R15

Code No: 125EQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
GEOTECHNICAL ENGINEERING
(Civil Engineering)

Time: 3 hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a)	Comment on significance and importance for Toughness Index.	[2]
b)	Derive the relation between void ratio and porosity.	[3]
c)	What do you mean by Capillary water?	[2]
d)	What are the uses of flow net?	[3]
e)	What is the purpose of compacting the soil? Comment your answer.	[2]
f)	State the Boussinesq's and Westergaard's theories for point load.	[3]
g)	Discuss the limitations of Terzaghi's theory of consolidation.	[2]
h)	Differentiate between Consolidation and Compaction.	[3]
i)	What is Mohr-Coulomb theory of failure?	[2]
j)	Define critical void ratio and draw the void ratio variations for loose and dense sand with the strain.	[3]

PART - B

(50 Marks)

2.a) A sheet of water of thickness 1 m is available to fill the voids of cohesionless soil to a degree of saturation of 80%. The soil has a void ratio of 0.5. Determine the thickness of soil layer required to accommodate this amount of water.

b) Describe briefly different types of soil structures. [5+5]

OR

3.a) Explain the laboratory procedure for determining the percentage fines by Hydrometer analysis.

b) A compacted cylindrical specimen of 45 mm diameter and 90 mm length is to be prepared from oven dry soil. The specimen is required to have water content of 12% and percent air voids of 18%. Determine the weight of soil mass and mass of water required for the preparation of the above specimen (Take G=2.72). [5+5]

4. A non-homogeneous soil deposit consists of a silt layer sandwiched between a fine sand later at top and a clay layer below. Permeability of silt layer is 10 times the permeability of clay layer and one-tenth of the permeability of the sand layer. Thickness of silt layer is 2 times the thickness of the sand layer and two-third of the thickness of the clay layer. Determine the ratio of equivalent horizontal and equivalent vertical permeability of the deposit. [10]

OR

5.a) A uniform homogeneous sand deposit of specific gravity 2.60 and void ratio 0.65 extends to a large depth. The ground water table is 2 m from ground level. Determine the effective, neutral, and total stress at depths of 2 m and 6 m. Assume that the soil from 1 m to 2 m has capillary moisture leading to degree of saturation of 60%.

b) Discuss the characteristics of flow net. [5+5]

6.a) Discuss the assumptions of Boussinesq's theory. Explain its limitations.

b) Using Boussinesq's expression, derive the expression for vertical stress at depth 'z' under the centre of a circular area of radius, 'r' loaded uniformly with a load 'q' at the surface of the mass of soil. [5+5]

OR

7.a) Explain about field compaction equipment and their suitability with respect to type of soil.

b) Explain the contact pressure distribution beneath a rigid footing founded on cohesive and Cohesion less Soils. [5+5]

8. A 2 cm thick sample of clay was taken from field for predicting the times of settlement for a proposed building which exerts a uniform pressure of 200 kN/m^2 over the clay stratum. The sample was loaded to 200 kN/m^2 and proper drainage was allowed from top and bottom. It was seen that 50% of the total settlement occurred in 180 seconds. Find the time required for 50% of the total settlement of the building if it is to stand on 8m thick layer of clay which extends from ground surface and is underlain by sand.[10]

OR

9.a) Explain Taylor's square root of time fitting method to determine coefficient of consolidation.

b) A layer of soft saturated clay, 5m thick, lies under a newly constructed building. The effective pressure due to overlaying strata on the clay layer is 300 kN/sq.m, and the new construction increases the effective overburden pressure by 120 kN/sq.m. If the compression index of the clay is 0.45, compute the settlement, assuming the natural water content of the clay layer to be 45%, and the specific gravity of its soil grains as 2.7. [5+5]

10.a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes?

b) In an unconfined compression test, a sample of 7.5cm long and 3.5cm in diameter fails under a load of 90N at 10% strain. Compute the unconfined compressive strength and shear strength of the sample. [5+5]

OR

11.a) Explain briefly about tri-axial test. Also explain its merits.

b) In a direct shear test on a sand sample, the normal stress was 200 kN/m^2 and the sample failed at a shear stress of 120 kN/m^2. Determine (i) the angle of shearing resistance of the soil, (ii) the magnitude of the major and the minor principal stresses, (iii) the orientation of the principal planes. [5+5]

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Code No: 125EQ **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May - 2018
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) A fully saturated soil sample has a water content of 35% and specific gravity of 2.65. Determine its porosity, saturated unit weight and dry unit weight. [2]
b) A clay soil has a liquid limit of 62% and plastic limit of 34%. Classify the soil as per the IS classification. [3]
c) The effective size of a silt is 0.01 mm. The void ratio is 0.7. What is the height of capillary rise of water in this soil? [2]
d) Define the terms discharge velocity and seepage velocity. [3]
e) State the Boussinesq's and Westergaard's theories for point load. [2]
f) Explain briefly the mechanism of compaction. [3]
g) How do you determine the pre-consolidated pressure? [2]
h) Write a short note on stress history of clay. [3]
i) Define the term dilatancy. [2]
j) Explain Liquefaction. [3]

