Roll No. | | | | | | | | | | |

B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2014

CIVIL ENGINEERING BRANCH

FOURTH SEMESTER

CE 284 / CE 9255 – Soil Mechanics

(Regulations 2004/2008)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is the relationship between degree of saturation and air content?
2. What is consistency index? State approximate value of consistency index for very soft clay.
3. How do you know that the flow through a soil obeys Darcy's law?
4. Develop an equation for determining the rise of water in a capillary tube.
5. Define coefficient of consolidation and compression index.
6. Define isobar and pressure bulb.
7. What are (i) undrained (ii) consolidated undrained and (iii) drained tests?
8. What are the factors affecting shear strength parameters of soil.
9. Differentiate between slope failure and base failure. When does each of the above type occur?
10. What are different factors of safety used in stability analysis of slopes?

Part – B (5 x 16 = 80 marks)

11. i) A cubic meter of soil in its natural state weighs 17.75kN; after being dried it weighs 15.08kN. The specific gravity of the soil is 2.70. Determine the degree of saturation, void ratio, porosity and water content of the original soil sample. (6)

    ii) A soil sample is a mixture of cohesionless and cohesive soils. Explain the method of determining the grain size distribution curve of the soil. (5)

    iii) Discuss various factors influencing compaction behaviour of soils. (5)

12. a(i) A sand sample 25cm length was subjected to a constant head permeability test in a permeameter having the area of $30cm^2$. A discharge of $100cm^3$ was obtained in a period of one minute under a head of 39cm. Mass of the dry sand in the sample was 1350gm. The specific gravity of the sand particles was 2.67. Determine (i) the coefficient of permeability; (ii) the discharge velocity and (iii) the seepage velocity. (8)

    a(ii) Explain pumping out test and derive the expression to determine the coefficient of permeability of soil at site. (8)

    OR

    b(i) Derive the expression to find the horizontal and vertical permeabilities of a soil mass made up of layered soils stating clearly the assumptions made. (10)

    b(ii) A weir built over sand with a porosity of 0.35 and a specific gravity of 2.65 creates a difference of head of 7.5m between upstream and downstream beds. A flow net drawn for the foundations has 10 equipotential drops, and the field just downstream of the weir floor has dimensions of 50cm×50cm. Determine the factor of safety of the weir against critical gradient at exit. (6)

13. a(i) At a construction site, a 3m thick clay layer is followed by a 4m thick gravel layer, which is resting on impervious rock. A load of 25kN/m^2 is applied suddenly at the surface. The saturated unit weights of the soils are 19kN/m^3 and 20kN/m^3 for the clay and gravel layers respectively. The water table is at the surface. Draw the diagram showing variation with depth of effective stress in the layers. (8)

a(ii) A building is constructed over a 12m thick clay layer. On either side of the clay layer, there are sand layers. Calculate the time required for 80% settlement. Time factor for 80% consolidation is 0.60 and coefficient of consolidation of clay sample is 0.015cm^2/minute. What additional time will be required for the same settlement if the bottom of the clay rested on impervious rock? (8)

OR

b(i) Explain the process of consolidation of clay and differentiate between primary and secondary consolidation. (8)

b(ii) A circular foundation rests on the horizontal upper surface of a semi infinite soil mass and carries a load of 1000kN. The diameter of the foundation is 3m. Determine the vertical stress distribution on horizontal planes along the central axis of the foundation to a depth of 10m below the surface. (8)

14. a(i) Two undrained triaxial tests were conducted on identical specimens of a soil. The first specimen failed at a deviator stress of 500kPa when the cell pressure was 150kPa, while the second specimen failed at a deviator stress of 800kPa under a cell pressure of 300kPa. Determine the shear strength parameters. If the same soil is tested in a direct shear apparatus, estimate the shear stress at which the sample will fail under a normal stress of 600kPa. (8)

a(ii) Compare the methods of determining the shear strength of soils by the shear box and the unconfined compression apparatus. (8)

OR

b(i) The following results were obtained from shear box test on specimens of sandy clay of cross-section 6cm×6cm:

Normal load in N	280	560	1080
Shear force at failure in N	240	320	460

Find the shear strength parameters. If the triaxial test is carried out in a specimen of the same soil with a cell pressure of 120kN/m^2, find the total axial stress at which failure would be expected. (8)

b(ii) Discuss in detail about pore pressure parameters and their significance. (8)

15. a(i) A 45° slope has been excavated to a depth of 8m in a saturated clay, which has following properties; c_u=60kN/m^2, ϕ_u=0; and unit weight = 20kN/m^3. Determine the factor of safety for the trial failure surface whose radius is 12m and arc length is 18.84m. The area of the trial wedge is 70m^2 and centre of gravity of the trial wedge is 4.5m away from the centre of the failure surface. (8)

a(ii) Explain Fellenius method for the analysis of stability of finite slopes. (8)

OR

b(i) Calculate the factor of safety in an infinite slope at a point 5m below the surface. The slope angle with the horizontal is 20°, and the effective shear parameters for the given soil: c=10kN/m^2 and ϕ=30°; unit weight of the moist soil = 19kN/m^3. (8)

b(ii) Discuss the stability analysis of slopes by friction circle method. (8)

****