Heaven's Light is Our Guide

**DEPARTMET OF CIVIL ENGINEERING**

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** Year **EVEN SEMESTER** Examination, **2020**

**CE 3233**

**Geotechnical Engineering - II**

**Full Marks: 72** **Time: 3 Hours**

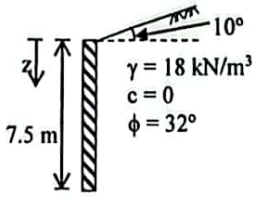
N.B.:
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

## SECTION-A

Q.1 (a) Write short notes on: (i) Active earth pressure (ii) Passive earth pressure, and (iii) Earth pressure at rest 3.00

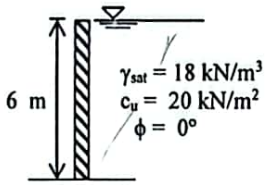
(b) Derive the expression for critical unsupported height of a clayey backfill. 4.00

(c) A retaining wall is shown in figure below. Calculate: (i) intensity of Rankine's active force at z = 2, 4, 6 and 7.5 m; (ii) Rankine's active earth force per meter of wall and also the location and direction of the resultant. 5.00

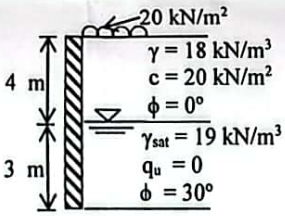



Q.2 (a) Derive an expression for active earth pressure in a dry backfill with an inclined ground surface. 4.00

(b) A retaining wall is shown in figure below. Compute: (i) the maximum depth of tensile crack (ii) the active force before the tensile crack and (iii) the active force after the tensile crack. 4.00



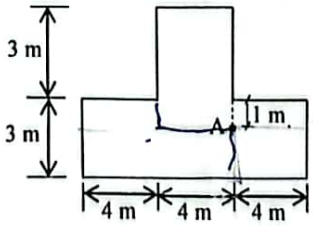

(c) A retaining wall with the soil profile is shown in figure below. Determine the pressure on the wall if it is pushed towards the backfill. 4.00




Q.3 (a) Derive Boussinesq's equation for vertical stress at a point due to a load on the surface of an elastic media. 4.00

(b) What do you understand by pressure bulb? Illustrate with sketches. 4.00

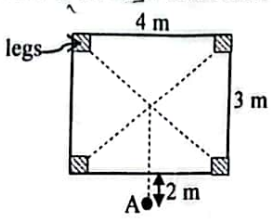
(c) The plan of a foundation is shown in figure below. The uniform pressure on the soil is 45 kN/m². Determine the vertical stress increment due to the foundation at a depth of 4 m below the point A. Use Newmark's solution. 4.00




Q.4 (a) Describe the methods of computing the stress at a point below the corner of a rectangular load. 3.00

(b) Draw the vertical stress distribution on a horizontal plane due to point load. The horizontal plane is located at 4 m below the ground surface and the value of point load is 100 kN. 4.00

(c) The base of a tower is shown in figure below. The total load of the tower is 1000 kN, which is equally carried by the four legs. Compute the increase in the vertical stress in the soil caused at a point 5 m below each leg. Also compute the stress at a point A due to the tower at the same depth. 5.00

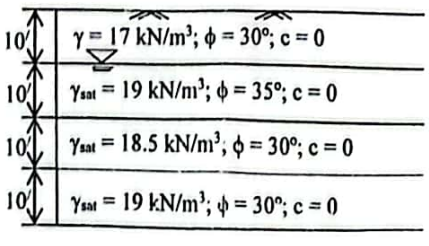


## SECTION-B

Q.5 (a) What do you understand by site investigation? What are the different purposes for which site investigation are done? 4.00

(b) Describe the split-spoon sampler. What is its use? Draw a typical cross-section of split-spoon sampler. 4.00

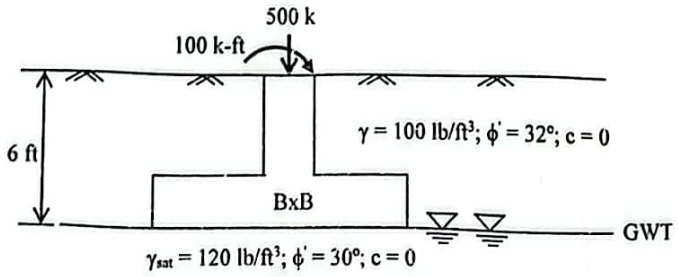
(c) The soil profile is shown in figure below. Compute the corrected SPT value using Skempton's relationship. The soil is overconsolidated coarse sand. 4.00




Q.6 (a) What do you understand by disturbed and undisturbed soil samples? How do you obtain undisturbed soil sample from field? 4.00

(b) How will you modify the bearing capacity equation for various locations of GWT? 2.00

(c) A square footing is shown in figure below. Use FS = 3, and determine the size of the footing. 6.00




Q.7 (a) Differentiate between finite and infinite slopes. 2.00

(b) How do you find the factor of safety of a finite slope using Bishop's method of slices? 5.00

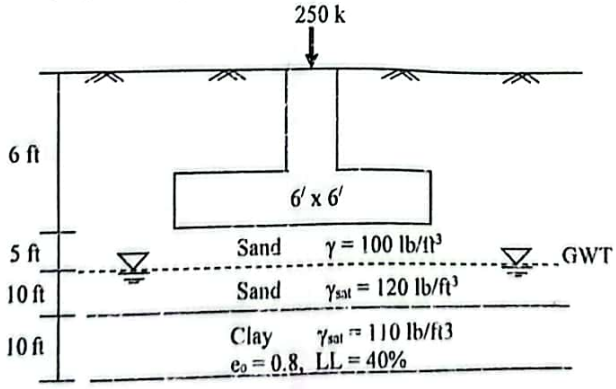
(c) Differentiate between rigid footing and flexible footing. 2.00

(d) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

Q.8 (a) What are the different types of settlement occur below a foundation? Explain each of them. 3.00

(b) What are the causes of differential settlement of foundation? Mention the allowable settlement values of various structures. 3.00

(c) Calculate the primary and secondary consolidation settlement of the foundation as shown in figure below. The clay is normally consolidated. Use the weighted average method to calculate the average increase of effective pressure in the clay layer. Use $C'_\alpha = 0.0004$ and $t_2/t_1 = 10000$. 6.00



Heaven's Light is Our Guide

DEPARTMET OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering Third Year Even Semester Examination, 2019

CE 3233

Geotechnical Engineering - II

**Full Marks: 72** **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 active and passive states with necessary figures. 3.00

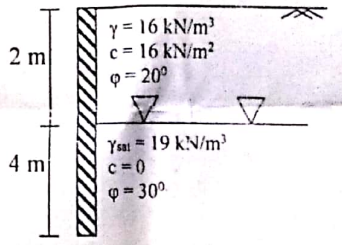
(b) Discuss Rankine's theory for passive earth pressure. Derive expression for critical height of an unsupported vertical cut in cohesive soil. 5.00

(c) A counterfort retaining wall of 8 m height retains non-cohesive backfill. The void ratio and angle of internal friction of the backfill respectively are 0.8 and $26^0$ in loose state and they are 0.45 and $35^0$ in dense state. Calculate and compare active and passive earth pressures in both cases, taking G = 2.67. Give your comments on the results. 4.00

Q.2 (a) Enumerate the assumptions that are made in Rankine's theory. 3.00

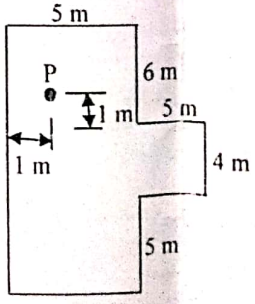
(b) Derive the condition for maximum pressure from a sliding wedge by Coulomb's wedge theory. 4.00

(c) A retaining wall with the soil profile is depicted in the figure below. Compute the active earth pressure, draw the active earth pressure diagram, and find the location of active force on the wall. 5.00




Q.3 (a) Describe various approximate methods for the determination of the vertical stress at a point. State the limitations. 6.00

(b) Determine the vertical stress increase at point P of the figure given below at a depth of 4 m. Given, q = 100 kN/m², use equivalent point load method. 6.00




Q.4 (a) Discuss the basis of the construction of Newmark's influence chart. Also state its uses. 5.00

(b) "In actual design, the contact pressure distribution below a foundation is generally taken as uniform"- explain the statement. 3.00

(c) A square foundation (4 m x 4 m) is to carry a load of 35000 kN. Calculate the vertical stress at a depth of 5 m below the centre of the foundation. Also, determine the vertical stress using 1:2 distribution. 4.00

## SECTION B

Q.5 (a) What is sub-soil exploration? Discuss the procedure suggested by ASCE to decide the depth of exploration. 3.50

(b) What is N-value? Discuss the importance of N-value in Geotechnical Engineering. 3.50

