Total No. of Questions—12] [Total No. of Printed Pages—7

[3662]-105

S.E. (Civil) (I Sem.) EXAMINATION, 2009

GEOTECHNICAL ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, electronic calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define the following terms with mathematical expressions :

(*i*) Water content

(*ii*) Void ratio

(*iii*) Porosity

(*iv*) Degree of saturation

(*v*) Percentage air void

(*vi*) Density Index. [6]

P.T.O.

(*b*) Write a short note on Plasticity Chart used for classification of fine grained soil. [6]

(*c*) A stand sample has a porosity of 30% and specific gravity of solid as 2.7. Calculate :

(*i*) dry unit weight of sand; and

(*ii*) unit weight of sand

if S_r = 0.56. [5]

Or

2. (*a*) What is meant by soil exploration ? List out the purposes of soil exploration programme. [6]

(*b*) What is Stokes' law ? Describe the procedure for doing hydrometer analysis for grain size analysis. [6]

(*c*) A soil has a plastic limit of 25% and a plasticity index of 30%. If the natural water content of soil is 34%, what is the liquidity index and consistency index of soil ? [5]

3. (*a*) What is Darcy's law ? What are its limitations ? [5]

(*b*) What do you understand by critical hydraulic gradient ? Derive the expression for the same. [6]

(*c*) In a falling head permeability test, head causing flow was initially 50 cm and it drops by 2 cm in 5 minutes. How much time will be required for the head to fall to 25 cm ? [6]

Or

4. (*a*) Derive the expression for determination of coefficient of permeability by variable head method. [5]

(*b*) Explain quick sand condition phenomenon with mathematical expression involved. [6]

(*c*) For a homogenous earth dam 32 m high and 2 m free board, a flow net was constructed with four flow channels. The number of potential drop was 20. The dam has a horizontal filter at the base near the toe. The coefficient of permeability of the soil was 9×10^{-2} mm/sec. Determine the anticipated seepage, if the length of dam is 100 meters. [6]

5. (*a*) Give Boussinesq's equation of a vertical stress due to point load. Also give meaning of each of term, with the help of a neat well labelled sketches. [4]

(*b*) How would you use the proctor needle to check the insite density of embankment ? [6]

(*c*) An embankment was constructed by compacting a soil at a moisture content of 15.50% and a dry density of 17.20 kN/m^3. If the specific gravity of soil solids be 2.68, determine the void ratio and degree of saturation of the embankment soil. [6]

Or

6. (*a*) Explain the factors affecting compaction of soil. [4]

(*b*) Write a short note on Newmarks Influence Chart with respect to construction and use. [6]

(*c*) A concentrated load of 22.50 kN acts on the surface of homogenous soil mass of large extent. Find the stress intensity at a depth of 15 meters :

(*i*) diriectly under the load; and

(*ii*) at a horizontal distance of 7.5 meters.

Use Boussinesq's equation. [6]

SECTION II

7. (*a*) State the advantages and disadvantages of triaxial compression test. [6]

(*b*) Mention the soil type for which unconfined compression test gives good results. Draw the Mohr's circle for this test and show all details. [6]

(*c*) A direct shear test was carried out on cohesive soil sample and the following results were obtained :

Sample No.	Normal Stress (kN/m^2)	Shear Stress (kN/m^2)
01	150	110
02	250	120

What would be the deviator stress at failure if a triaxial test is carried on the same soil with cell pressure of 150 kN/m^2 ? [6]

Or

8. (*a*) What are the *three* standard triaxial tests with respect to the drainage condition ? Explain with reasons the situation for which these test is to be performed. [6]

(*b*) A cylinder of soil fails under an axial vertical stress 150 kN/m^2, when it is laterally unconfined. The failure plane makes an angle of 55° with the horizontal. Calculate the value of cohesion and the angle of internal friction (ϕ). [6]

(*c*) Explain the procedure for vane shear test and also state the equation for shear stress of vane shear test. [6]

9. (*a*) State the assumption made in Rankine's Earth Pressure theory. [4]

(*b*) Explain Coulomb's Wedge theory for determination of earth pressure. [6]

(*c*) A retaining wall with a smooth, vertical backface has to retain a sand backfill up to a height of 4.5 m and ϕ = 30°, the water table is at 2.0 m below ground level. The specific gravity

of solids and void ratio of the backfill are 2.68 and 0.82 respectively. The soil above the water table has a degree of saturation of 10%.

Draw the earth pressure diagram, and calculate the total active earth pressure at the base of wall. [6]

Or

10. (*a*) Discuss the Culmann's graphical method for the determination of active earth pressure. [6]

(*b*) A cohesive soil has a unit weight of 20 kN/m^3, c = 15 kN/m^2 and $\phi = 12°$. Calculate the critical height of vertical excavation that can be made without any lateral support. [6]

(*c*) Derive the expression for coefficient of earth pressure at rest (K_0). [4]

11. (*a*) Write short notes on :

(*i*) Porosity

(*ii*) Sonic velocity. [8]

(*b*) Differentiate between finite and infinite slope. [4]

(*c*) A 6.0 m deep cut is to be made in cohesive soil with a slope of 1 : 1 the soil has C_u = 30 kN/m^2 and r = 18 kN/m^3. Find the factor of safety with respect to cohesion; if Taylor's Stability Number = 0.108. [4]

Or

12. (*a*) Discuss geological classification of rocks. Give example of each type of rock. [8]

(*b*) A slope is to be constructed at an inclination of 30° with the horizontal. Determine the safe height of the slope at factor of safety 1.5, the soil has the following properties : c = 15 kN/m^2, ϕ = 20°, r = 18 kN/m^3 and Taylor's Stability Number = 0.0625. [4]

(*c*) Write a short note on Landslides. [4]