Heaven's light is our Guide

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering **FOURTH** year **BACKLOG** Examination, 2018

CE 3131
Geotechnical Engineering-I

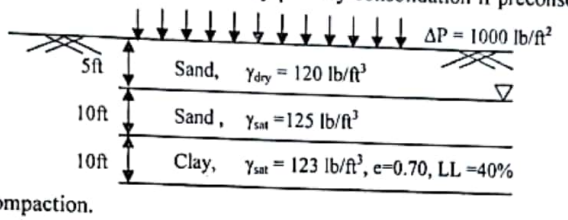
Full Marks: 70 **Time: 3 Hours**

N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1(a) Define (i) Water content (ii) Optimum moisture content and (iii) Degree of saturation 4.50
(b) Derive an expression for "e" in terms of G_s, γ_w and γ_d, where the symbols bears their usual meaning. 3.50
(c) A soil having specific gravity 2.65 and moist unit weight 20 kN/m^3 with 20% water content. Determine dry unit weight and mass of water to be added to reach full saturation. 4.00

Q.2(a) Distinguish between true degree of consolidation and average degree of consolidation. 3.00
(b) Define e-logP curve. How can you determine preconsolidation pressure from this curve? Explain. 4.00
(c) As oil profile is shown in figure below. A uniformly distributed load ΔP=1000 lb/ft^2 is applied on the ground surface. What will be settlement of the clay layer caused by primary consolidation if preconsolidation pressure is 2000 lb/ft^2. Use $C_s = 1/5C_c$. 5.00



Q.3(a) Explain the principle of soil compaction. 4.00
(b) Briefly explain the factors affecting compaction with figures. 4.00
(c) A soil having specific gravity 2.70 was compacted by standard proctor test method with 15% water content (degree of saturation 80%) and found maximum dry density 1.80 g/cm^3. Calculate percent air void present in soil sample. 4.00

Q.4(a) Define "grain size distribution curve". Draw a qualitative diagram of it and write the uses of this curve. 4.00
(b) Briefly explain the plasticity chart with sketches and write the uses of this chart. 4.00
(c) Define the terms total stress, effective stress and pore pressure and state the relationship that is assumed to exist among them. 4.00

SECTION-B

Q.5(a) What are the silent characteristics of a flow net? Describe a suitable procedure of drawing flow net. 3.00
(b) Show how the effective pressure is altered when water is flowing through the soil vertically downwards and vertically upwards. 4.00
(c) In a container filled with each of the following materials, at a porosity of 40%, determine the upward gradient required to cause quick condition: 5.00
  (i) Sand with specific gravity of 2.65
  (ii) Fibre beads with a specific gravity of 1.55
  (iii) Lead shot with a specific gravity of 10.8

Q.6(a) Define the terms 'Compression Index', 'Coefficient of Consolidation' and 'Coefficient of Compressibility' and indicate their units and symbols. 3.00
(b) Explain what is meant by normally consolidated clay stratum and over-consolidated clay stratum. Sketch typical results of consolidation test data to a suitable plot relating the void ratio and consolidation pressure in each case and show how preconsolidation pressure can be estimated. 4.00
(c) A 30 mm thick Oedometer sample of clay reached 30% consolidation in 15 mins with drainage at top and bottom. How long would it take the clay layer from which this sample was obtained to reach 60% consolidation? The clay layer had one-way drainage and was 6 m thick. 5.00

Q.7(a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes? 3.00
(b) Explain the Mohr-Coulomb strength envelope. Sketch the stress-strain, pore pressure-strain, volumetric change-strain relationships for dense and loose sand. 4.00
(c) A cylindrical specimen of a saturated soil fails at an axial stress of 180 kN/m^2 in an unconfined compression test. The failure plane makes and an angle of 54° with the horizontal. What are the cohesion and angle of internal friction of the soil? 5.00

Q.8(a) Explain why soils are compacted in the filed. How is the degree of compaction ensured in the field? 3.00
(b) Listing the various factors that influence the compaction of soils. Show their influence with illustrative sketches of compaction curves. 4.00
(c) The soil from a borrow pit is at a bulk density of 17.1 kN/m^3 and a water content of 12%. It is desired to construct an embankment with a compacted unit weight of 19.6 kN/m^3 at a water content of 18%. Determine the quantity of soil to be excavated from borrow pit and the amount of water to be added for every 100 m^3 of compacted fill in the embankment. 5.00

Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** Year **BACKLOG** Examination, 2017

CE 3131

Geotechnical Engineering-I

Time: 3 Hours

Full Marks: 72

N.B.:-
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1 (a) Distinguish between "void ratio and porosity" and "saturated density and submerged density". 4.00

(b) What do you mean by particle size distribution curve? Write the uses of it. 3.00

(c) The moisture content of a saturated soil w_{sat} is 35% and specific gravity of soil is 2.70. Find the void ratio and porosity. What will be the degree of saturation and air content if the moisture content gets reduced to 5% on drying? 5.00

Q.2 (a) Briefly explain the Atterberg's limits. 3.00

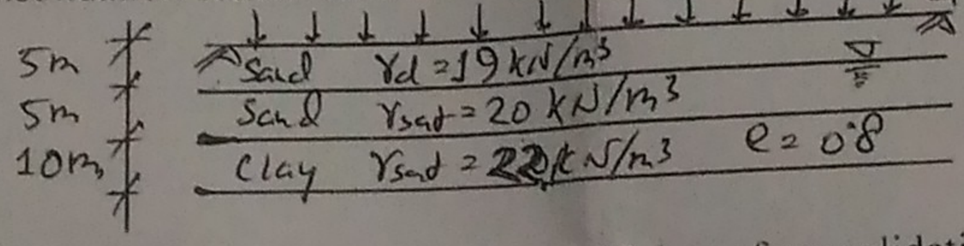
(b) Show that at saturation the moisture content is $w_{sat} = n\gamma_w/(\gamma_{sat} - n\gamma_w)$, where symbols bear their usual meanings. 4.00

