GUJARAT TECHNOLOGICAL UNIVERSITY

4th Semester Civil Engineering – PDDC

Subject Code & Name : X40603 - Soil Engineering

Sr. No.	Course content
1.	**Stress distribution in soil:** Boussinesq's theory for distribution of pressure on a vertical plane and a horizontal plane below ground surface due to vertical point load on the ground surface, isobar, assumptions, comparison and limitations of Boussinesq theory & Westergaard theory. Stress caused by loaded areas of different shapes, equivalent point load method, stresses due to trapezoidal loads. Newmark's influence chart.
2.	**Shear strength of Soil:** Mohr's strength theory, Mohr- coulomb's strength theory, Modified Mohr-coulomb's theory, direct shear test, unconfined compression test, lab. vane shear test, introduction to tri axial compression test, shear tests based on drainage conditions.
3.	**Compaction:** Definition, theory of compaction, factors affecting compaction, laboratory compaction tests, effect of compaction on soil properties, placement water content, placement layer thickness, field control of compaction, Proctor's needle, methods of compaction used in field.
4.	**Consolidation of soils:** Compressibility of soils, definitions and mechanism of consolidation, spring analogy, void ratio and effective stress relation, related indices, assumptions of Terzaghi's one dimensional consolidation theory, time factor, one dimensional consolidation tests, laboratory and theoretical time curves, determination of pre-consolidation pressure, estimation of consolidation settlement and rate of settlement for uniform pressure increment in a clay layer
5.	**Earth pressure:** Active and passive earth pressures due to level and uniform surcharged backfill for cohesion less and cohesive soils using Rankine's theory, earth pressure at rest, introduction to Coulomb's theory, limitations and differences of Rankine's and Coulomb's theory
6.	**Stability of slopes:** Idealized condition used in the analysis, types of slope failures, infinite and finite slopes, factor of safety, stability of infinite slopes, Fundamentals of conventional methods, Swedish circle method, friction circle method, Taylor stability numbers, stability charts, effects of seepage and non-homogeneity on the stability of slopes, factor of safety and soil parameters for special cases such as end of construction, rapid (instantaneous) draw down, steady seepage, Tension cracks.

Term Work: work and tutorials (Mini. 30 Problems) based on above course. The assessment of term work shall include a practical/oral Term work shall consist of laboratory test also.

References Books:

1. Arora K.R. : Soil Mechanics & Foundation Engineering
2. Murthy V.N.S. : Soil Mechanics & Foundation Engg. Vol-I
3. Taylor D.W. : Fundamentals of Soil Mechanics
4. Lambe & Whitman. : Soil Mechanics

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

Seat No.: _____ Enrolment No._____

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**

(i) An isobar is a curve which _____
(a) joins point of equal horizontal stress
(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

(iii) With an increase in liquid limit, compression index _____
(a) decreases (b) increases
(c) remain constant (d) may increase or decrease

(iv) 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
© 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) $Ø_u = 0$ 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/m^2 **07**

OR

(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:

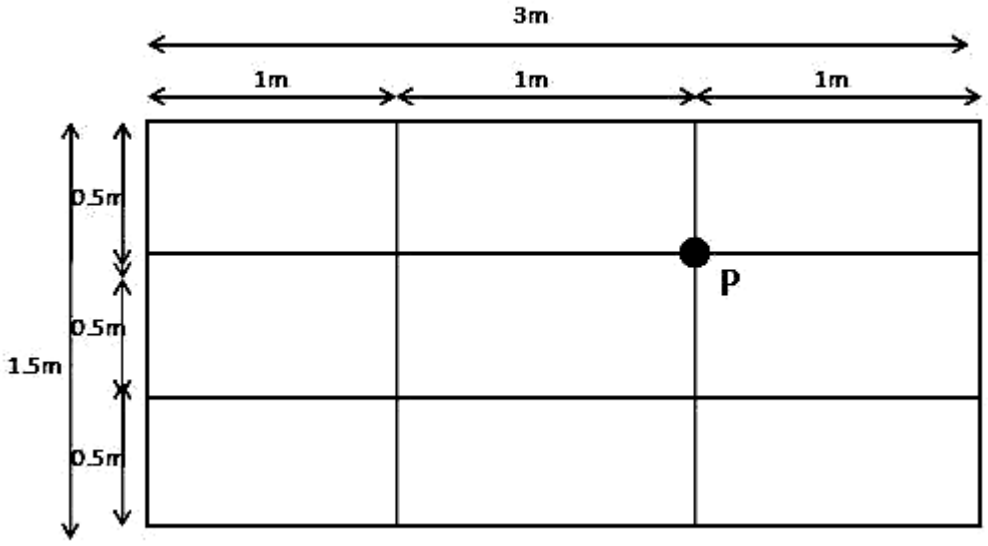
(1)All questions are compulsory.
(2)Figures to the right indicates the marks.
(3)Use of Programmable calculator is strictly prohibited.
(4)Draw neat sketch wherever necessary.
(5)Write your seat no and enrolment no in space provided on the question paper.

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: σ_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.	07

OR

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

(b) A new canal is excavated to a depth of 5m below ground level. Through a soil having the following characteristics: c=14 kN/m^2 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? 07



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Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER–IV • EXAMINATION – SUMMER 2013

Subject Code: X40603 **Date: 10-06-2013**

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.**

Q.1 **(a)** Enlist assumption made in Boussinesq's theory of stress distribution. **07**

(b) Differentiate between standard proctor test and Modified proctor test. **07**

Q.2 **(a)** Explain about vertical stress distribution, on horizontal plane and on vertical line. **07**

(b) A concentrated load of 22.5 kN acts on a surface of a homogeneous soil mass of large extent. Find a stress intensity at a depth of 15 m (i) directly under the load and (ii) at a horizontal distance of 7.5 m. Use Boussinesq's equation. **07**

OR

(b) A raft of size 4 m x 4 m carries a uniform load of 220 kN/m^2. Using the point load approximation with four equivalent point loads, calculate the stress increment at a point in the soil which is 4 m below the centre of the loaded area. **07**

Q.3 **(a)** Derive the equation of K_A for Rankine's theory. **07**

(b) A retaining wall, 6 m high, retains dry sand with an angle of friction of 30° and unit weight of 16.2 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**

OR

Q.3 **(a)** Describe the wedge theory to determining the active earth pressure and also discuss the advantages of it. **07**

(b) Describe the Culmann's graphical method to evaluate active thrust. **07**

Q.4 **(a)** The following data have been obtained in a standard laboratory proctor compaction test on glacial till **07**

Water content %	5.02	8.81	11.25	13.05	14.40	19.25
Wt. of container with compacted soil (N)	35.8	37.3	39.32	40.00	40.07	39.07

The specific gravity of soil particle is 2.77. The container is 9.44 cm^3 in volume and its weight is 19.78 N. Plot the compaction curve and find out OMC and MDD.

(b) Write short note on Compaction needle. **07**

OR

Q.4 **(a)** Explain any method to determine coefficient of consolidation. **07**

(b) In a consolidation test following result have been obtained when the load was changed from 50 kN/m^2 to 100 kN/m^2, void ratio changed from 0.7 to 0.65. Determine the coefficient of volume decrease (m_v) and compression index (C_c). **07**

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

(b) An embankment is inclined at angle 35° and its height is 15 m. The angle of shearing resistance is 15° and cohesion intercept is 200 kN/m^2. the unit weight of soil is 18 kN/m^3. If the Taylor's stability number is 0.06 , find the factor of safety with respect to cohesion. **07**

OR

Q.5 **(a)** A series of shear test were performed on a soil. Each test was carried out until the sample sheared and principal stresses for each test were **07**

Sample No	Normal stress (kN/m^2	Shear stress (kN/m^2
1	200	600
2	300	900
3	400	1200

Plot the failure envelop and find out shear parameters.