(c) Calculate the corrected SPT number for the data given below. The GWT is located at a depth of 5.5 m below the EGL. Given that the dry unit weight of sand from 0 to a depth of 5.5 m is 18 kN/m$^3$, and the saturated unit weight of sand for depth 5.5 m to 10.5 m is 19.5 kN/m$^3$. The sand is over consolidated coarse sand. Use Skempton's relationship. 5.00

| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) What do you understand by disturbed and undisturbed soil samples? How would you collect undisturbed soil sample from field? 3.00

(b) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

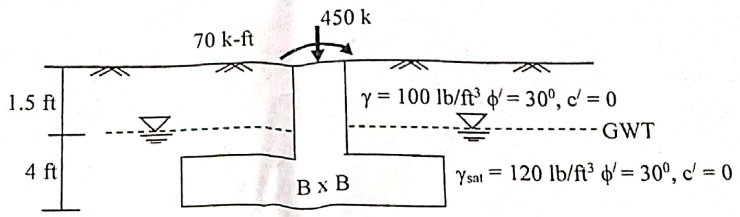
(c) What do you mean by 'Boring log'? What are the information should be presented in a boring log? 3.00

(d) What are the different types of settlement occur below a foundation? Explain each of them. 3.00

Q.7 (a) Write short notes on: (i) CPT, (ii) PMT, and (iii) VST. 3.00

(b) Discuss Meyerhof's bearing capacity theory. How does it differ from Terzaghi's bearing capacity theory? 3.00

(c) A square footing is shown in figure below. Use an FS of 3 and determine the size of the footing. 6.00

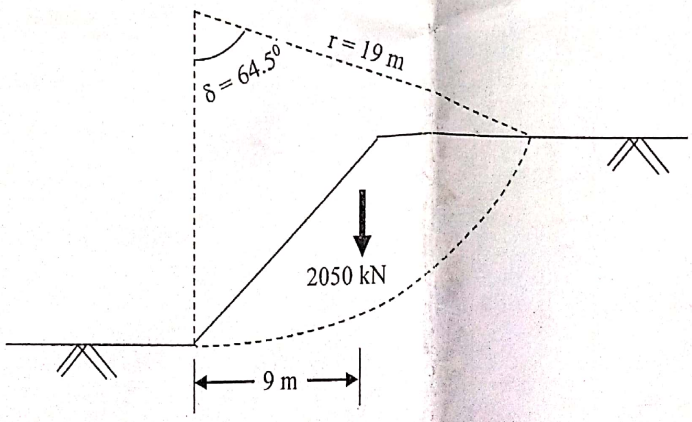



Q.8 (a) Differentiate between rigid footing and flexible footing. 2.50

(b) What are the different types of slope failures? Discuss with neat sketches. 3.00

(c) How will you modify the bearing capacity equation for various locations of ground water table? 2.00

(d) An earth slope of clayey soil is shown in figure below. Determine the factor of safety against sliding along the slip surface. 4.50



Heaven's Light is Our Guide

**DEPARTMET OF CIVIL ENGINEERING**

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** Year **EVEN SEMESTER** Examination, **2018**

**CE 3233**

**Geotechnical Engineering - II**

**Full Marks: 72** **Time: 3 Hours**

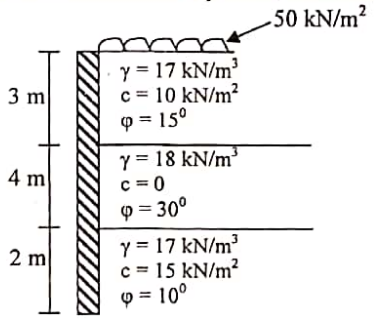
**N.B.:-**
(i) Answer any **SIX** questions, taking **THREE** from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing.

## SECTION-A

Q.1 (a) Explain the term "tension crack". Explain the active earth pressure before and after the formation of tension crack. 3.00

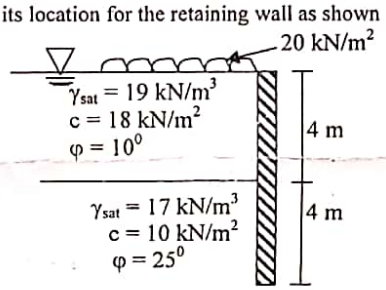
(b) Derive the expression for active earth pressure considering inclined backfill. 4.00

(c) Compute the active earth pressure and sketch the active earth pressure distribution before and after the tension crack of the retaining wall shown below. 5.00

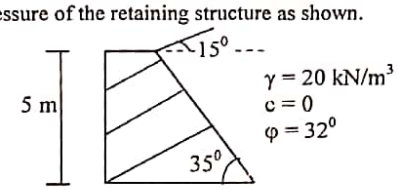



Q.2 (a) Explain why passive earth pressure is larger than active earth pressure for a given height and soil. 3.00

(b) Compute the active earth force and its location for the retaining wall as shown in figure. 5.00



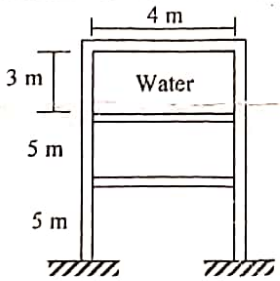

(c) Determine the active earth pressure of the retaining structure as shown. 4.00

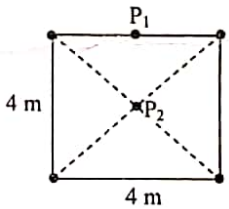



Q.3 (a) Differentiate between active and passive earth pressure. 2.00

(b) Draw the vertical stress distribution on (i) a horizontal plane for z = 2 unit, and (ii) vertical plane for r = 2 unit. 4.00

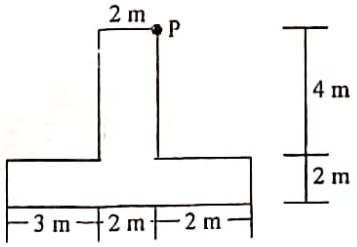
(c) A water tower is shown in figure below. Compute the vertical stress increase at point $P_1$ and $P_2$, 5 m below GL. The thickness of all sides of water tank = 0.3 m and size of all the columns and beams is 0.4 m x 0.4 m. 6.00



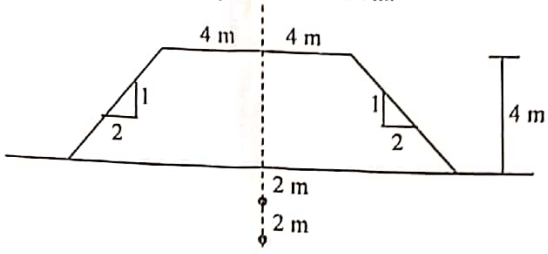




Q.4 (a) "In actual design, the contact pressure distribution is generally taken as uniform" – explain the statement. 3.00

(b) Determine the vertical stress increase at point P of the figure given below at a depth of 4 m. Given that $q = 90\ kN/m^2$. 6.00



(c) A railway embankment is shown in figure below. Assume the unit weight of soil to be 20 kN/m³. Compute the increase in vertical stress under the center line at a depths of 2 m and 4 m. 3.00




## SECTION B

Q.5 (a) What do you mean by 'Subsoil exploration'? Discuss the procedure suggested by ASCE to decide the depth the depth of exploration. 4.00

(b) What is 'Subsoil exploration report'? What are the salient features of a subsoil exploration report? 3.00

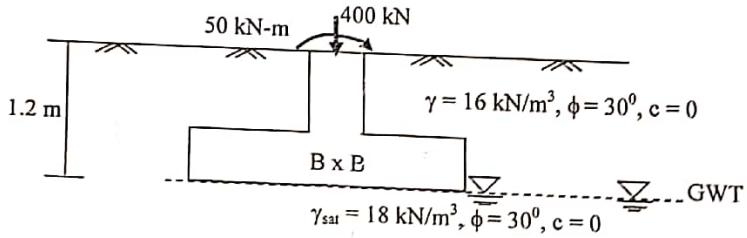
(c) Calculate the corrected SPT number for the data given below. The GWT is located at a depth of 5.5 m below EGL. Given: $\gamma$ = 18 kN/m³ and $\gamma_{sat}$ = 19.5 kN/m³. The sand is normally consolidated coarse sand. Use Skempton's relationship 5.00

| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) Write short notes on: (i) CPT, (ii) PMT, and (iii) VST. 3.00

(b) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

(c) A square footing is shown in figure below. Use FS = 3, and determine the size of the footing. 6.00



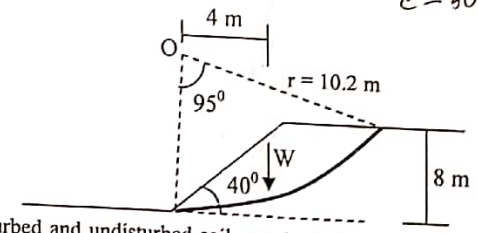

Q.7 (a) Describe split-spoon sampler with its use? 2.00

(b) What do you mean by "Boring log"? What are the information should be presented in a boring log? 3.00

(c) Discuss Meyerhof's bearing capacity theory. How does it differ from Terzaghi's theory? 3.00

