Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV EXAMINATION – SUMMER 2016

Subject Code:X40603 Date:01/06/2016

Subject Name:Soil Engineering

Time:10:30 AM TO 01:00 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 Answer the following with reasons/calculations: **14**

(i) Using A-line equation given for IS plasticity chart, classify the soil type _____ from the given data:
Liquid limit = 72.5%, G = 2.66, Plastic limit = 34%, Natural water content = 38.7%

(ii) A concentrated load of 1000 kN acts vertically at a point on the soil surface. According to Boussinesq's equation the ratio of the vertical stresses at depth of 3m and 5m is _____

(iii) Using Skemptons equation determine compression index for remoulded clay sample whose liquid limit is 68%.

(iv) For a given soil sample, standard compaction test is performed and it is determined that air content is 16%, G = 2.69, γ_w = 10 kN/m^3, estimate maximum dry density at this air content.

(v) When normal; stress is 200kN/m2, the magnitude of shear stress on a principal plane is _____

(vi) In a consolidation test, the degree of consolidation observed is 43%, then corresponding time factor Tv for vertical drainage will be _____

(vii) The active earth pressure coefficient Ka and passive earth pressure coefficient Kp for cohesionless soil with Ø = 35^o is _____ and _____.

Q.2 **(a)** Write and explain the Boussinesq's equation for stress distribution in soil for (i) a point load and (ii) Line load. **07**

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

OR

(b) A square footing 2m x 2m carries a uniformly distributed load of 325 kN/m². Find the intensity of vertical pressure at a depth of 5 m below a point 0.5 m inside each of two adjacent sides of the footing. **07**

Q.3 **(a)** The following are the observation of a compaction test **10**

Water content (w %) 5, 10, 14 , 20, 25
Bulk unit weight (kN/m^3) 17.70, 19.80, 21.00, 21.80, 21.16

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 ?

(b) What are the advantages of triaxial shear test over direct shear test? **04**

OR

Q.3 **(a)** Two identical specimens were tested in a tri-axial test apparatus, first sample was failed at a deviator stress of 850 kN/m^2 at a confining pressure **07**

of 350 kN/m^2. While second specimen fails a total vertical stress of 1600 kN/m^2 at a confining pressure of 400 kN/m^2. Find the shear parameters.

(b) Explain spring analogy theory for primary consolidation of any soil sample. **07**

Q.4 **(a)** Derive the equation of K_A for Rankine's theory. **07**

(b) The settlement analysis (based on the assumption of the clay layer draining from top and bottom surfaces) for proposed structure shows 2.2cm 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 2.2cm settlement. **07**

OR

Q.4 **(a)** How many days would be required by a clay stratum 4 m thick, draining at both ends with an average value of coefficient of consolidation = $35x10^{-4}$ cm^2/sec, to attain 50% of its ultimate settlement. **07**

(b) A wall with a smooth vertical back , 10 m high, supports a purely cohesive soil with c = 12.92 kN/m^2 and γ = 17.86 kN/m^3. Determine **07**
(i) total Rankine's active pressure against the wall.
(ii) Position of zero pressure.

Q.5 **(a)** Explain in detail swedish circle method for stability of slopes to get factor of safety. **07**

(b) A new canal is excavated to a depth of 4m below ground level through a soil having the following characteristic c=14kN/m^2; Ø =18^o; e=0.66 and G=2.67. 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= 5^o ,10^o ,15^o ,20^o

Sn = 0.136, 0.108, 0.083, 0.062

OR

Q.5 **(a)** A finite slope has an inclination of 48° with a horizontal ground surface. The height of the slope is 16 m, and the details of the soil are c=28 kPa, Φ=16°, and γ=17.3 kN/m^3. Compute the factor of safety assuming plane rupture surface. Adopt Culmann's method. **07**

(b) Attempt **any one**: **07**
i) Explain types of slope failure
ii) Draw a neat sketch of direct box shear test set-up.