(b) Explain Modified Mohr-coulomb theory. **07**

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Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC - SEMESTER – IV • EXAMINATION – WINTER 2012

Subject code: X40603 **Date: 29/12/2012**

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.**

Q.1 (a) Explain factors affecting compaction. 07

(b) The following are the results from a standard compaction test on a soil sample. 07

Water content %	12	14	16	18	20	22
Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.87	1.85

The volume of the mould is 950 ml. Plot compaction curve and obtain MDD and OMC.

Q.2 (a) Explain Modified Mohr-coulombs theory. 07

(b) Two identical specimens were tested in a tri-axial test apparatus, first sample was failed at a deviator stress of 750 kN/m^2 at a confining pressure of 250 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. 07

OR

(b) Write merits of tri-axial test. 07

Q.3 (a) A concentrated load of 2000 kN is applied at the ground surface. Determine the vertical stress at a point which is at a depth 6 m directly below the load. Also calculate the vertical stress at a point which is at a depth 6 m but at a horizontal distance of 5 m from the axis of the load. 07

(b) Draw stress distribution curve for various depth for the soil subjected by a point load. Also draw the curve for r = 0 condition. 07

OR

Q.3 (a) Derive equation for vertical stress for the soil subjected by a strip load. 07

(b) Give assumptions made in Boussinesq's theory. 07

Q.4 (a) Explain spring analogy theory for primary consolidation of any soil sample. 07

(b) Enlist assumptions made in Terzaghi's one dimensional consolidation theory. 07

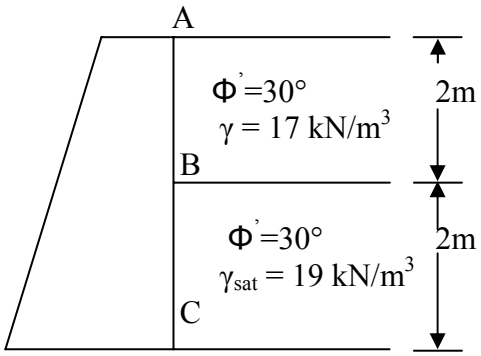
OR

Q.4 (a) Enlist the method determination of coefficient of consolidation and explain any one in detail. 07

(b) The laboratory consolidation data for an undisturbed clay sample are as follows e1= 1.00 , σ = 85 kN/m^2 and e2 = 0.80 , σ = 465 kN/m^2 determine the void ratio for a pressure σ = 600 kN/m^2. 07

Q.5 (a) Give assumptions made in Rankine's earth pressure theory and derive equation for k_a. 07

(b) Determine the lateral earth pressure at rest per unit length of the wall shown in figure. Also determine the location of th resultant earth pressure. Take
$K_0 = 1 - \sin\Phi'$ and
$\gamma_w = 10$ kN/m^3 07



OR

Q.5 (a) Explain types of slope failure. 07

(b) Explain swidish circle method. 07

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GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC-Semester –IV (May-2012) Examination

Subject code: X40603

Subject Name: Soil Engineering

Date: 10/05/2012

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.**

Q.1 **Choose right option of followings:** **20**

(i) Newmark's chart is used in foundation engineering to find
(a)Stresses in soil due to surface loading (b)Seepage loss
(c) Earth pressure (d)permeability of soil

(ii) The intensity of vertical pressure directly below a concentrated loading *P* kN at a depth of *y* meters in a soil mass is

$(a)\frac{3P}{2\pi y^2}(b)\frac{2\pi Py^2}{3}$ (c) $\frac{3P}{2\pi y^3}(d)\ \frac{3P}{2\pi y}$

(iii) In a slope stability analysis by friction circle method, the radius of friction or ϕ circle is given by
(a)R·cosϕ (b)R·sinϕ (c)R·tanϕ (d)C·Secϕ