(d) A 40⁰ slope is excavated at a depth of 8 m in a deep layer of saturated clay. Determine the factor of safety for the trial slip surface as shown in figure below. Given, W = 1050 kN. 4.00

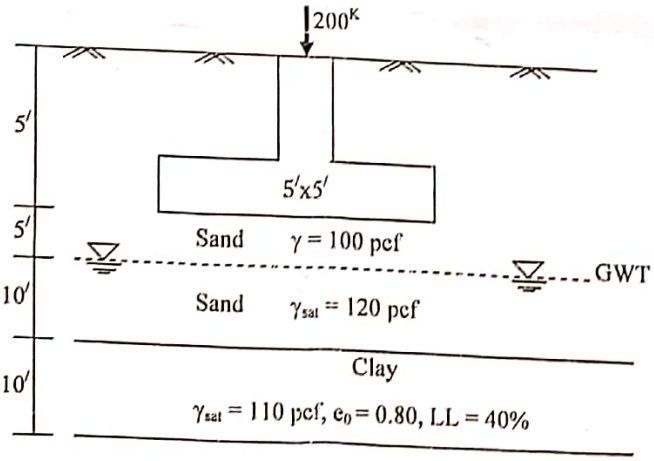
c = 50 kN/m²




Q.8 (a) What do you mean by disturbed and undisturbed soil samples? How would you collect undisturbed sample from field? 3.00

(b) Discuss the various causes of differential settlement. What measures should be taken to avoid differential settlement? 3.00

(c) Calculate the consolidation settlement (both primary and secondary) of the foundation as shown in figure below. The clay is normally consolidated. Use the weighted average method to calculate the average increase of effective pressure in the clay layer. Use $C'_\alpha$ = 0.0005 and $t_2/t_1$ = 10000. 6.00



Heaven's Light is Our Guide

**DEPARTMET OF CIVIL ENGINEERING**

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** Year **Even Semester** Examination, **2017**

**CE 3233**

**Geotechnical Engineering - II**

**Full Marks: 72** **Time: 3 Hours**

**N.B.:-**
(i) Answer any **SIX** questions, taking **THREE** from each section.
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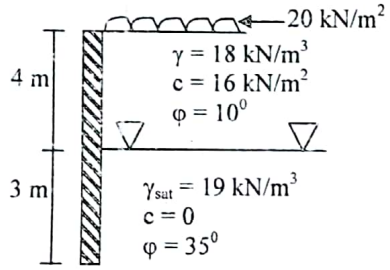
## SECTION-A

Q.1 (a) "The active pressure is the minimum pressure which develops when the wall moves away from fill" – explain. 3.00

(b) What are the assumptions of Rankine's theory? Derive expression for passive earth pressure for sandy soil. 4.00

(c) A retaining wall is shown in figure below. Compute the active force on the wall. Also compute the location of resultant force. 5.00




Q.2 (a) Derive expression for active pressure using Coulomb's theory. 4.00

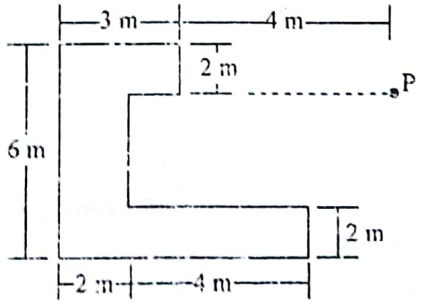
(b) A retaining wall is 7 m high with its back face smooth and vertical. It retains sand with its surface horizontal. Using Rankine's theory, determine active earth pressure at the base when the backfill is (i) dry, (ii) saturated, and (iii) submerged with water table at the surface. Take $\gamma = 18$ kN/m$^3$, $\varphi = 30^0$, and $\gamma_{sat} = 21$ kN/m$^3$. 5.00

(c) A vertical back was formed during the excavation of a soil having $\varphi = 15^0$ and unit weight of 1800 kg/m$^3$. When the depth of excavation reached 5.5 m the back failed. What was the approximate value of cohesion of clay? 3.00

Q.3 (a) What do you understand by geostatic stresses? How are these determined? 2.00

(b) Discuss the basis of the construction of Newmark's influence chart. How is it used? 5.00

(c) Determine the vertical stress increase at point P of the figure given below at a depth of 4 m. Given that q = 100 kN/m$^2$. 5.00




Q.4 (a) What do you understand by contact pressure? Draw and explain the contact pressure distribution below a mat foundation. 4.00

(b) Derive the equation for vertical pressure under a line loading. 4.00

(c) The base of a tower consists of equilateral triangular frame, on corners of which the three legs of the tower is supported. The total weight of the tower is 300 kN, which is equally carried by all the three legs. Compute the increase in vertical stress in the soil caused at a point 6 m below one of the legs. 4.00

## SECTION B

Q.5 (a) What is subsoil exploration? Why is it necessary to perform subsoil exploration before any Civil Engineering construction? 3.00

(b) How would you decide the depth of exploration and the extent of the boring? 3.00

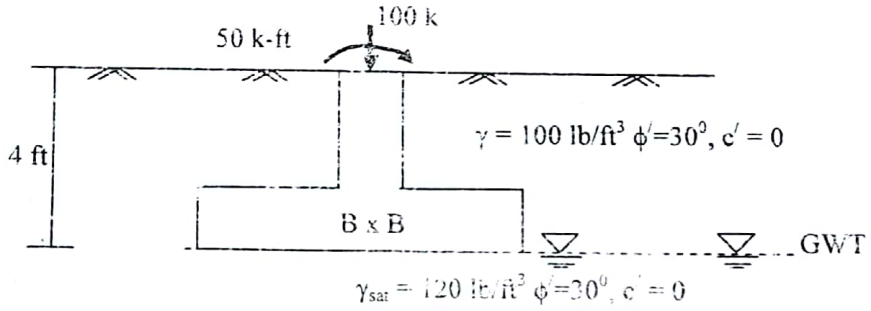
(c) Calculate the corrected SPT number using Skempton's relationship. The GWT is located at a depth of 5.5 m. The dry and saturated unit weight of sand are 18 kN/m$^3$ and 19.5 kN/m$^3$ respectively. The sand is overconsolidated sand. 6.00

| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

(b) Describe the salient features of a good subsoil exploration report. 3.00

(c) A square footing is shown in figure below. Use an FS of 3 and determine the size of the footing. 6.00




Q.7 (a) What are the limitations of Terzaghi's bearing capacity theory? 2.00

(b) What do you understand by disturbed and undisturbed soil samples? How would you collect undisturbed soil sample from field? 3.00

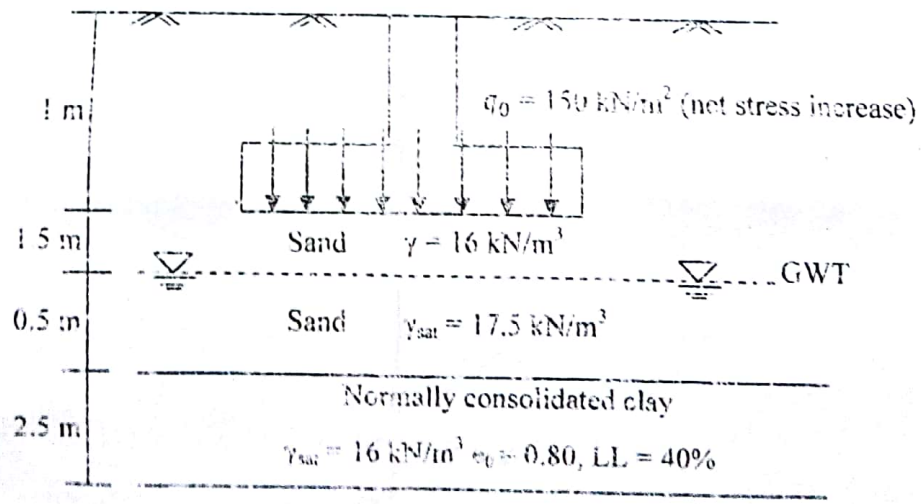
(c) Describe Culmann's method for the stability analysis of finite slopes with plane failure surfaces. 5.00

(d) How will you modify the bearing capacity equation for various locations of ground water table? 2.00

Q.8 (a) Write short notes on: (i) Floating foundation, (ii) Plate load test, and (iii) CPT. 3.00

(b) What is N-value? Why and when we need to correct the N-value? 3.00

(c) A plan of foundation 1 m x 2 m is shown in figure below. Estimate the consolidation settlement (Primary and Secondary) of the foundation. Use secondary compression index, $C_\alpha$ = 0.0013, void ratio at the end of primary consolidation, $e_p$ = 0.25, and $t_2/t_1$ = 10000. 6.00



Heaven's Light is Our Guide

**DEPARTMET OF CIVIL ENGINEERING**

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

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

# CE 3233
# Geotechnical Engineering - II

**Full Marks: 72** **Time: 3 Hours**

N.B.:-
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(iv) Assume reasonable value for any data missing.