(c) A loose (D_r = 50%) layer of sandy soil has a thickness of 10 m. After being subjected to dynamic in-situ compaction, the relative density D_r of the soil has been increased to 75%. Calculate the change in thickness of the soil layer (for the soil e_{min} = 0.50 and e_{max} = 1.0). 5.00

Q.3 (a) What is optimum moisture content? How can you obtain the optimum moisture content from standard proctor test? 4.00

(b) Write short notes on (i) Primary and Secondary consolidation (ii) Coefficient of compression. 3.00

(c) A uniformly distributed load Δp is applied at the ground surface as shown in figure below. What is the primary consolidation settlement of the clay layer if the preconsolidation pressure is 200 kPa. 5.00



Q.4 (a) What are the methods available for evaluating coefficient of consolidation, C_v from consolidometer test data? Explain any one of them. 5.00

(b) What is flow nets? Write the properties of flow nets. 3.00

(c) For a soil with specific gravity of grains 2.65, determine the dry density at a moisture content of 15% with 80% saturation. 4.00

SECTION-B

Q.5 (a) What do you mean by normally consolidated and over consolidated soil? Define OCR. 4.00

(b) What are the advantages of triaxial test over direct shear test? 3.00

(c) The results of two drained triaxial tests on a saturated clay are given below: 5.00

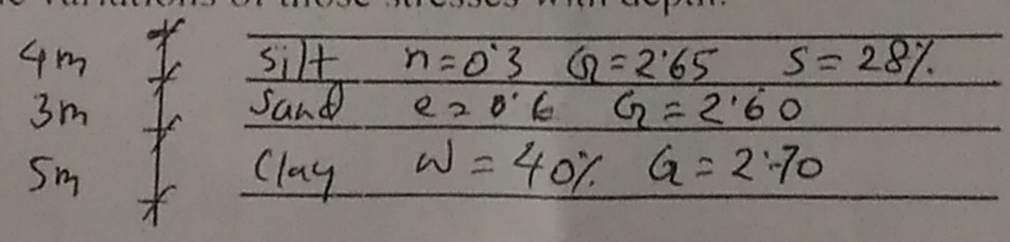
Test-I	σ_3 = 100 kPa	$(\sigma_d)_f$ = 215 kPa
Test-II	σ_3 = 200 kPa	$(\sigma_d)_f$ = 300 kPa

Calculate the shear strength parameters of the soil.

Q.6 (a) Define the terms total stress, effective stress and pore water pressure. Also state the relationship exists between them. 3.00

(b) Derive expression for maximum capillary rise and capillary tension in soil. 4.00

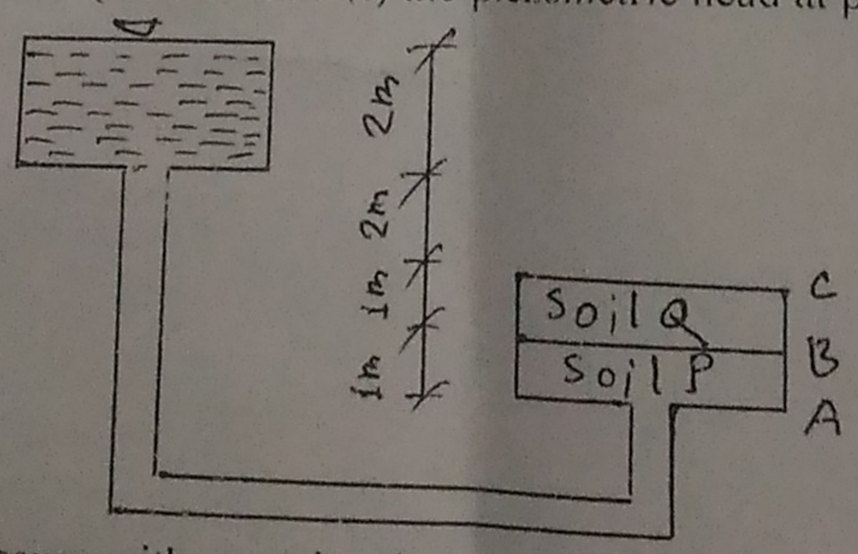
(c) Determine total stress, effective stress and pore water pressure for the soil profile shown in figure below. Also plot the variations of those stresses with depth. 5.00



Q.7 (a) Write short notes on the followings: (i) honeycomb structure (ii) placement water content (iii) sand cone method (iv) preconsolidation pressure. 4.00

(b) What is quick sand? Explain it with hydraulic gradient. 3.00

(c) The experimental permeability test set up shown in figure below, flow takes place under a constant head through the soils P and Q. Determine (i) the piezometric head at point A (ii) discharge per unit area. 5.00



Q.8 (a) What is soil structure? Discuss with neat sketches the structures that obtained in cohesive soil? 4.00

(b) Define Plasticity Index. Describe the importance of Plasticity Chart in civil engineering by using the sketch. 4.00

(c) Derive the basic differential equation of Terzaghi's consolidation theory. 4.00

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DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third Year Odd Semester** Examination, 2016

CE- 3131

Geotechnical Engineering - I

Full marks: 72 **Time: 3 Hours**

N.B:-
(i) Answer any SIX questions, taking **THREE** from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