(iv) Taylor's stability number is given by

$(a)\frac{F_c}{c\cdot\gamma\cdot H}(b)\frac{\gamma\cdot H}{c\cdot F_c}(c)\frac{c}{F_c.\gamma\cdot H}\ (d)\frac{H}{c\cdot F_c\cdot\gamma}$

(v) For non cohesive soil, so long as the inclination of the infinite slope is less than the angle of shearing resistance ϕ the slope is
(a)stable for any height
(b) stable up to a certain height , called the critical height
(c) unstable for any height (d) none of above

(vi) For a base failure of a slope the depth factor *D* is
(a)Zero (b)1 (c) $0 < D < 1$ (d) $D > 1$

(vii) 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

(viii) The process of compaction of soil involves
(a) expulsion of pore water (b) expulsion of pore air
(c) expulsion of both pore air and pore water
(d) none of the above

(ix) Consolidation
(a) is a function of the total stress.
(b) is a function of the neutral stress.
(c) is a function of the effective stress.
(d) does not depend upon the present stress.

(x) The shear strength for a saturated clay from unconfined compression test is

(a) twice the unconfined compression strength
(b) half the unconfined compression strength
(c)Four times the unconfined compression strength.
(d) not related to the unconfined compression strength.

(xi) Settlement at any time to final settlement in a clay is known as:
(a) Settlement ratio (b) degree of consolidation
(c) Co-efficient of volume decrease (d) time factor

(xii) The unit of coefficient of consolidation are:
(a)cm^2/sec (b) cm^2/N(c) N/cm^2/sec (d) none of above

(xiii) Length to diameter ratio for cylindrical specimen of soils for triaxial shear tests is:
(a) 1.0 (b) 2.0 (c) 3.0 (c) 3.5

(xiv) When normal; stress is 100kN/m^2, the magnitude of shear stress on a principal plane is
(a) infinity (b) 100kN/m^2 (c) 200kN/m^2(d) nil

(xv) In shear box test, failure plane is the
(a) weakest plane (b) vertical plane
(c) major principal plane (d) horizontal plane

(xvi) With increase of angle of shearing resistance, coefficient of passive earth pressure:
(a) increase
(b) decreases
(c) remains constant
(d)none of the above

(xvii) Cohesive soils are:
(a) good for backfill because of low lateral pressure
(b) poor for backfill because of large lateral pressure
(c) good for backfill because of high shear strength
(d) none of the above

(xviii) According to Coulomb's wedge theory, the active earth pressure slides the wedge:
(a) downward and outward on a slip surface
(b) upward and inward on a slip surface
(c) horizontally inward parallel to base
(d) none of the above

(xix) The angle of internal friction is minimum for
(a) angular grained dense sand
(b) angular grained loose sand
(c) rounded grained dense sand
(d) none of the above

(xx) The ultimate angle of internal friction of a soil depends upon
(a) the amount of interlocking of particles
(b) the amount of friction between the particles
(c) both (a) and (b)
(d) none of the above

Q.2. A standard specimen of cohesionless sand was tested in triaxial compression and the sample failed at deviator stress of 482kN/m^2, when the cell pressure was 100kN/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? **08**

OR

Q.2. In an unconfined compression test a sample of clay 100mm long and 50mm in diameter fails under a load of 150N at 10% strain. Calculate the shearing resistance taking into account the effect of change in cross-section of the sample. **08**

Q.3 (a) 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) Explain Direct Shear Test **07**

(b) Explain Standard Proctor Test **07**

Q.4 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. **14**

Water Content (%)	8.5	12.2	13.75	15.5	18.2	20.2
Weight of wet sample (kg)	1.80	1.94	2.00	2.05	2.03	1.98

OR

Q.4 A stratum of normally consolidated clay 7m thick is located at a depth 12m below ground level. The natural moisture content of the clay is 43percent and its liquid limit is 48percent .The specific gravity of the solid particles is 2.776. The water table is located at a depth 5m below ground surface. The soil is sand above the clay stratum. The submerged unit weight of the san is 11kN/m^3 and the same weighs 18kN/m^3 above the water table. The average increase in pressure at the center of the clay stratum is 120kN/m^2 due to the weight of a building that will be constructed on the san above the clay stratum. Estimate the expected settlement of the structure. **14**