## SECTION-A

Q.1 (a) Explain the concept of pressure bulb in soils. 3.00

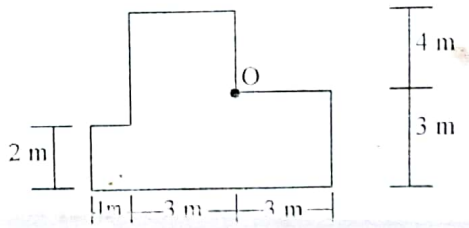
(b) Derive the principle of construction of Newmark's influence chart and explain its use. 5.00

(c) Four vertical loads of 1000 kN each are placed at the corners of a square of side 5 m. Determine the increase of vertical stress 5 m below (i) each load, (ii) mid point between adjacent loads, and (iii) the center of rectangle. 4.00

Q.2 (a) Derive as per Boussinesq's theory, expression for vertical stress at any point in a soil mass due to line load. 4.00

(b) A concentrated load of 40 kN acts on the surface of a soil. Determine the variation of vertical stress increment at points directly beneath the load upto a depth of 10 m and draw a plot. Also plot the variation of vertical stress increment due to load on horizontal planes at depths of 1 m and 2 m upto a horizontal distance of 3 m on either side of center. 4.00

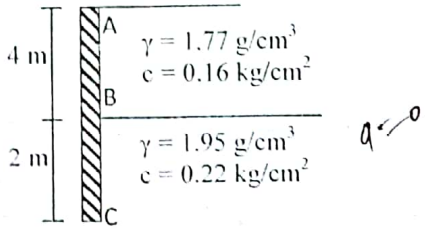
(c) The plan of a foundation is shown in figure below. The uniform load intensity on the soil is 50 kN/m$^2$. Determine the vertical stress increment due to the foundation at a depth of 5 m below point O. Use Boussinesq influence charts. 4.00




Q.3 (a) Derive an expression for active earth pressure in a dry backfill when the ground surface is inclined. 4.00

(b) Write short notes on: (i) Active earth pressure, (ii) Passive earth pressure, and (iii) Earth pressure at rest. 3.00

(c) A retaining wall of 6 m height is shown in figure below. (i) Determine total active thrust on the wall if tension crack develop, (ii) Draw the pressure distribution diagram before and after tension cracks, and (iii) Find the location of the point of application of the resultant lateral thrust. 5.00



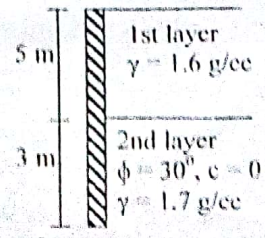

Q.4 (a) Draw with neat sketches the contact pressure distribution below a mat footing. 3.00

(b) "The active pressure is the minimum pressure which develops when the wall moves away from the fill" – explain. 4.00

(c) The consolidated drained tests on the soil of 1st layer in figure below yields the following data 5.00

| $\sigma_3$ (N/mm$^2$) | $\sigma_1$ (N/mm$^2$) |
|---|---|
| 0.2 | 0.46 |
| 0.4 | 0.88 |

Calculate the active earth force and its location after the formation of tension crack.



## SECTION B

Q.5 (a) What is subsurface exploration? Write down the purposes of subsurface exploration in the field of Geotechnical Engineering. 3.0

(b) How would you decide the depth of exploration and lateral extent of the site investigation? 3.00

(c) Calculate the corrected SPT number for the data given below. The GWT is located at a depth of 5.5 m. Given that the dry unit weight of sand from 0 to a depth of 5.5 m is 18 kN/m$^3$, and the saturated unit weight of sand for depth 5.5 m to 10.5 m is 19.5 kN/m$^3$. The sand is normally consolidated coarse sand. Use Skempton's relationship. 6.00

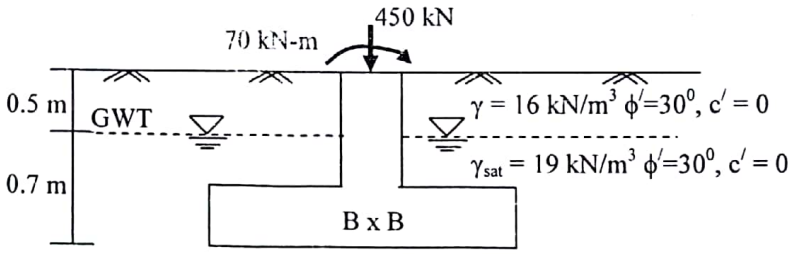
| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) Differentiate between footing and foundation. 1.00

(b) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

(c) How will you modify the bearing capacity equation for various locations of ground water table? 2.00

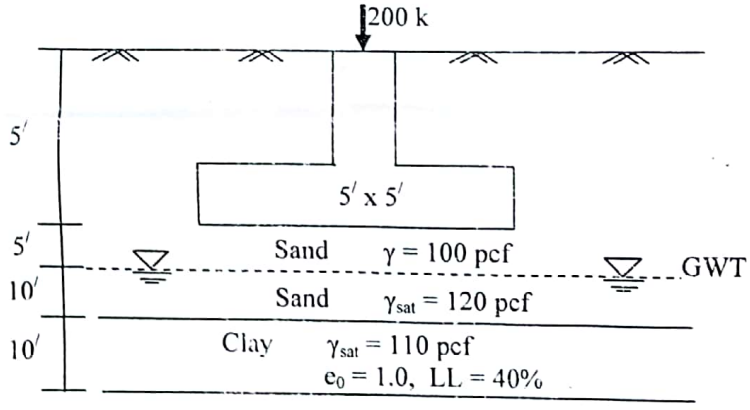
(d) A square footing is shown in figure below. Use FS = 3, and determine the size of footing. 6.00




Q.7 (a) Discuss the various causes of differential settlement. What measures should be taken to avoid differential settlement? 3.00

(b) What do you understand by disturbed and undisturbed soil samples? How would you collect undisturbed sample from field? 3.00

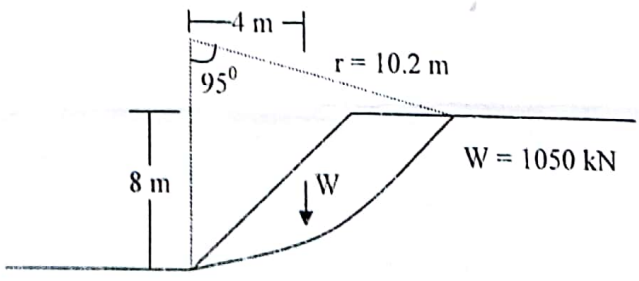
(c) Calculate the consolidation settlement (Primary and Secondary) of the foundation as shown in figure below. The clay is normally consolidated. Use the weighted average method to calculate the average increase of effective pressure in the clay layer. Use $C_\alpha' = 0.0005$ and $t_2/t_1 = 10000$. 6.00




Q.8 (a) What are the assumptions that are generally made in the analysis of slopes? Describe briefly their validity. 4.00

(b) Discuss the method for checking the stability of an infinite slope in a cohesionless soil. 4.00

(c) A 40$^0$ slope is excavated to a depth of 8 m in a deep layer of saturated clay ( c = 70 kN/m$^2$, $\phi$ = 0, and $\gamma$ = 19 kN/m$^3$). Determine the factor of safety for the trial failure surface shown in figure below. 4.00



Heaven's light is our Guide

**DEPARTMENT OF CIVIL ENGINEERING**

**RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY**

B.Sc. Engineering **THIRD** year **SIXTH SEMESTER** Examination, 2015

130070

**CE 333**

**Geotechnical Engineering-II**

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

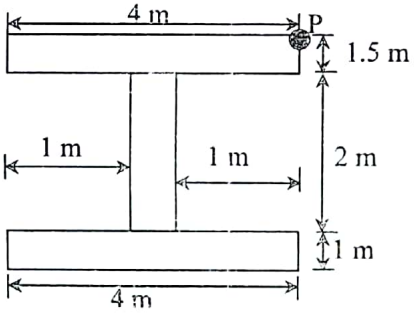
N.B.:-
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data not given.