Rakibul Islam
CE-140022

SECTION-A

Q.1(a) Define residual soil, alluvial soil, and weather of soil. 3.00

(b) For a given soil so that $\gamma_{sat} = \frac{(G+e)\gamma_w}{(1+e)}$ 4.00

(c) A sand is composed of solid constituents having a density of 2.6 mg/m³. The void ratio is 0.58. Compute the density of sand when dry and when saturated and compare it with the density when submerged. 5.00

Q.2(a) Write brief but critical notes on 'texture' and 'structure' of soils. 3.00

(b) Distinguish between: Liquid limit and liquidity Index (ii) Density and relative density. 4.00

(c) The hydraulic gradient for an upward flow of water through a sand mass is 0.90. If the specific gravity of soil particles is 2.66 and the void ratio is 0.50, will quicksand conditions develop? 5.00

Q.3 (a) Explain with sketches 'neutral' and 'effective' pressure in soils. 3.00

(b) Define 'permeability' and explain how would you determine it in the field. 4.00

(c) The initial head is 300mm in a falling head permeability test. It drops by 10mm in 3 minutes. How much longer should this test continue, if the head is to drop to 120mm?. 5.00

Q.4 (a) Classify the shear tests based on drainage conditions. Explain how the pore pressure variation and volume change take place during these tests. 4.00

(b) Define stress path. How do you calculate the shear strength parameters by using stress path method? 3.00

(c) For a normally consolidated clay $\phi_{cu} = 30°$. Deviator stress at failure of the same soil is 250 kN/m² in CU test. If Skempton's A parameter at failure is 0.62, find out ϕ_u for this test. Also, find out the confining pressure during the consolidation state. 5.00

SECTION-B

Q.5(a) Define degree of consolidation and average degree of consolidation. 3.00

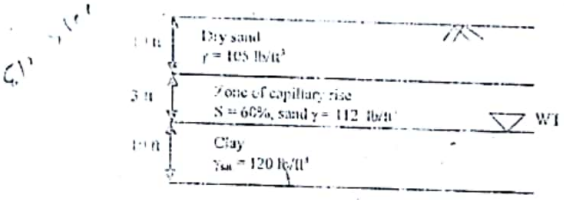
(b) Derive the basis differential equation of Terzaghi's consolidation theory with assumptions. 4.00

(c) A saturated clay specimen is subjected to a pressure of 240 kN/m². After the lapse of a time, it is determined that the pore pressure in the specimen is 72 kN/m². What is the degree of consolidation? 5.00

Q.6(a) Define surface tension. Derive an expression for capillary rise. 4.00

(b) Define flow net with sketches. Write the properties of flow net. 3.00

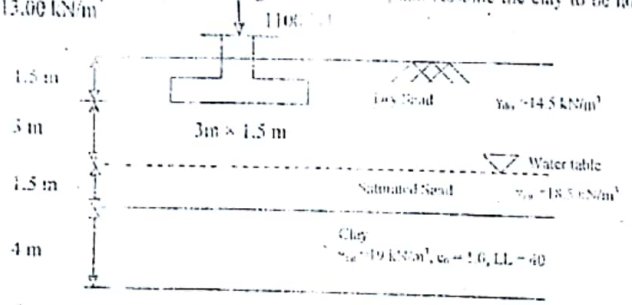
(c) For a given soil profile, determine the total pressure, effective pressure and pore water pressure and draw the pressure diagram. 5.00



Q.7(a) What are the causes of settlement? Briefly discuss the different types of settlement. 4.00

(b) Define e-logP curve with figure. How can you determine pre-consolidation pressure from it-explain. 3.00

(c) Calculate the consolidation settlement of the 4m thick clay layer (shown in figure below) that will result from the load carried by a footing measuring 3m × 1.5m in plan. Assume the clay to be normally consolidated and ΔP_{avg} = 13.00 kN/m². 5.00



Q.8(a) Describe the process of soil formation. 4.00

(b) What are the structures generally obtained in cohesive soil? Explain with sketches. 4.00

(c) Derive an expression of 'zero air-void' line and draw the line for a specific gravity of 2.66. 4.00

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Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** Year **Fifth** Semester Examination, 2015

CE 331

Geotechnical Engineering-I

Full marks: 70 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.

SECTION-A

Q.1 (a) Describe the process of soil formation. 3.67

(b) Write short notes on: (i) Gibbsite sheet (ii) Illite (iii) Colluvial Soil 4.00

(c) Draw qualitative particle-size distribution curve and from it determine D_{10} D_{30} and D_{50}. Also determine uniformity coefficient and coefficient of gradation using above data. 4.00

Q.2 (a) Define hydraulic gradient. Prove that 'the seepage velocity is inversely proportional to the porosity of soil'. 3.67

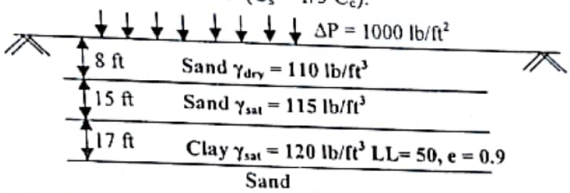
(b) Define 'permeability' and explain how would you determine it in the field. 4.00

(c) Derive the relationship between soil moisture content (w), degree of saturation (s), specific gravity (G) and void ratio (e). 4.00

Q.3 (a) What are the causes of settlement? Briefly discuss the different types of settlement. 3.00

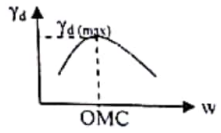
(b) Distinguish normally consolidated and over consolidated soil. Also define overconsolidation ratio. 3.67

(c) A soil profile is shown in figure below. If a uniformly distributed load ΔP, is applied at the ground surface, estimate the primary consolidation settlement if (i) the clay is normally consolidated (ii) the preconsolidation pressure is 2600 lb/ft^2 (C_s = 1/5 C_c). 5.00