Q.5 (a) Compare the Coulomb's theory with Rankine theory for lateral earth pressure **07**

(b) The infinite slope as shown in Fig.-1 is stable? If not, how much above the rock surface will the slip occur? **07**

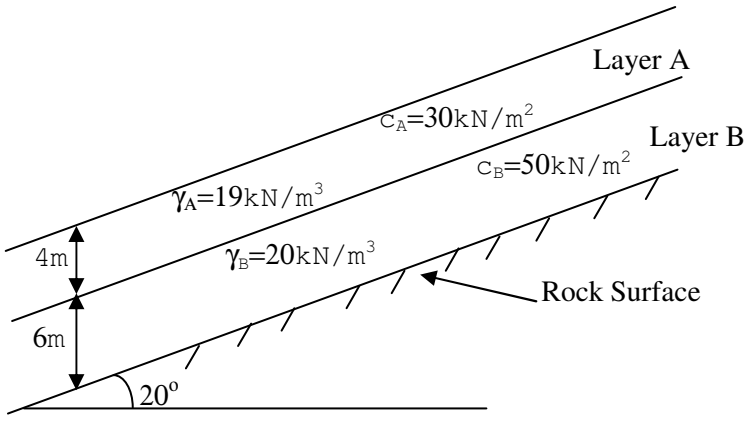

Fig.-1

OR

Q.5 **(a)** A retaining wall, 7.5m high, retains a cohesionless backfill. The top 3m of the fill has init weight of 18kN/m^3 and ϕ=30^o and the rest has init weight of 24kN/m^3 and ϕ=20^o. Determine the pressure distribution on the wall. **07**

(b) An infinitely long slope having an inclination of 26^o in an area is underlain by firm cohesive soil (G=2.72 and e=0.50). There is a thin, weak layer of soil 6m below and parallel to the slope surface (c=25kN/m^2 ,ϕ'= 16^o) Compute the factor of safety when the slope is dry. If ground – water flow could occur parallel to the slope on the ground surface, what factor safety would result? **07**

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Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC SEM-IV Examination-Nov-2011

Subject code: X40603 **Date: 25/11/2011**

Subject Name: Soil Engineering

Time: 2.30 pm -5.00 pm **Total marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	Explain stress distribution in soils for concentrated loads by Boussinesq's equation	**07**
	(b)	What do you understand by "Pressure bulb"? Illustrate with sketches.	**07**
Q.2	**(a)**	A concentrated load of 40 kN acts on the surface of a soil. Determine the vertical stress increment at points directly beneath the load up to a depth of 10m and draw a plot at an interval of 1m. Also plot the variation of vertical stress increment due to load in horizontal planes at depth of 2m up to a horizontal distance of 3m on either side of centre at an interval of 1m.	**07**
	(b)	Explain the principle of the direct shear test. What are the advantages of this test?	**07**
		OR	
	(b)	Differentiate between unconsolidated undrained test and a drained test. Under what condition are these test results used for design purposes?	**07**
Q.3	**(a)**	Write short notes on Mohr's Circle	**07**
	(b)	Calculate the potential shear strength on a horizontal plane at a depth of 3m below the surface in formation of cohesionless soil (i) when the water table is at a depth of 3.5 m. The degree of saturation may be taken as 0.5 on the average. Void ratio =0.5, grain specific gravity =2.7; angle of internal friction $=30^{o}$. (ii) What will be the modified value of shear strength if the water table reaches the ground surface?	**07**
		OR	
Q.3	**(a)**	Two identical specimens, 3cm in diameter and 6cm high, of partly saturated compacted soil are tested in a triaxial cell under untrained conditions. The first specimen failed at an additional axial load (i.e. deviator load) of 800N under a cell pressure of 120 kN/m^2. The second specimen failed at an additional axial load of 950N under a cell pressure of 250 kN/m^2. The increase in volume of the first specimen at second specimen at failure is 1.6ml and it shortens by 0.8 cm, at failure. The increase in volume of the second specimen at failure is 2.4ml and it shortens by 1.2 cm at failure. Determine the value if apparent cohesion and the angle of shearing resistance.	**07**
	(b)	Write short notes on Unconfined compression test	**07**
Q.4	**(a)**	What are the various factors that affect the compaction of soil in the field? How will you measure compaction in the field?	**07**