## SECTION-A

Q.1(a) What is influence diagram? Enumerate its application. 2.67

(b) Prove that the vertical pressure due to single concentrated load can be considered negligible when horizontal radial distance is equal to twice the depth. 4.00

(c) A uniformly loaded area is shown in figure. It carries a uniform load of 60 kN/m$^2$ at ground surface. Find the vertical pressure at point *P* below 3 m depth using Newmark solution. 5.00




Q.2(a) Explain the applicability of Newmark's Influence Chart. 2.67

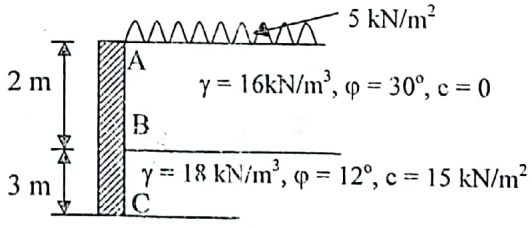
(b) Derive expression for vertical stress due to line load. 5.00

(c) A circular area is loaded with a uniform load intensity of 80 kN/m$^2$ at ground surface. Calculate the vertical pressure at a point P so situated on the vertical line through the centre of the loaded area that the area subtends an angle 90° at P. Use Boussinesq Analysis. 4.00

Q.3(a) What are the different types of earth pressure? Give examples. 3.67

(b) "The active earth pressure increases if a dry soil becomes submerged" – explain. 3.00

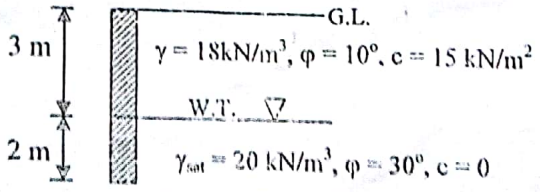
(c) A retaining wall with a stratified backfill and surcharge is shown in figure below. Draw the earth pressure diagram detailing the values at the critical points. Also estimate the resultant thrust on the wall and its position. 5.00




Q.4 (a) What do you understand by contact pressure? Draw and explain the contact pressure distribution below a mat foundation. 4.00

(b) "In actual design, contact pressure is generally taken as uniform" – justify the statement. 2.67

(c) Calculate the total active earth thrust and its location from ground level following the figure below. 5.00



## SECTION-B

Q.5 (a) What is sub-soil exploration? Write down the purposes of sub-soil exploration in the field of Geotechnical Engineering? 3.00

(b) What is N-value? Why and when we need to correct the N-value? 3.67

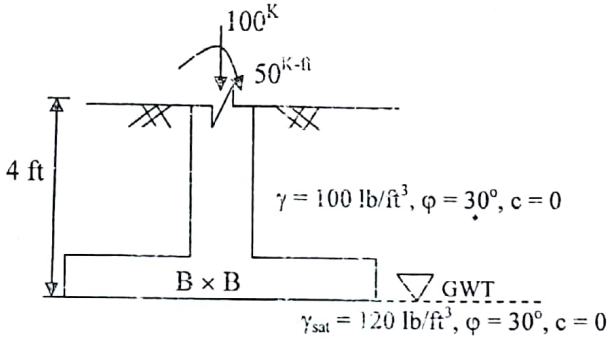
(c) Calculate the corrected standard penetration number using Skempton correction factor. The GWT is located at a depth of 5.5 m and the dry unit weight of sand and saturated unit weight of sand are 18 kN/m$^3$ and 19.5 kN/m$^3$, respectively. 5.00

| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

(b) How will you modify the bearing capacity equation for various location of ground water table? 2.67

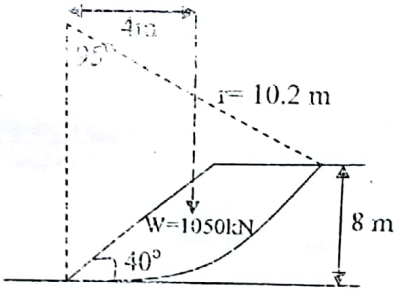
(c) A square footing is shown in figure below. Use an FS of 3 and determine the size of the footing. 6.00




Q.7 (a) What do you understand by disturbed and undisturbed soil samples? How would you collect undisturbed sample from field? 3.67

(b) How would you decide the depth of exploration and the extent of the boring? 3.00

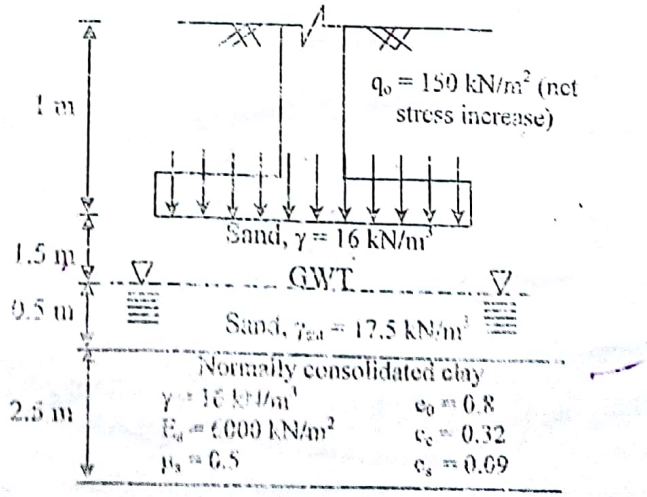
(c) A 40° slope is excavated to a depth of 8 m in a deep layer of saturated clay (c = 70 kN/m$^2$ and $\varphi$ = 0, $\gamma$ = 19 kN/m$^3$). Determine the factor of safety for the trial failure surface as shown in figure below. 5.00




Q.8 (a) Discuss the various causes of differential settlement. What measures should be taken to avoid differential settlement? 3.00

(b) Describe the salient features of a good sub-soil investigating report. 2.67

(c) A plan of a foundation 1 m × 2 m is shown in figure below. Estimate (i) Primary consolidation settlement, and (ii) secondary consolidation settlement of the foundation (Use $C'_\alpha$ = 0.0005 and $t_2/t_1$ = 10000).



Heaven's Light is Our Guide

# DEPARTMENT OF CIVIL ENGINEERING

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **THIRD** year **SIXTH SEMESTER** Examination, 2014

## CE 333

## Geotechnical Engineering - II

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

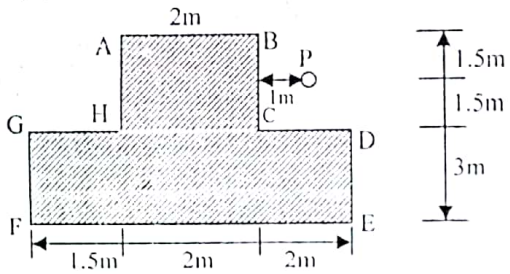
**N.B.:**
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing

## SECTION-A

Q.1(a) Describe the usefulness of Newmark's influence chart. 2.67

(b) What is Equivalent Point Load Method? Describe its limitations. 3.00

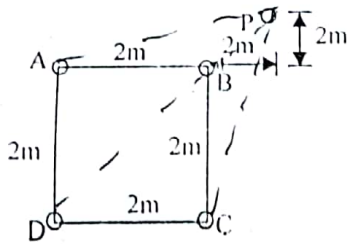
(c) A uniformly loaded area is shown in figure below. It carries a uniform load of 80 kN/m² at ground surface. Find the vertical pressure at point P below 5m of ground surface using Newmark solution. 6.00




Q.2(a) What is pressure bulb? Mention its significance. 3.67

(b) Prove that, at a given depth, when horizontal radial distance is equal to twice the depth, the vertical pressure due to single concentrated load can be considered negligible. 4.00

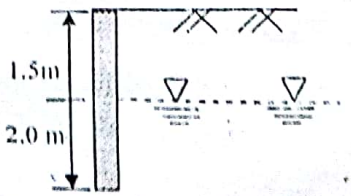
(c) A water tank of weight 1000 kN is supported by four legs as shown in figure below. Determine the increase in the vertical stress in the soil below 3m at point P. 4.00




Q.3(a) Compare between Rankin's theory and Coulomb's wedge theory for earth pressure. 2.67

(b) Derive an expression for active thrust against the retaining wall for a backfill using Coulomb's wedge theory. 3.00

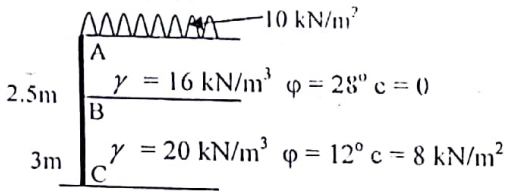
(c) A cohesionless soil with a retaining wall is shown in figure below. Determine (i) Total vertical stress (ii) Effective vertical stress (iii) Pore-pressure (iv) Horizontal pressure and (v) Location of horizontal pressure. Given: $G_s = 2.66$, $e = 0.6$ and $\varphi = 32^0$. 3.00



Q.4(a) What is contact pressure? Draw contact pressure diagram for clayey soil. 2.67

(b) Describe the effect of surcharge on clayey soil with example. 4.00

(c) A retaining wall with stratified backfill and a surcharge load is shown in figure below. (i) Draw the earth pressure diagram detailing the contact point (ii) Estimate the resultant thrust and its location. 5.00




## SECTION-B

Q.5(a) What is sub-soil exploration? What are the purposes of sub-soil exploration in Geotechnical Engineering? 3.00

(b) What is N-value? Discuss the necessity of correcting N-value. 3.67

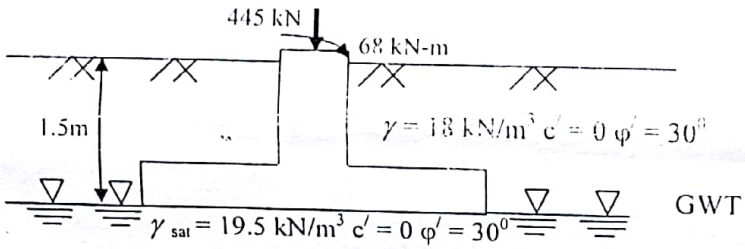
(c) Calculate the corrected standard penetration number using Liao and Whitman correction factor. The ground water table is located at a depth of 5.5 m. given that the dry unit weight of sand is 18 kN/m³ and the standard unit weight of sand is 19.5 kN/m³. 5.00

| Depth (m) | 1.5 | 3.0 | 4.5 | 6.0 | 7.5 | 9.0 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_{60}$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6(a) Discuss the limitations of Terzaghis bearing capacity equation. 1.67

