_{yz}=5, τ_{xz}=10 MPa. If the co-ordinate system is rotated about Z axis in anti clockwise direction through 30^0. Prove that the stress invariants remains unchanged (15)

b) State and explain Mohr circle of stresses. (10)

OR

2. a) Define octahedral stresses, spherical stresses, deviator stresses and plane stresses as applied to soil mass. (12)

b) At a point in body the components of strain tensor are ϵ_x=0.1, ϵ_y=-0.05, ϵ_z=-0.01, γ_{xy}=0.02, γ_{yz}=-0.01, γ_{xz}=-0.03. Determine the principal strain and their orientation with respect to x,y,z co-ordinate axis. (8)

c) The normal stresses on a plane are σ_1=9, σ_2=6, σ_3=3KPa.Determine the normal and shearing stresses on a plane whose direction cosines are $1/2$, $1/2$, $1/\sqrt{2}$. (5)

3. (a) A rectangular foundation 2m x 3m transmits a pressure of 360 kN/m^2 to the underlying soil. Determine vertical stress at a point 1m vertically below a point lying outside the loaded area, 1m away from a short edge and 0.5m away from a long edge. Use Boussinesq's theory (15)

(b) Obtain an expression for vertical stress for a uniform load on circular area (10)

OR

4. (a) The load from a continuous footing of 1.8m width, which may be considered to be strip load of considerable length, is 180 kN/m^2. Determine the maximum principal stress at 1.2m depth below the footing, if the point lies

i. Directly below the centre of the footing

ii. Directly below the edge of the footing

iii. 0.6m away from the edge of the footing

What is the maximum shear stress at each of these points? What is the absolute maximum shear stress and at what depth will it occur directly below the middle of the footing? (15)

(b) A raft of size 4m x 4m carries a uniform load of 200kN/m^2. Using the point load approximation with four equivalent point loads, Calculate the stress increment at a point in the soil which is 4m below the centre of the loaded area. (10)

5 (a) With the aid of a mechanical model simulate and explain load deformation behavior of material (13)

(b) Briefly explain the pore pressures developed in soil by applied stresses (12)

OR

6. (a) Explain the rheological property of material (10)

(b) Define permanent set with respect to deformation aspect of a material subjected to loading and un loading. (15)

7. (a) Mention the influence of intermediate principal stress on failure (13)

(b) Discuss the frictional aspect of various soils with packing and how failure theory can be applied to cohesionless soils (12)

OR

8. Write short note on (25)

i. Viscous models
ii. Hvorselev's parameter
iii. Isotropic elastic soil model
iv. Tresca failure theory
v. Mohr-Coulomb failure theory