Q.4 (a) Briefly explain the equipments which are used in field compaction of soil. 3.67

(b) From the laboratory compaction test result, the following compaction curve is obtained. Explain the behavior of compaction of soils. 4.00



(c) The maximum and minimum dry unit weights of sand were determined in the laboratory to be 18.31 and 15.25 kN/m^3, respectively. What is the relative compaction in the field if the relative density is 64%? 4.00

SECTION-B

Q.5 (a) What do you mean by effective stress? Determine the expression of effective stress at a point located at depth z below the top of the soil surface with downward seepage. 4.00

(b) Prove that "the height of capillary rise decreases with increase in temperature". 2.67

(c) A glass container with pervious bottom containing fine sand in loose state (void ratio 0.8) is subjected to hydrostatic pressure from underneath until quick condition occurs in the sand. If the specific gravity of sand particles = 2.65, area of cross section of sand sample = 10cm^2 and height of sample = 10 cm, compute the head of water required to cause quicksand condition and also the seepage force acting from below. 5.00

Q.6 (a) What are the principles of a flownet? What are its uses? 3.00

(b) Briefly discuss the various parameters that affect the permeability of soil in field. 3.67

(c) In a falling head permeability test, the time intervals noted for the head to fall from h_1 too h_2 and from h_2 to h_3 have been found to be equal. Show that h_2 is geometric mean of h_1 and h_3. 5.00

Q.7 (a) Explain the Mohr-Coulomb strength envelope. 2.67

(b) Sketch the stress-strain relationship for loose and dense sand. Also explain the shear characteristics of sand and normally loaded clays. 4.00

(c) For a normally consolidated insensitive clay $\varphi_{CD} = 30^\circ$. Deviator stress at failure of the same soil is 250 kN/m^2 in CU test. If Skempton's A-parameter at failure is 0.62, find out φ_{cu} for this soil. Also find out the confining pressure during the consolidation state. 5.00

Q.8 (a) Draw e-logp curve and write uses of it. Also determine preconsolidation pressure from it. 4.00

(b) How can you determine coefficient of consolidation by Square-Root-of-Time method? Explain 3.67

(c) A normally consolidated clay layer is 4m thick (one-way drainage). From the application of a given pressure, the total anticipated primary consolidation settlement will be 80 mm. 4.00

(i) What is the average degree of consolidation for the clay layer when the settlement is 30 mm?

(ii) If the average value of c_v for the pressure range is 0.003 cm^2/sec, how long will it take for 50% settlement to occur?

(iii) How long will it take for 50% consolidation to occur if the clay layer is drained at both top and bottom?

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering **Third** year **Fifth Semester** Examination, 2014

CE 331
Geotechnical Engineering - I

Full marks: 70 **Time: 3 Hours**

N.B:- (i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION - A

Q.1(a) Explain that the problems/properties of soils and foundation are very difficult and complex as compared with the superstructure. 2.67

(b) Derive the dry unit weight equation for any constant degree of saturation as a function of moisture content, specific gravity of the soil, and unit weight of the water. 4.00

(c) Calculate the dry unit weight, the saturated unit weight, and the effective (buoyant) unit weight of a soil having a void ratio of 0.7 and a specific gravity of 2.7. Also calculate the unit weight and the water content at a degree of saturation of 70%. 5.00

Q.2(a) What types of soil generally get the highest rating in the AASHTO classification systems for usage as subgrade soils beneath pavements? Explain the uses of grain size distribution curves. 5.00

(b) Write short notes on: (i) Primary consolidation settlement, (ii) Activity, and (iii) Over consolidated soil. 3.67

(c) In a few sentences, explain the basic principles underlying measurement of soil grain size distributions using hydrometers. 3.00

Q.3(a) What is plasticity chart? Explain. 3.67

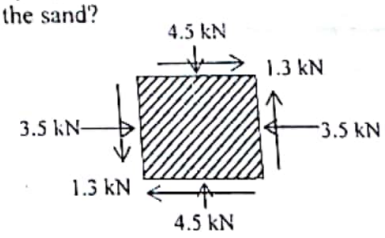
(b) Derive expressions for the maximum capillary rise and capillary tension in soil. 4.00

(c) For the site profile shown in following table, draw total stresses, pore water pressures, and effective vertical stresses against depth for the following conditions: (i) Water table at the ground surface, and (ii) Water table at a depth of 2.5 m assuming the silty sand stratum above the water table to remain saturated with capillary water (i.e. negative pore pressure are present). Saturated unit weight of silty sand = 18.5 kN/m^3, and saturated unit weight of clay = 17.2 kN/m^3. 4.00

Depth (m)	Stratum
0 - 5	Silty sand
5 - 9	Peaty clay
>9	Rock (impermeable)

Q.4(a) Clearly explain how soil grain sizes (i.e, sands versus clays) affect observed shear strength behaviors in terms of drained and undrained behaviors. 5.00

(b) A 100 mm cubical sample of sands is in equilibrium when subjected to the forces as shown in figure below. (i) Determine the stresses on the soil element and construct the Mohr's circle of stress, (ii) Determine the magnitude of the major and minor principal stresses and the orientation to the horizontal of the major principal stress plane, (iii) Determine the stresses on a plane at an orientation of 30° anti-clockwise to the major principal plane, and (iv) If the sample is at failure, what is the angle of shearing resistance of the sand? 6.67



SECTION - B

Q.5(a) Write short notes on: (i) Optimum moisture content, (ii) Placement water content, (iii) Water content, and (iv) Air void line. 4.00

(b) Describe the differences between the Standard compaction test and Modified compaction test. Use sketch to show differences in their relationship. 3.67