(b) A soil in the borrow pit is at a dry density of 17kN/m^3 with a moisture content of 10%. The soil is excavated from this pit and compacted in an embankment to a dry density of 18kN/m^3 with a moisture content of 15%. Compute the quantity of soil to be excavated from the borrow pit and the amount of water to be added for 100m^3 of compacted soil in the embankment. **07**

OR

Q.4 **(a)** Differentiate between the compaction and consolidation. **07**

Q.4 **(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**

Q.5 **(a)** Differentiate critically between Rankine and Coulomb theories of earth pressure. **07**

(b) A retaining wall, 6m high, retains dry sand with an angle of friction of 30^o and unit weight of 16.2kN/m^2. 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 10kN/m^3. **07**

OR

Q.5 **(a)** A new canal is excavated to a depth of 4m below ground level through a soil having the following characteristic c=12kN/m^2; ϕ =20^o; 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 S_n for i = 45^o as follows: **07**

ϕ	5^o	10^o	15^o	20^o
S_n	0.136	0.108	0.083	0.062

(b) A granular soil has γ_{sat}=19kN/m^3, ϕ=35^o. A slope has to be made of this material. If a factor of safety of 1.3 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 1.5m, what is the factor of safety available on a slip plane parallel to the ground surface at a depth of 4 m? Assume β=28^o. **07**

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Seat No : _____ Enrollment No:_____

GUJARAT TECHNOLOGICAL UNIVERSITY

P.D.D.C. Sem - IV Examination June- 2011

Subject Code : X40603

Subject Name : Soil Engineering

Date: 06/06/2011 **Time: 10.30 am – 01.00 pm**

Total Marks: 70

Instructions:

1. **Attempt any five questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Describe the method to find out shear strength of soil on the field. **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/m^2 **07**

Q.2 **(a)** 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=2.65. 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 effect of compacting energy and void ratio on the compaction of soil. **07**

OR

(b) Write short note on proctor needle. **07**

Q.3 **(a)** Write and explain the Boussinesq's equation for stress distribution in soil for (i) a point load and (ii) Line load. **07**

(b) A square footing 2m x 2m carries a uniformly distributed load of 314 kN/m². find the intensity of vertical pressure at a depth of 4 m below a point 0.5 m inside each of two adjacent sides of the footing. **07**

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 30 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 8 m (i) directly under the load & (ii) at horizontal distance of 6 m. **07**

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

(b) A wall with a smooth vertical back , 10 m high, supports a purely cohesive soil with c=9.91 kN/m² and γ = 17.66 kN/m^3. Determine **07**
(i) total Rankine's active pressure against the wall.
(ii) Position of zero pressure.

OR

Q.4	**(a)**	Explain Square root of time method to determine coefficient of consolidation.	**07**
	(b)	How many days would be required by a clay stratum 5 m thick, draining at both ends with an average value of coefficient of consolidation = 50×10^{-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)	A finite slope has an inclination of 48° with a horizontal ground surface. The height of the slope is 15 m, and the details of the soil are c=26 kPa, Φ=18°, and γ=17.2 kN/m^3. Compute the factor of safety assuming plane rupture surface. Adopt Culmann's method.	**07**

OR

Q.5	**(a)**	Discuss about earth pressure at rest.	**07**
	(b)	Write assumptions made in terzaghi's theory of consolidation.	**07**

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