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**

An isobar is a curve which _____

(i)
(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)

The coefficient of compressibility is the ratio of _____

(iii)
(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

The angle of failure plane with the major principal plane is given by _____

(iv)
(a) $45^\circ + \text{Ø}'$ (b) $45^\circ + \text{Ø}'/2$
(c) $45^\circ - \text{Ø}'/2$ (d) $45^\circ - \text{Ø}'$

Coulombs equation for shear strength can be represented as _____

(v)
(a) $c = s + \sigma \tan\text{Ø}$ (b) $c = s - \sigma \tan\text{Ø}$
(c) $s = c + \sigma \tan\text{Ø}$ (d) $s = c - \sigma \tan\text{Ø}$

(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) $\emptyset$ = 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/m^3. Determine
(i) total Rankine's active pressure against the wall.   07

(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; $\emptyset \square\square\square\square\square\square\square\square$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

   $\emptyset$= 5o ,10o ,15o ,20o
   Sn = 0.136, 0.108, 0.083, 0.062

OR

Q.5 (a) A granular soil has γsat=19kN/m3, $\emptyset$=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

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GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER–IV • EXAMINATION – SUMMER • 2014

Subject Code: X40603   **Date: 21-06-2014**
Subject Name: Soil Engineering
Time: 10:30 am - 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		Choose the correct answer from the following:	**14**
		An isobar is a curve which _____	
		(a) joins point of equal horizontal stress	
	(i)	(b) joins point of equal vertical stress	
		© joins point of zero vertical stress	
		(d) joins point of maximum vertical stress	
	(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 _____	
		(a) 0.35 (b) 0.70 (c) 1.75 (d) 2.78	
		With an increase in liquid limit, compression index _____	
	(iii)	(a) decreases (b) increases	
		(c) remain constant (d) may increase or decrease	
		The coefficient of compressibility is the ratio of _____	
		(a) Change in void ratio to change in effective stress	
	(iv)	(b) Volumetric strain to change in effective stress	
		© Change in thickness to change in effective stress	
		(d) Stress to strain	
	(v)	The line of optimum generally corresponds to percentage air voids of about_____	
		(a) zero percent (b) 5 percent (c) 10 percent (d) 20 percent	
	(vi)	For a standard compaction test the mass of hammer and drop of hammer are as follows:	
		(a) 2.6 kg and 450mm (b) 2.6 kg and 310mm	
		(c) 4.8 kg and 310mm (d) 4.89 kg and 450mm	
	(vii)	Taylors stability charts are based on the total stresses using the _____	
		(a) friction circle method (b) method of slices	
		(c) $\emptyset_u = 0$ analysis (d) none of these	
Q.2	**(a)**	Explain Direct Shear Test.	**07**
	(b)	Two identical specimen of a soil were tested in a triaxial apparatus. First specimen failed at a total stress of 770 kN/m² when the cell pressure was 200 kN/m², while the second specimen failed at a total stress of 1370 kN/m² under a cell pressure of 400 kN/m². Determine the value of c and Φ for the soil. 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 600 kN/m²	**07**

OR

Solve Last 3 Paper for Asignment of Soil Engineering

(b) A standard specimen of cohesionless sand was tested in triaxial compression and the sample failed at deviator stress of 460kN/m^2, when the cell pressure was 150kN/m^2, under drained conditions. Find the effective angle of shearing resistance of sand. What would be the deviator stress and the major principle stress at failure for another identical specimen of sand if it is tested under a cell pressure of 200kN/m^2? **07**

Q.3 A rectangular raft of size 30x12m founded at a depth of 2.5m below the found surface is subjected to a uniform pressure of 150kPa. Assume the centre of the area is the origin of coordinates (0,0), and the corners have coordinates (6,15). Calculate stresses at a depth of 20m below the foundation level by the method of (a) Boussinesq, and (b) Westergaard at coordinates of (0,0),(0,15),(6,0) (6,15) and (10,25). Also determine the ratios of the stresses as obtained by the two methods. Neglect the effect of foundation depth on the stresses. **14**

OR

Q.3 **(a)** Derive the Boussinesq equation for vertical stress for a uniform load on a strip area. **07**

(b) A concentrated load of 40 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 9 m (i) directly under the load and (ii) at horizontal distance of 6 m. **07**

Q.4 **(a)** Compare the Coulomb's theory with Rankine theory for lateral earth pressure **07**

(b) Plot the compaction curve and obtain the maximum dry unit weight and optimum moisture content The following data refers to a compaction test as per Indian Standard. Take specific gravity of soil is 2.7. **07**

Water Content (%)	8.5	12.2	13.75	15.5	18.2	20.2
Weight of wet sample (N)	18	19.4	20	20.5	20.3	19.8

OR

Q.4 **(a)** A retaining wall, 7.5m high, retains a cohesionless backfill. The top 3m of the fill has init weight of 18.2kN/m3 and f =30^0 and the rest has init weight of 24kN/m3 and f=24^0. Determine the pressure distribution on the wall. **07**

(b) How many days would be required by a clay stratum 5.5 m thick, draining at both ends with an average value of coefficient of consolidation = 54x10^{-4} cm²/sec, to attain 50% of its ultimate settlement. **07**