(b) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.00

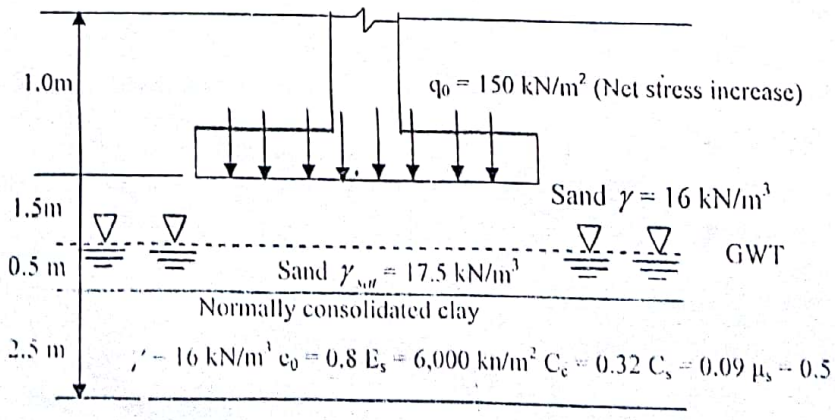
(c) A square footing is shown in figure below. Using a factor of safety of 3, determine the size of the footing. 6.00




Q.7(a) Discuss various causes of differential settlement. What measures should be taken to avoid differential settlement? 3.00

(b) How would you decide the depth of exploration and the lateral extent of the boring 2.67

(c) A plan of a foundation 1m x 2m is shown in figure below. Estimate the consolidation settlement of the foundation. 6.00




Q.8(a) Describe the salient features of good sub-soil investigation report. 3.00

(b) How will you modify the bearing capacity equation for various location of water table? 2.00

(c) What do you understand by disturbed and undisturbed soil samples? How would you obtain 3.67

Heaven's Light is Our Guide

**DEPARTMENT OF CIVIL ENGINEERING**

RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering **Third** year **Sixth Semester** Examination, 2013

**CE 333**

**Geotechnical Engineering-II**

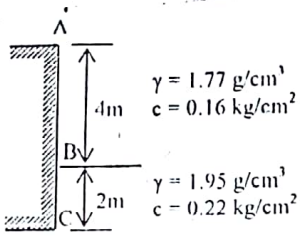
**Full marks: 70** **Time: 3 Hours**

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) Define earth pressure at rest. Derive an expression for active earth pressure in a dry backfill when the ground surface is inclined. 3.67

(b) A retaining wall of 6 m height is shown in figure below. Determine: (i) Total active thrust on the wall if tension cracks develop, (ii) Draw the pressure distribution diagram before and after tension cracks, (iii) Find the location of the point of application of the resultant lateral thrust. 5.00

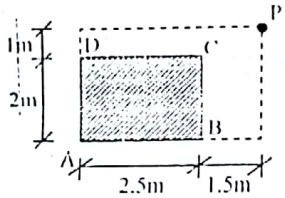



(c) A vertical excavation was made in a clay deposit having unit weight of 21 kN/m³. It caved-in after the digging reached 4 m depth. Assuming $\phi = 0$, calculate the magnitude of cohesion. 3.00

Q.2 (a) What are the assumptions in Boussinesq's formula for stress distribution in soil? 3.00

(b) What is an Influence diagram? What is its use in practice? 3.67

(c) A rectangular loaded area (shaded) is shown in figure below, which carries a load of 100 kPa. Determine the vertical stress at point 'P' at a depth of 4m. 5.00




Q.3 (a) Write down the assumptions that are made in Rankine's theory. 2.67

(b) Derive the criteria for maximum active pressure by Coulomb's theory in cohesion less soil. 4.00

(c) Derive an expression for vertical stress below the centre of a flexible circularly loaded area using Boussinesq equation. 5.00

Q.4 (a) What are the assumptions used in the solution of settlement using the theory of elasticity? 2.00

(b) What are the causes of differential settlement of foundation? Mention the allowable settlement of various structures. 2.00

(c) How earthquake condition can be incorporated to the Coulomb's active earth pressure theory? 3.67

(d) A 6m deep cut is to be made in cohesive soil with a slope of 1:1. The soil has $C_u$ = 30 kN/m², $\phi_u = 10^0$, and $\gamma$ = 18 kN/m³. Find the factor of safety with respect to cohesion. What will be the critical height of the slope in this soil? 4.00

## SECTION-B

Q.5 (a) How would you decide the depth of exploration and the lateral extent of the site investigation?

(b) Discuss standard penetration test. What are the various corrections needed in SPT value?

(c) Describe the salient features of a good sub-soil investigation report.

(d) The $N_{60}$ value at a depth of 4.5m for a sandy soil is 10. Determine the soil friction angle, $\sigma'$. 1.6

Q.6 (a) Discuss Meyerhof's bearing capacity theory? How does it differ from Terzaghi's theory? 3.67

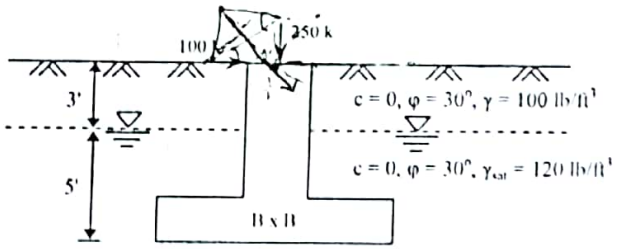
(b) Describe Skempton's analysis for bearing capacity of cohesive soil. 4.00

(c) Estimate the immediate settlement of a concrete footing, 1m x 2m size, founded at a depth of 1m in a soil with $E = 10^4$ kN/m$^2$, $\mu = 0.3$. The footing is subjected to a pressure of 200 kN/m$^2$. Assume the footing to be rigid. Given: for L/B = 2, I = 1.20. 4.00

Q.7 (a) How will you modify the bearing capacity equation for various locations of water table? 2.00

(b) What do you understand by disturbed and undisturbed samples? How would you obtain undisturbed sample from field? 3.67

(c) A square footing is shown in figure below. Using a FS of 4, determine the size of the footing. 6.00




Q.8 (a) What are the different types of slope failures? Discuss them briefly with sketches. 3.00

(b) How do you find the factor of safety of a finite slope using Bishop's Simplified Method of slices? 4.67

(c) A vertical cut is made through a homogeneous soil mass, the properties of which are c = 25 kN/m$^2$, $\sigma = 15^0$, $\gamma = 16.5$ kN/m$^3$. (i) Using Culmann's method, determine the safe depth of cut taking FS = 2.0. (ii) Also determine the safe depth using stability charts. 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 Six Semester Examination, 2012**

* Monir (100105) *

**CE 333**

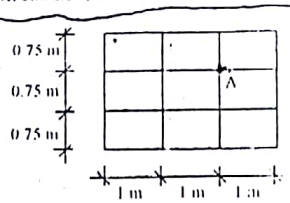
**Geotechnical Engineering-II**

**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.

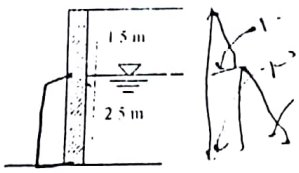
## SECTION-A

1. (a) What are the assumptions used in Boussinesq's formula for stress distribution in soil? 3.00
   (b) Derive the equation for vertical pressure under a line loading. 3.67
   (c) A rectangular foundation 3m x 2.25m carries a uniform load of 50 kPa as shown in figure below. Determine the vertical stress at 'A' which is 3m below the ground surface. 5.00




2. (a) Derive the expression for a vertical pressure at any given depth at the centre of a strip load. 4.00
   (b) Discuss briefly the equivalent point load method for calculating the vertical stress at any given point due to any loaded area. 4.00
   (c) The base of a tower consists of equilateral triangular frame, on corners of which the three legs of the tower is supported. The total weight of the tower is 800 kN, which is equally carried by all the three legs. Compute the increase in the vertical stress in the soil caused at a point 6 m below one of the legs. 3.67

3. (a) Compare between Rankine theory and Coulomb's wedge theory. 2.67
   (b) Derive expression for active thrust against the retaining wall for a backfill using Coulomb's wedge theory. 3.00
   (c) A cohesionless soil with a retaining wall is shown in figure below. Determine (i) Total vertical stress (ii) Effective vertical stress (iii) Pore pressure (iv) Horizontal pressure (v) Location of horizontal pressure. Given: $G_s = 2.66$, $e = 0.6$, $\phi = 32°$ 6.00