(c) During a road construction, a sand replacement method was performed to evaluate the required in-situ density of soil. (i) Explain what you understand by sand replacement method. (ii) The weight of sand used to fill test hole and funnel of sand-cone device is 853 gm and weight of sand to fill funnel is 321 gm. the density of the sand is found to be 1.54 gm/cm^3, the weight of the wet soil from the test hole is 739 gm and the moisture content is 15%. Calculate the dry unit weight of the compacted soil. 4.00

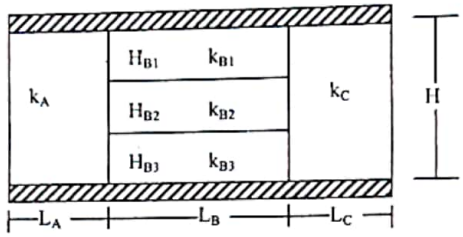
Q.6(a) Explain with sketches three types of clay fabric structure that are commonly found. 4.67

(b) The effective size of a soil is found 0.55 mm from grain size analysis. What will be the co-efficient of permeability of that soil? Use Hazen's equation. 3.00

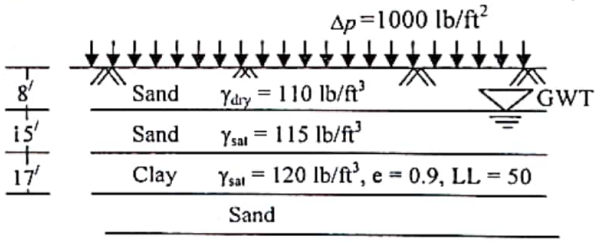
(c) The backfill material for a vibroflotation project has the following grain sizes: D_{10} = 0.36 mm, D_{20} = 0.52 mm, and D_{50} = 1.42 mm. Determine the suitability number. What would be its rating as a backfill material? 4.00

Q.7(a) What is $e - \log p$ curve? How can you determine preconsolidated pressure from this curve? Explain. 3.00

(b) Consider the soil deposit shown in figure below. Write an expression for the effective or equivalent horizontal permeability of this soil deposit in terms of the dimensions and isotropic permeability shown. 4.67



(c) A soil profile is shown in figure below. A uniformly distributed load Δp, is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if (i) the clay is normally consolidated, and (b) the preconsoldation pressure is 2600 lb/ft^2. 4.00



Q.8(a) What types of laboratory tests are best suited to determine soil strength parameters for the following problems? (i) The longterm stability of a slope in stiff fissured clay, and (ii) The vital stability of a footing on saturated clay. Give reasons for your choice of test. 4.00

(b) The results of an undrained direct shear box test are given in the following table: 7.67

Normal stress (kPa)	200	300	500
Shear stress (kPa)	113	141	205

(i) Find the apparent cohesion (c_u) and angle of shearing resistance (φ_u). (ii) What values of c_u would be expected from an unconfined compression test on the same soil? (iii) If another specimen of this soil is subjected to an undrained triaxial test with lateral pressure of 290 kPa, find the total axial pressure at which failure would be expected.

Heaven's Light is Our Guide

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering Third Year Fifth Semester Examination, 2013

CE 331
Geotechnical Engineering -I

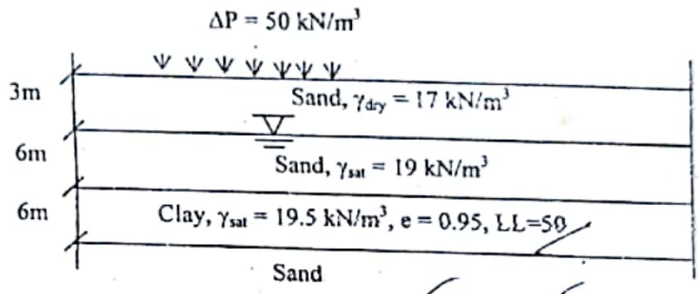
Full marks: 70 **Time: 3 Hours**

N.B:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figures in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

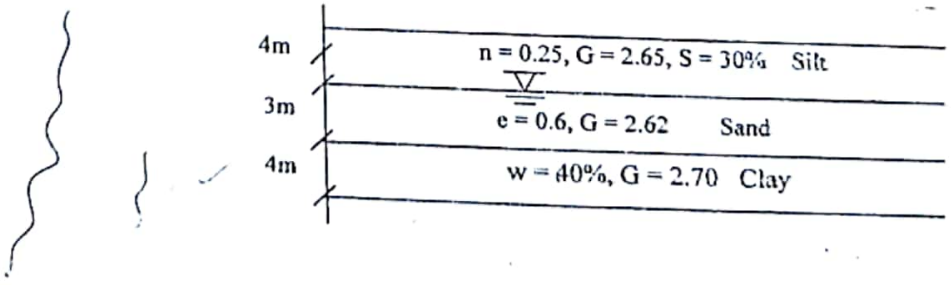
Q.1(a) Describe the process of soil formation.
(b) Define (i) degree of saturation (ii) percent air voids (iii) density index (iv) relative density.
(c) A saturated soil completely filling a container of volume 0.05m³ has a mass of 100 kg and water content of 25%. Compute Gs and e for the soil.

Q.2 (a) Briefly explain the different soil settlements which are caused by loads.
(b) What is e-log P curve? How can you determine compression index, Cc and swelling index, Cs by using this curve? Explain.
(c) A soil profile is shown in figure below. A uniformly distributed load, ΔP, is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if (i) the clay is normally consolidated (ii) the precompression pressure is 170kN/m².



Q.3 (a) Write short notes on the following: (i) Zero air void line (ii) Kaolinite (iii) Dry density.
(b) What is particle size distribution curve? How can you classify whether the soil is well graded, uniformly graded or poorly graded?
(c) What is textural classification? Compare the AASHTO and unified soil classification system.