Q.5 **(a)** Write a short note on stability analysis of Infinite slopes for c-Φ soils. **07**

(b) Enlist the method for determination of coefficient of consolidation and explain any one in detail. **07**

OR

Q.5 **(a)** Explain swidish circle method to get factor of safety. **07**

(b) Discuss about earth pressure at rest. What is active and passive earth pressure? **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
PDDC - SEMESTER–IV • EXAMINATION – WINTER 2013

Subject Code: X40603 **Date: 07-12-2013**
Subject Name: Soil Engineering
Time: 02.30 pm - 05.00 pm **Total Marks: 70**
Instructions:
 (1)All questions are compulsory.
(2)Figures to the right indicates the marks.
(3)Use of Programmable calculator is strictly prohibited.
(4)Draw neat sketch wherever necessary.
(5)Write your seat no and enrolment no in space provided on the question paper.

Q.1(a) Using Boussinesq's theory, derive an expression for the vertical stress at a point due to a   point load. 07

(b) Differentiate between consolidation and Compaction with examples. 07

Q.2 (a) What is the effect of compaction on the engineering properties of the soil? 07

(b) Discuss shear tests based on different drainage conditions. 07

OR

(b) Calculate the vertical stress at a point P at a depth 2.5 m directly under the center 0f the circular area of radius 2m and subjected to a load 100 kN/m^2. Also calculate the vertical stress at point Q which is at the same depth of 2.5m away from the centre of the loaded area. 07

Q.3 (a) Derive an expression for active pressure when the ground surface in inclined. 07

(b) A retaining wall has a vertical back and is 8m high. The back force of the wall is smooth and the upper surface of the fill is horizontal. Determine the thrust on the wall per unit length. Take c = 10 kN/m^2, γ=19 kN/m^3 and Φ=20°. 07

OR

Q.3 (a) Discuss the limitation of Terzaghi's theory of consolidation. 07

(b) A stratum of clay is 2m thick and has an initial overburden pressure of 50 kN/m^2 at its middle. Determine the final settlement due to an increase in pressure of 40 kN/m^2 at the middle of the clay layer. The clay is over-consolidated, with a preconsolidation pressure of 75 kN/m^2 . the values of the coefficient of recompression and compression index are 0.05 and 0.25, respectively. Take initial void ratio as 1.40. 07

Q.4 (a) Differentiate critically between Rankine and Coulomb theories of earth pressure. 07

(b) Explain Square root of time methods to determine coefficient of consolidation. 07

OR

Q.4 A rectangular foundation 3.0 × 1.50 m carries a uniform load of 40 kN/m^2, determine the vertical the stress at P which is 3m below the ground surface (as shown in fig). use equivalent point load method. 14

Q.5 (a) Write a short note on Stability analysis of infinite slopes for c-Φ soils. 07

(b) A consolidated undrained triaxial test was conducted on normally consolidated clay yielding the following data: 07
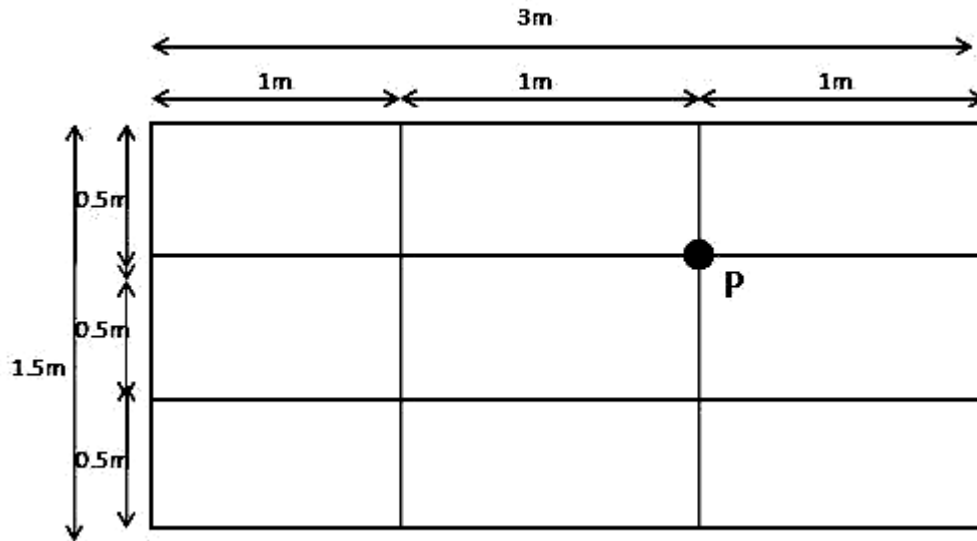
$$\sigma_3= 250 \ kN/m^2 \ ; (\sigma_d)_f = 275 \ kN/m^2$$

Determine (i) the angle of friction (ii) angle which the failure plane makes with the major principal plane and (iii) normal stress and shear stress on the failure plane.

Q.5 (a) What are the assumptions that are generally made in the analysis of the stability of   07
         slopes? Discuss briefly their validity.

(b)   A new canal is excavated to a depth of 5m below ground level. Through a soil having   07
         the following characteristics: c=14 kN/m² Φ= 15° ; e = 0.8 and G= 2.70. the slopes of
         banks is 1 in 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?

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