4. (a) Differentiate between shallow and deep foundation. 2.00
   (b) Explain how consistency of clayey soil is related to N-value. 3.00
   (c) What is $N_{cor}$? Discuss the necessity of correcting N-value. 3.00
   (d) Mention the factors that affect the N-value in the field. 3.67

## SECTION-B

5. (a) What is sub-soil exploration? What are the purposes of sub-soil exploration in Geotechnical Engineering? 3.00
   (b) What is N-value? Discuss the importance of N-value in Geotechnical Engineering. 3.67
   (c) Calculate the corrected standard penetration number. The ground water table is located at a depth of 5.5m. Given that the dry unit weight of sand from 0 to a depth of 5.5m is 18 kN/m³ and the saturated unit weight of sand for depth 5.5m to 10.5m is 19.5 kN/m³. 5.00

| Depth (m) | 1.5 | 3 | 4.5 | 6 | 7.5 | 9 | 10.5 |
|---|---|---|---|---|---|---|---|
| $N_1$ | 5 | 7 | 9 | 8 | 13 | 12 | 14 |

Q.6 (a) Differentiate between finite and infinite slopes. 3.00

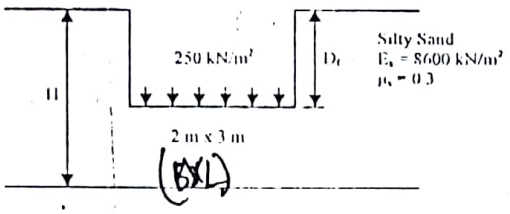
(b) What is "tension crack"? How does it affect the stability of slopes? 3.00

(c) How do you find the factor of safety of a finite slope using Swedish circle method? 5.67

Q.7 (a) What is meant by Immediate settlement? 2.67

(b) Discuss various causes of differential settlement of foundation. What measures should be taken to avoid differential settlement. 4.00

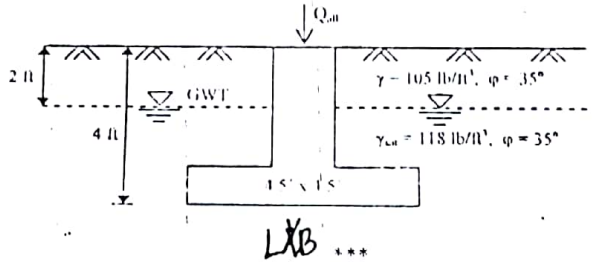
(c) A flexible area in Figure below is 2m x 3m in plan and carries a uniformly distributed load of 250 kN/m$^2$. Estimate the elastic settlement below the center of the loaded area, assume (i) H = ∞; $D_f$ = 0 and (ii) H = 6m; $D_f$ = 0. 5.00




Q.8 (a) How will you modify the bearing capacity equation for various locations of water table? 2.00

(b) What do you understand about disturbed and undisturbed samples? How would you obtain undisturbed sample from field? 3.67

(c) A square foundation is 4.5 ft x 4.5 ft in plan. Given: $D_f$ = 4 ft, φ = 35°, and c = 0. Using a FS of 3, determine the gross allowable load the foundation could carry. 6.00



Heaven's Light is Our Guide

**DEPARTMENT OF CIVIL ENGINEERING**

**RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY**

**B.Sc. Engineering Third year Sixth Semester Examination, 2011**

**CE 333**

**Geotechnical Engineering -II**

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

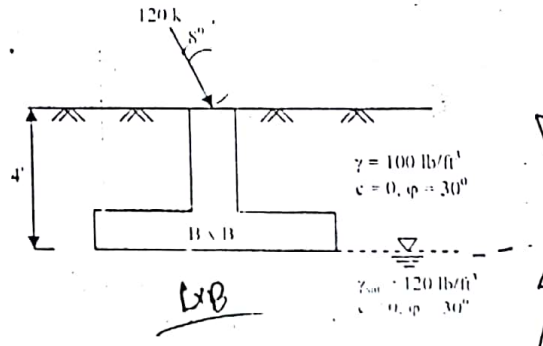
**N.B:-**
(i) Answer any SIX questions, taking THREE from each section.
(ii) Figure in the margin indicate full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing. [Necessary graphs will be supplied]

## SECTION-A

Q.1 (a) What is sub-soil exploration? Why is it necessary to do sub-soil exploration before any Civil Engineering construction? 3.00

(b) What is N-value? Discuss the importance of N-value in Geotechnical Engineering. 3.00

(c) A square footing is shown in figure below. Using a FS of 6, determine the size of footing. 5.67




Q.2 (a) Differentiate between active and passive earth pressure. 2.67

(b) "The effect of cohesion in soil is to reduce the pressure intensity"-explain the statement. 3.00

(c) An unsupported excavation is to be made in a clay layer. If $\gamma_t$ = 19 kN/m³, c = 35 kN/m² and φ = 12°, 6.00

(i) Calculate the depth of tension crack
(ii) Calculate the maximum possible unsupported depth
(iii) Draw the pressure diagram before the occurrence of crack
(iv) Draw the pressure diagram after the formation of crack

Q.3 (a) Differentiate between finite and infinite slope. 2.67

(b) Write down the applicability of the following methods 2.00
(i) Ordinary Method of slices (ii) Bishop's Simplified Method of slices.

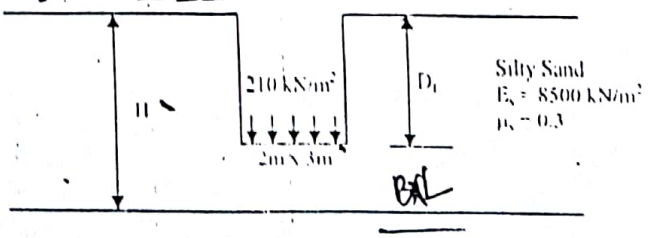
(c) Derive the equation for critical height of slope for finite slope with plane failure surface. 4.00

(d) What is Taylor's Stability Number? Write down its significance. 3.00

Q.4 (a) What are the causes of differential settlement of foundation? Mention the allowable settlement of various structures. 2.67

(b) What are the assumptions used in the solutions of settlement using the theory of elasticity? 3.00

(c) A flexible area shown in figure below is 2m x 3m in plan and carries a uniformly distributed load of 210 kN/m². Estimate the elastic settlement below the center of the loaded area. 6.00
Assume (i) H = ∞; $D_f$ = 0, (ii) H = 5m; $D_f$ = 0.

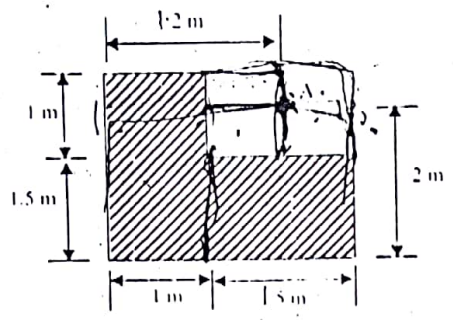


## SECTION-B

Q.5 (a) Explain Newmark's Influence Chart. How can you determine the vertical stress at any point under a uniformly loaded area of any shape using Newmark's Influence Chart?

(b) Mention the significance of pressure bulb.

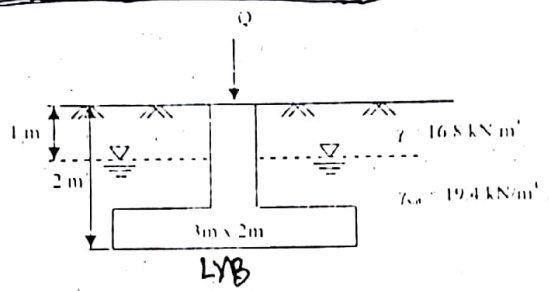
Determine the vertical stress at point A below 4m of the following figure. The foundation given in the figure below carries a uniform load of 60 kPa. 5.0




Q.6 (a) Discuss with neat sketches the nature of bearing capacity failure of soil. 3.67

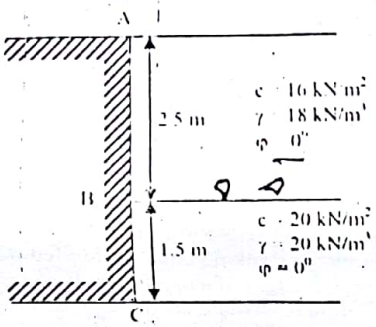
(b) How will you modify the bearing capacity equation for various locations of water table? 2.00

(c) A column foundation is 3m x 2m in plan. Given: $D_f$ = 2m, $\varphi = 25^0$, and $c = 50$ kN/m$^2$. Using FS = 4, determine the net allowable load the foundation could carry. 6.00




Q.7 (a) Write down the assumptions that are made in Rankine Theory. 2.67

(b) For an earth retaining structure shown in figure below, determine the total active earth pressure on the wall. Also draw the earth pressure distribution diagram before and after the formation of tension crack. 5.00




(c) A 6m deep cut is to be made in cohesive soil with a slope of 1:1. The soil has $C_u$ = 30 kN/m$^2$, $\varphi_u$ =10°, and $\gamma$ = 18 kN/m$^3$. Find the factor of safety with respect to cohesion. What will be the critical height of the slope in this soil? 4.00