Q.4 (a) What is meant by "Flow net"? Explain how an approximate flow net can be drawn.
(b) In general when seepage is occuring in soil, how can you calculate the fluid pressure at specific locations in the soil.
(c) For a given soil profile, determine the total pressure, effective pressure and pore water pressure and draw the pressure diagram.



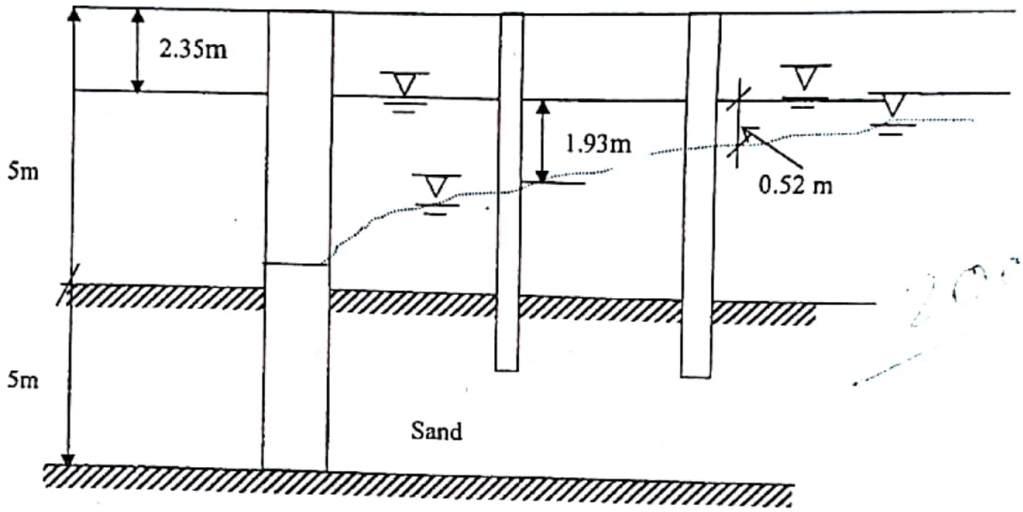
SECTION-B

Q.5(a) In a few sentences, discuss the significance of the three Atterberg limits of fine –grained soil.
(b) What is plasticity chart? How can you ascertain whether the soil is organic or inorganic from the plasticity chart?
(c) "Clay minerals show plastic behaviuor when mixed with water" –Explain.
(d) The Plastic limit of a soil is 25% and its plasticity index is 8%. When the soil is dried from its state at plastic limit, the volume change is 25% of its volume at plastic limit. Similarly, the corresponding volume change from the liquid limit to dry state is 34% of its volume at liquid limit. Determine the shrinkage limit and the shrinkage ratio.

Q.6(a) State and explain Darcy's law. Also define coefficient of permeability.

(b) For a stratified soil deposit, "prove that the average permeability parallel to the bedding planes is higher than the average permeability perpendicular to the bendding planes".

(c) During preparations for a pumping test a well was sunk through a confined aquifer shown in figure below. Observation holes were drilled at 15m and at 60m from the well. The water in the well and in the observation holes stood originally at the same level 2.35m below the top of the well. After pumping until steady conditions had been achieved, the discharge was found to be $20m^3$/hour. The water level in the observation hole 15m from the well had dropped 1.93m, and that in the hole 60m away had dropped 0.52m. Determine the field co-efficient of permeability of sand in m/sec.



Q.7(a) Draw typical curves of deviator stress versus axial strain and volumetric strain versus axial strain for loose and dense sand. Also write the test from which you will obtain this data. 3.00

(b) What are the advantages of triaxial test over direct shear test? 3.67

(c) A consolidated –undrained test on a normally consolidated soil yielded the following results; 5.00

$\sigma_3 = 10$ lb/in^2

$(\Delta\sigma_d)_f = 9.4$ lb/in^2

$(\Delta\sigma_u)_f = 6.8$ lb/in^2

Calculate the undrained and drained friction angles of soil.

Q.8 (a) Fallowing are the details for the backfill material used in a vibroflotation project: D_{10}= 0.35 mm, D_{20} =0.50 mm, D_{50} = 1.40 mm Determine the Stability number, S_N. What would be its rating as a backfill material? 4.00

(b) What do you mean by velocity potential, equipotential line and stream function. 4.00

(c) Define the following terms: (i) Activity (ii) Flocculent structure (iii) Degree of saturation 3.67

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DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** year **FIFTH** Examination, 2012

CE 331

Geotechnical Engineering-I

Full Marks: 70 **Time: 3 Hours**

N.B.:- (i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

SECTION-A

Q.1(a) Write short notes on the followings: 3.00
(i) Colluvial soils (ii) Gibbsite sheet (iii) Dispersed structure

(b) Derive an expression for γ_d in terms of γ_{sat}, γ_w, G_s. 3.67

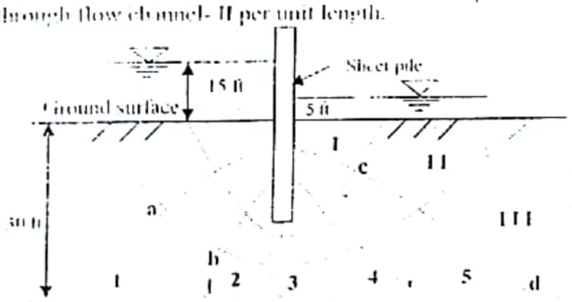
(c) Following are the results from the liquid limit and plastic limit tests for a soil. Liquid limit test: 5.00

No. of blows (N)	water content (w) %
15	36.5
19	33.1
28	27.0

Q.2(a) Explain what is meant by flow net and show an example how an approximate flow net can be drawn. 3.67

