Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: X40603 Date: 31-12-2014

Subject Name: Soil Engineering

Time: 02:30 pm - 05:00 pm Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of Programmable calculator is strictly prohibited**
5. **Draw neat sketch wherever necessary**

Q.1 Choose the correct answer from the following: **14**

(i) An isobar is a curve which _____
(a) joins points of equal horizontal stress
(b) joins points of equal vertical stress
(c) joins points of zero vertical stress
(d) joins points of maximum vertical stress

(ii) Newmarks influence chart can be used for the determination of vertical stress under any shape of loaded area (True/False)

(iii) The coefficient of compressibility is the ratio of _____
(a) change in void ratio to change in effective stress
(b) volumetric strain to change in effective stress
(c) change in thickness to change in effective stress
(d) stress to strain

(iv) The angle of failure plane with the major principal plane is given by _____
(a) $45^o + Ø'$ (b) $45^o + Ø'/2$
(c) $45^o - Ø'/2$ (d) $45^o - Ø'$

(v) Coulombs equation for shear strength can be represented as _____
(a) $c = s + \sigma \tan Ø$ (b) $c = s - \sigma \tan Ø$
(c) $s = c + \sigma \tan Ø$ (d) $s = c - \sigma \tan Ø$

(vi) The zero air void line and 100% saturation line are identical (True/False)

(vii) For a standard compaction test the mass of hammer and the drop of hammer are as follows_____
(a) 2.6kg and 450mm (b) 2.60kg and 310mm
(c) 4.8kg and 310mm (d) 4.89kg and 450mm

(viii) The factor of safety against sliding of a slope is _____
(a)The ratio of shear strength to shear stress along the surface
(b)the ratio of actual cohesion to that required to maintain stability of slope
(c) both (a) and (b) (d)None of the above

(ix) The ultimate settlement of a soil deposit increases with _____
(a) an increase in the compression index
(b) an increase in the initial void ratio
(c) a decrease in thickness of the stratum
(d) an increase in time

(x) The stability numbers cannot be used for the analysis of purely cohesionless slopes. (True/False)

(xi) The active earth pressure coefficient Ka generally refers to _____
(a) affective stresses (b) total stresses
(c) neutral stresses (d) all the above

(xii) In case of passive earth pressure wall moves away from the backfill(True/False)

(xiii) There is complete control over drainage conditions, pore pressure changes

and volumetric changes can be measured directly, stress distribution on the failure plane is uniform. The above advantages belongs to which shear test _____

(a) Direct box shear test (b) Triaxial shear test
(c) Vane shear test (d) None of the above

(xiv) In a consolidation test, the degree of consolidation observed is 46%, then corresponding time factor Tv for vertical drainage will be _____
(a) 0.166 (b) 0.197 (c) 0.123 (d) 0.108

Q.2 **(a)** Derive an expression for the vertical stress at a point due to point load, using Boussinesq's theory. **07**

(b) What do you understand by "Pressure bulb"? Illustrate with sketches. **07**

OR

(b) Calculate the vertical stress at a point P at a depth of 2.5m directly under the centre of the circular area of radius 2m and subjected to a load of 150 kN/m^2. Also calculate the vertical stress at appoint Q which is at the same depth of 2.5m but 2.5m away from the centre of the loaded area. Assume suitable data wherever necessary. **07**

Q.3 **(a)** What are the effect of compacting energy and void ratio on the compaction of soil. **07**

(b) A sample of a soil failed in a triaxial test under a deviator stress of 200 kN/m^2 when the confining pressure was 100 kN/m^2. If for the same sample the confining pressure had been 200 kN/m^2 what would have been the deviator stress at failure? Assume the soil has (a) c = 0 and (b) Ø = 0 **07**

OR

Q.3 **(a)** Explain direct box shear test with neat sketch. What are the advantages of triaxial shear test over direct shear test? **07**

(b) The following are the observation of a compaction test **07**
Water content (w %) 7.7, 11.5, 14.6,17.5, 19.5, 21.2
Wt. of wet soil W (N) 16.67, 18.54, 19.92, 19.52, 19.23, 18.83
If the volume of compaction mould is 950 cc. Assuming G=2.67. Draw compaction curve. Report maximum dry unit weight and optimum moisture content (OMC). Draw 100% saturation line (zero air void line). What is the degree of saturation at OMC ?

Q.4 **(a)** Explain Square root of time method to determine coefficient of consolidation. **07**

(b) The settlement analysis (based on the assumption of the clay layer draining from top and bottom surfaces) for proposed structure shows 2.5cm of settlement in four years and an ultimate settlement of 10cm. However, detailed sub-surface investigation reveals that there will be no drainage at the bottom. For this situation, determine the ultimate settlement and the time required for 2.5cm settlement. **07**

OR

Q.4 **(a)** A retaining wall, 6 m high, retains dry sand with an angle of friction of 34° and unit weight of 17.3 kN/m^3. Determine the earth pressure at rest. If the water table rises to the top of the wall , determine the increase in the thrust on the wall. Assume the submerged unit weight of sand as 10 kN/m^3. **07**

(b) In a consolidation test following result have been obtained when the load was changed from 100 kN/m^2 to 200 kN/m^2, void ratio changed from 0.7 to 0.65. Determine the coefficient of volume decrease (m_v) and compression index (Cc). **07**

Q.5 (a) A wall with a smooth vertical back , 10 m high, supports a purely cohesive soil with c=12.45 kN/m^2 and γ = 17.86 kN/m3. Determine 07
(i) total Rankine's active pressure against the wall.

(ii) Position of zero pressure.

(b) A new canal is excavated to a depth of 4m below ground level through a soil having the following characteristic c=12kN/m2; Ø□□□□□□□□e=0.6 and G=2.6. The slope of banks is 1in 1. Calculate the factor of safety with respect to cohesion when the canal runs full. If it is suddenly and completely emptied, what will be the factor of safety? Take Taylor's Stability Number Sn for i = 45o as follows: 07

Ø= 5o ,10o ,15o ,20o

Sn = 0.136, 0.108, 0.083, 0.062

OR

Q.5 (a) A granular soil has γsat=19kN/m3, Ø=35o. A slope has to be made of this material. If a factor of safety of 1.5 is needed against slope failure, determine the safe angle of the slope (i) when the slope is dry or submerged without seepage, (ii) if seepage occurs at and parallel to the surface of the slope. (iii) If seepage occurs parallel to the slope with the water table at a depth of 1.8m, what is the factor of safety available on a slip plane parallel to the ground surface at a depth of 4.5 m? Assume β=28o. 07

(b) Write a short note on stability analysis of Infinite slopes for c-Φ soils. 07