Q.8 (a) What do you understand about disturbed and undisturbed samples? How would you obtain undisturbed samples from field? 3.67

(b) What is meant by $N_{cor}$? When and why should we use $N_{cor}$ instead of N? 4.00

(c) Calculate the corrected standard penetration number. The ground water table is located at a depth of 5.5m. Given that the dry unit weight of sand from 0 to a depth of 5.5m is 18 kN/m$^3$ and the saturated unit weight of sand for depth 5.5m to 10.5m is 19.5 kN/m$^3$. 4.00

| Depth (m) | $N_f$ |
|---|---|
| 1.5 | 5 |
| 3 | 7 |
| 4.5 | 9 |
| 6 | 8 |
| 7.5 | 13 |
| 9 | 12 |
| 10.5 | 14 |

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc Engineering **THIRD** year **SIXTH SEMESTER** Examination, 2010

**CE 333**
**Geotechnical Engineering - II**

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

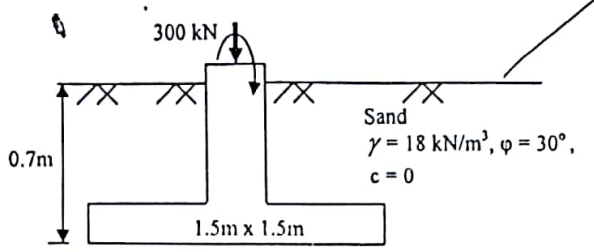
**N.B.:**
(i) Answer SIX questions, taking THREE from each section.
(ii) Figure in the margin indicates full marks.
(iii) Use separate answer script for each section.
(iv) Assume reasonable value for any data missing

## SECTION-A

Q.1(a) What is sub-soil exploration? What are the purposes of sub-soil exploration in geotechnical engineering? 3.67

(b) What is N-value? Discuss the importance of N-value in geotechnical engineering. 3.00

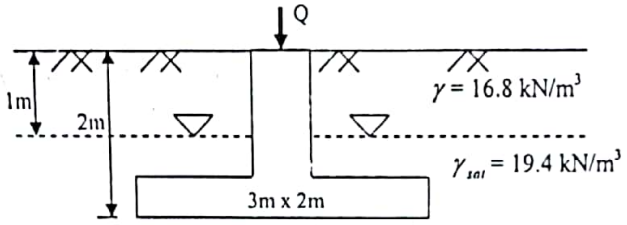
(c) A square footing of 1.5m x 1.5m is shown in figure below. Assume that the one-way load eccentricity e = 0.15m. Determine the allowable bearing capacity of the footing using a FS of 3. 5.00




Q.2(a) How earthquake condition can be incorporated to the Coulomb's active earth pressure theory? 3.67

(b) Discuss with neat sketches the nature of bearing capacity failure in soil. 3.00

(c) A column foundation is 3m x 2m in plan. Given: $D_f$ = 1.5m, φ = 25°, and c = 50 kN/m². Using FS = 4, determine the net allowable load the foundation could carry. 5.00




Q.3(a) What is stability number? What is its utility in the analysis of stability of slopes? 3.67

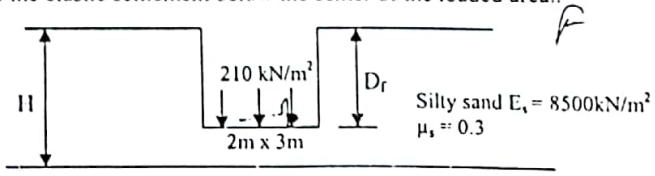
(b) What is Taylor's stability chart? How do you find the factor of safety of a finite slope using Swedish circle method? 5.00

(c) Define the following terms: (i) Newmark's influence chart, (ii) Negative skin friction and (iii) Point bearing piles. 3.00

Q.4(a) What are the causes of differential settlement of foundation? Mention the allowable settlement of various structures. 2.67

(b) Write short notes on: (i) Pressure bulb (ii) Isobar. 3.00

(c) A flexible area shown in figure below is 2m x 3m in plan and carries a uniformly distributed load of 210 kN/m². Estimate the elastic settlement below the center of the loaded area. 6.00

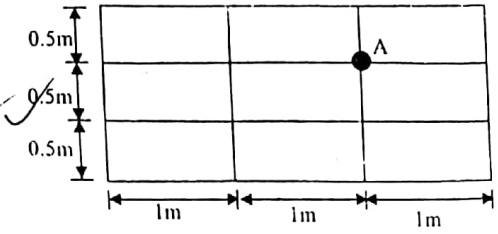



Assume (i) H = ∞ $D_f$ = 0
(ii) H = 5m $D_f$ = 0

Q.5(a) What are the assumptions in Bousineq's formula for stress distribution in soil? 3.00

(b) Derive the equation for vertical pressure under a line loading. 5.67

(c) A rectangular foundation 3m x 1.5m carries a uniform load of 50 kPa as shown in figure below. Determine the vertical stress at A which is 3m below the ground surface. 5.00

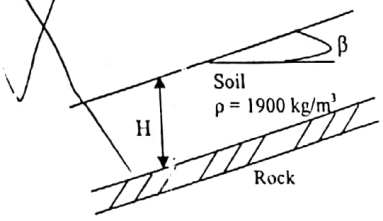



Q.6(a) Deduce the condition for which maximum pressure will generate from a sliding wedge. 5.67

(b) An infinite slope is shown in figure below. The shear strength parameters at the interface of soil and rock are as $c = 18$ kN/m$^2$ and $\varphi = 25°$ 6.00

(i) If H = 8m and $\beta = 20°$ find the factor of safety against sliding on the rock surface.

(ii) If $\beta = 30°$ find the height, H for FS = 1 (Assume pore water pressure to be zero).




Q.7(a) Deduce Rankine's active and passive earth pressure equations. 6.00

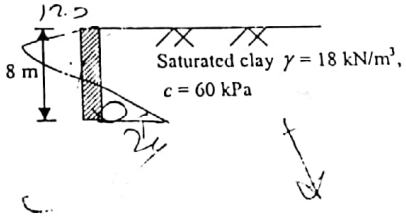
(b) Differentiate between the general shear failure and the local shear failure. How the ultimate bearing capacity in local shear failure is determined? 3.67

(c) How the bearing capacity of footing on a layered cohesive soil deposit is determined? 2.00

Q.8(a) What are the conditions where a pile foundation is more suitable than a shallow foundation? 3.00

(b) What do you understand about disturbed and undisturbed samples? How would you obtain undisturbed samples from field? 3.67

(c) A rectangular wall that has a saturated clay backfill is shown in figure below. Determine (i) maximum depth of the tensile crack, (ii) active pressure before the tensile crack (iii) active pressure after the tensile crack. 5.00






(d) "Undisturbed samples are not usually removed from the samplers in the field" explain. 3.00

III/CE (13S) CT-01 on CE3233 Time:20 min

Q.1 Which of the earth pressure coefficients among active, passive and at-rest gives the highest effect on a retaining wall and why? 05

Q.2 Show that a cohesive backfill can be kept unsupported for a height of $4c/\gamma\sqrt{K_a}$ 07

Q.3 A soil has the following properties: c=9 kN/m$^2$, $\phi$=20° and $\gamma$=18 kN/m$^3$. Draw the active and passive earth pressure diagram before and after formation of tension cracks if the ground carries a surcharge load of 3kN/m$^2$. Calculate also the magnitude of surcharge, at which the excavation is not possible without any lateral support. 08

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**Class Test on CE3233 (14s)**

Q.1 A retaining wall supports multilayer soil. The upper layer has the soil properties: $H_1$=3 m, $\gamma$=16.5 kN/m$^3$, $\phi$=30°, c=20 kN/m$^2$. The lower soil has the soil properties: $H_2$=3 m $\gamma_{sat}$=18.5 kN/m$^3$, $\phi$=35°, c=0 kN/m$^2$. The soil carries a surcharge of 30 kN/m$^2$. The water table is located at the depth of 3 m from top surface. (i) Draw the earth pressure distribution diagram (ii) Find the lateral force on the wall (iii) The location of the resultant force on the wall. 12

Q.2 A soil has the following properties: $\gamma$=18 kN/m$^3$, $\phi$=20°, c=10 kN/m$^2$. Calculate the critical depth of a vertical excavation that can be made in the soil without any lateral support. Also calculate the value of surcharge for which the soil is critically stable without any support. 8

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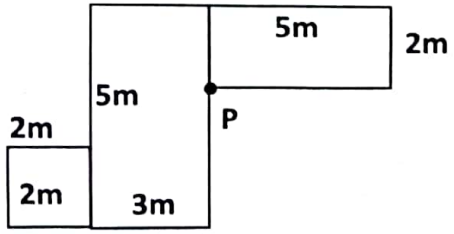
**Class Test-2 CE 3233 FM=20**

Q.1 Compute $\sigma_z$ at point P, 3 m below GL using Newmark's solution if $q$=100 kPa.

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