(b) Explain with sketches three types of clay fabric structure that are commonly found. 3.00

(c) A flow net for flow around a single row of sheet in a permeable soil layer is shown in figure below. Given hydraulic conductivity is 5×10^{-3} cm/sec, determine (i) How high (Above the ground surface) the water will rise if piezometers are placed at points a,b,c and d (ii) The rate of seepage through flow channel- II per unit length. 5.00



Q.3(a) Draw typical curves of deviator stress vs axial strain and volumetric strain vs axial strain for loose, medium dense and dense sand. Also write the test from which you will obtain this data. 3.00

(b) Find the ratio between compactive energy used in standard proctor compaction test and that in modified proctor compaction test. 2.67

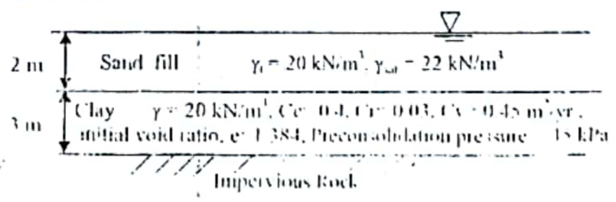
(c) What do you mean by degree of consolidation and average degree of consolidation? 2.00

(d) During a road construction, a sand replacement method was performed to evaluate the required in situ density of soil: 4.00
(i) Explain what you understand by sand replacement method?
(ii) The weight of sand used to fill test hole and funnel of sand cone device is 8539 and The weight of sand to fill funnel is 321 kg. The density of sand is found to be 1.549 kg/cm³, the weight of weight soil to from the test hole is 7399 and the moisture content is 15%. Calculate the dry unit weight of the compacted soil.

Q.4(a) What is the significance of the "Diffuse double layer" on the hydraulic and mechanical behavior of clays? 3.00

(b) Explain the difference between secondary compression and primary consolidation. 3.67

(c) Calculate the consolidation settlement of the soil profile shown in figure below, 2 years after the water table is lowered from the ground surface to the bottom of the clay layer. Assume that the clay layers remains full saturated after the lowering of the water table and account for capillary tension in calculations 6.00



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SECTION-B

(a) Define the terms total stress, effective stress, and pore pressure and state the relationship that is assumed to exist between them. [3.00]

(b) How are the majority of clay minerals formed? [3.00]

(c) A site investigation for a large excavation revealed that 10 m of uniform clay overlay 3m of sand which rested on bed rock. The water level in the clay was at ground level and piezometric head at the sand was 2m above the top of the clay. The unit weights of the clay and sand were 20 kN/m³ and 22 kN/m³ respectively. [5.00]

(i) Which type of laboratory tests are best suited to determine soil strength parameters for the following construction problems?
(ii) the long term stability of a slope in stiff fissured clay.
(iii) the initial stability of a footing on a saturated clay.
Give reasons for your choice of test. [3.00]

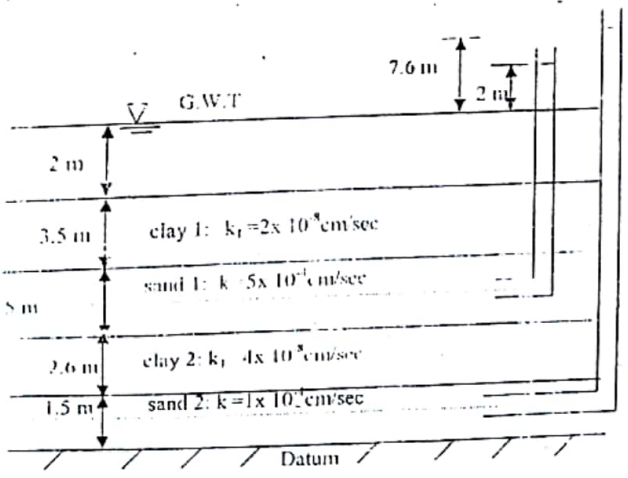
(d) The results of an undrained shear box test are given in the following table: [6.00]

normal stress (kPa)	200	300	400
shear stress (kPa),	113	141	167

(i) the apparent cohesion (Cu) and angle of shearing resistance (φ_u).
(ii) What value of Cu would be expected from an unconfined compression test on the same soil?
(iii) If another specimen of this soil is subjected to an undrained triaxial test with lateral pressure 225 kPa, find the total axial pressure at which failure would be expected.

(e) (i) "Clay minerals show plastic behaviour when mixed with water"- Explain. [3.00]
(ii) What do you mean by normally consolidated and over consolidated soils? Explain with e-log p curves. [3.00]

(f) With reference to the figure, (i) Plot the variation of elevated head, pressure head and total head on the soil profile (ii) Determine the average Darcy seepage velocity across clays 1 & 2. [6.00]



(a) Give Mohr-Coulomb strength equation and explain the quantities. [3.00]
(b) A fine grained soil has a liquid limit of 40% and in the plasticity diagram fall above the A-line. What is name and symbol of the soil? [3.00]
(c) Describe three factors affecting the compaction processes. Use diagram and sketches to support the answer. [4.00]
(d) How can you determine the shear stress in a triaxial specimen? [3.00]

i) i = ?, flow profile of σ, σ', u
ii) Calculate the depth to which an excavation can be taken before ground heave failure occurs

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DEPARTMENT OF CIVIL ENGINEERING
PABNA UNIVERSITY OF SCIENCE & TECHNOLOGY

B.Sc. Engineering THIRD year FIFTH Semester Examination, 2011

CE 331
Geotechnical Engineering - I

Full marks: 70 **Time: 3 Hours**

N.B:-
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

SECTION-A

Q.1(a) Write down the properties of organic materials. 3.67

(b) Define discharge velocity and seepage velocity. Also derive the relationship between discharge velocity and seepage velocity. 3.50

(c) Write short note on the followings: 4.50
(i) Mechanical weathering (ii) Kaolinite (iii) Honeycomb structure.

