

- Note**
1. Question 1 is compulsory
 2. Attempt any 4 out of six questions
 3. Assume any suitable data where ever required

- Q.1** Attempt any **four**
- a.** A soil sample has a compression index of 0.3. If the void ratio at a stress of 1.4kg/m² is 0.5. Compute the void ratio if the stress is increased to 2kg/m² **05**
 - b.** A sample of dry cohesionless soil was tested in a triaxial machine. If the angle of shearing resistance was 36° and the confining pressure is 100 kN/m², determine the deviator stress at which the sample failed. **05**
 - c.** A vertical cut is made in a clay deposit with cohesion = 30kN/m², angle of internal friction = 0°, bulk density = 16kN/m³. Find the maximum height of the cut which can be temporarily supported. Take $S_n = 0.261$ for slope angle and angle of internal friction equal to 90° and 0° respectively. **05**
 - d.** What are assumptions of Rankine's theory? Derive the expression for active and passive pressure. **05**
 - e.** Differentiate between the general shear failure and local shear failure. How the ultimate bearing capacity in local shear is determined. **05**
- Q.2**
- a.** Describe various types of pile foundations **05**
 - b.** Explain with a neat sketch different types of slope failures? **05**
 - c.** How would you estimate the load carrying capacity of a pile in cohesionless soils. A concrete pile 30cm in diameter is driven into a medium dense sand with angle of internal friction = 35°, bulk density = 21kN/m³, lateral earth pressure coefficient = 1.0 and $\tan \delta = 0.70$ for a depth of 8.0m. Estimate the safe load taking a FOS = 2.50. Take $N_q = 60$. **10**
- Q.3**
- a.** What are different types of earth pressure. Explain with a neat diagram the variation of earth pressure with the wall movement. **05**
 - b.** Derive a relationship between the principal stresses at failure using Mohr-Coulomb failure criterion. **05**
 - c.** A square footing fails by general shear in a cohesionless soil under an ultimate load of 7500kN. The footing is placed at a depth of 2m below ground level. Given angle of internal friction = 35° and bulk density = 17.25kN/m³, determine the size of the footing if the water table is at a great depth. For $\phi = 35^\circ$, $N_q = 41.4$ and $N_\gamma = 42.4$. **10**
- Q.4**
- a.** Discuss the effect of water table on the bearing capacity of the soil. **05**
 - b.** What is negative skin friction? What is its effect on the pile? **05**
 - c.** A smooth rigid retaining wall 6m high carries a uniform surcharge load of 12kN/m². The backfill is clayey sand with the following properties: bulk density = 16.0kN/m³, angle of internal friction = 25° and cohesion = 6.5kN/m². Determine the passive earth pressure and its location. Also draw the pressure diagram. **10**

- Q.5** a. A group of 9 piles with 3 piles in a row was driven into a soft clay extending from ground level to a great depth. The diameter and the length of the piles were 30cm and 10m respectively. The unconfined compressive strength of the clay is 70kPa. If the piles were placed 90cm centre to centre, compute the allowable load on the pile group on the basis of shear failure criterion for a factor of safety of 2.5. Assume $\alpha = 1.0$. **10**
- b. Find the factor of a slope of infinite extent having a slope angle = 25° . The slope is made of cohesionless soil with angle of internal friction = 30° . Also, determine critical height of the slope if it is made of clay having effective cohesion = 30kN/m^2 , effective angle of internal friction = 20° , void ratio = 0.65 and specific gravity = 2.7 under following conditions (1) when the soil is dry (2) when water seeps parallel to the surface of the slope and (3) when the slope is submerged. **10**
- Q.6** a. A soil sample has a compression index of 0.3. If the void ratio at a stress of 1.4kg/cm^2 is 0.5, compute (1) void ratio if the stress is increased to 2kg/cm^2 and (2) settlement of a soil strata 4m thick. **10**
- b. A cylindrical sample of soil having a cohesion of 80kN/m^2 and an angle of internal friction of 20° is subjected to a cell pressure of 100kN/m^2 . Determine (1) deviator stress at which sample fails, (2) angle made by the failure plane with the axis of the sample. **10**