Q.2 (a) Define the following terms: (i) Zero air void line (ii) Degree of saturation (iii) Dry density. 4.67

(b) Derive the relationship, $e = \frac{G_s \gamma_w}{\gamma_d} - 1$, where the symbols bear their usual meanings. 3.50

(c) For a given sandy soil, $e_{max} = 0.70$, $e_{min} = 0.45$ and $G_s = 2.70$. What are the moist and dry unit weight of compaction (kN/m^3) in the field if relative density is 80% and w = 10%. 3.50

Q.3(a) What are the causes of compression of soil? Briefly explain- Immediate settlement, Primary consolidation settlement and Secondary consolidation settlement. 4.00

(b) Explain the Casagrande's simple graphic construction to determine the preconsolidation pressure, P_c, from the laboratory e log P plot. 3.00

(c) Show the derivation of settlement from one-dimensional primary consolidation. 4.67

Q.4(a) What is plasticity chart. Where and how plasticity chart is used in geotechnical engineering? 3.00

(b) Draw in one plotting the typical curves for Standard Proctor test and Modified Proctor test. 2.67

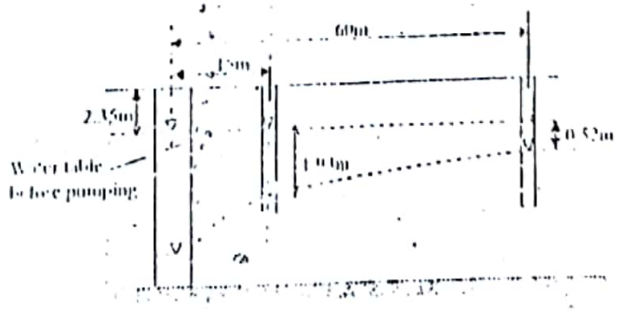
(c) The backfill material for a vibroflotation project has the grain sizes: $D_{10} = 0.36$ mm, $D_{20} = 0.52$ mm and $D_{50} = 1.42$ mm. Determine the suitability number. Also explain the backfill rating system proposed by Brown. 6.00

SECTION – B

Q.5(a) Define permeability and co-efficient of permeability. State and explain Darcy's law. 4.00

(b) Define flow nets. Write down the properties of flow nets. 2.67

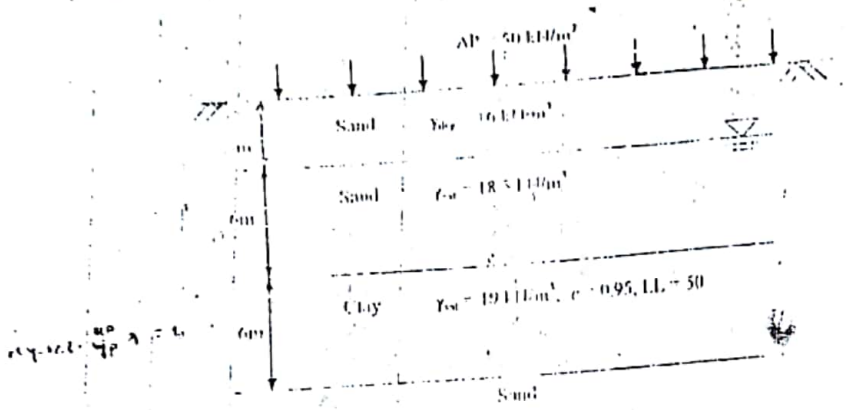
(c) During preparation for a pumping test, a well was sunk through a stratum of dense sand 10 m deep and into a clay of very low permeability beneath. Observation holes were drilled at 15m and at 60 m from the well. The water in the well and the observation holes stood originally at the same level, 2.35 m below the top of the well. After pumping until steady conditions had been achieved, the discharge was found to be 19.7 m^3/hour. The water level in the observation hole 15 m from the well had dropped 1.93 m and that in the hole 60 m away had dropped 0.52m. Determine the field coefficient of permeability of dense sand in m/s. 5.00



Q.6(a) Mention the limitations of Direct shear test.

(b) Explain the logarithm of time method for determining coefficient of consolidation, c_v, from laboratory one dimensional consolidation tests

(c) A soil profile is shown in figure below. If a uniformly distributed load, ΔP, is applied at the ground surface, what is the settlement of the clay layer caused by primary consolidation if preconsolidation pressure, P_c is 100 kN/m^2. Use $C_c = \frac{1}{5}$ of e_o.



Q.7(a) What do you mean by effective stress? Derive an expression of effective stress at any point of layer of soil in a tank with downward seepage.

(b) The water table in a deposit of sand 10 m thick is at a depth of 4 m below the surface. Above the water table the sand is saturated with capillary water. The bulk density of sand is 19.62 kN/m^3. Calculate the effective pressure at 1m, 4m and 10m below the surface. Hence plot the variation of total pressure, pore water pressure and effective pressure over the depth of 10 m.

Q.8(a) Draw the typical curves that usually obtained from CD and CU triaxial tests for both normally consolidated and over-consolidated clay.

(b) What do you mean by stress paths? Derive an expression that relates the major and minor principal stresses

For a clay soil $\phi = 32°$, $\phi_{cu} = 20°$. A consolidated-undrained triaxial test was conducted on this clay soil with a confining pressure of 13 lb/in^2. Determine the deviator stress and the pore water pressure at failure.

$\phi = 32°$, $\phi_{cu} = 20°$