PART - B

(50 Marks)

2.a) A clay soil has a liquid limit of 52%. The volume of the soil sample in the shrinkage dish at the liquid limit is 0.0401×10^{-3} m^3 and its shrinks to a volume of 0.0261×10^{-3} m^3 at the shrinkage limit. The specific gravity of solids is 2.72. Determine the shrinkage limit of the soil.
b) Write a brief note on soil formation. [5+5]

OR

3.a) Distinguish between the residual soil and transported soil.
b) What are building blocks of clay minerals? Explain three common groups of clay minerals. [5+5]

4.a) Discuss the different methods to determine the permeability of a soil sample?
b) A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5 m below ground level. If the bulk density of saturated sand is 1.8 g cc^{-1}, calculate the effective and neutral pressure on the top of the clay layer. [5+5]

OR

5.a) Discuss briefly the merits and demerits of different methods determining permeability and special applications.
b) Write a short on characteristics of flow net. Give its uses. [5+5]

6.a) A concentrated point load of 200 kN acts at the ground surface. Find the intensity of vertical pressure at a depth of 10 meters below the ground surface, and situated on the axis of loading. What will be the vertical pressure at a point at a depth at 5 m and at a distance of 2 m from the axis of loading? Use Westergaard analysis taking $\mu = 0$.

b) Discuss the factors which affect compaction of soils in embankments. [5+5]

OR

7. Describe briefly about Newmark's influence chart for irregular areas. [10]

8.a) How do you estimate the field e-p curve of an over consolidated clay?

b) Briefly explain the physical meaning of the coefficient of consolidation. [5+5]

OR

9.a) Why does it take infinite time for complete consolidation to occur?

b) Explain the Terzaghi's 1-D consolidation theory. [5+5]

10.a) Define critical void ratio. Explain the shear behavior of a soil whose void ratio is less than the critical ratio.

b) A vane of 80 mm diameter and 160 mm height has been pushed into an in-situ soft clay at the bottom of a bore hole. The torque required to rotate the vane was 76 N-m. Determine the undrained shear strength of the clay. After the test, the vane was rotated several times and the ultimate torque was found to be 50 N-m. Estimate the sensitivity of the clay. [5+5]

OR

11.a) Discuss the type of laboratory triaxial test you would recommend for the initial stability of a foundation on saturated clay.

b) Explain why the angle of failure plane observed in a shear test might differ more often from that predicted from Mohr diagram at failure. [5+5]

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 2019
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a)	Define density index and consistency index.	[2]
b)	Write about consistency limits.	[3]
c)	Write about principle of effective stress.	[2]
d)	Write short notes on quick sand condition.	[3]
e)	Write about mechanism of compaction.	[2]
f)	Discuss any three factors affecting compaction.	[3]
g)	Define immediate settlement and primary consolidation settlement.	[2]
h)	Write about stress history of clay using e- logσ curves.	[3]
i)	Define liquefaction and critical void ratio.	[2]
j)	Write about laboratory vane shear test to measure undrained shear strength.	[3]

PART - B

(50 Marks)

2.a) Derive the relation between void ratio and porosity.
b) A soil sample has a liquid limit of 75% and its plasticity index is 55 with a natural water content of 18%. Determine its plastic limit and liquidity index. [5+5]

OR

3.a) Explain step by step procedure to classify coarse grained soils.
b) A partially saturated sample has a moisture content of 15% and bulk unit weight of 21.5kN/m^3. The specific gravity of solids is 2.67. Determine void ratio, degree of saturation. [5+5]

4.a) Explain the laboratory procedure to determine coefficient of permeability by constant head method.
b) Determine the effective stress at a depth of 6 m below the ground level. The water table is at 2m below ground surface. The water content of the soil above water table is 10%. Take G = 2.65, e = 0.57. Neglect capillary flow. [5+5]

OR

5.a) Write about characteristics and uses of flownets.
b) In a laboratory permeability test, the discharge of water collected from a constant head permeameter in a period of 12 minutes is 250ml. The internal diameter of the permeameter is 8cm and the measured difference in head between two gauging points 15 cm vertically apart is 90cm. Calculate the coefficient of permeability. [5+5]

6.a) Write briefly about field compaction equipment.

b) A circular area of radius 4m carries a uniformly distributed load of 150kN/m^2. Determine the intensity of vertical pressure at 5m beneath the centre of the circle using Boussinesq's theory. [5+5]

OR

7.a) Write briefly about compaction control.

b) Using Westergaurd's theory, determine the vertical stress at a depth of 4m directly under the point load of 400kN acting at the surface of a soil mass and also at a horizontal distance of 3m. [5+5]

8.a) Explain Taylor's square root of time fitting method to determine coefficient of consolidation.

b) A 20mm thick consolidometer clay sample reached 80% consolidation in 1.2hours with double drainage. How long would it take for the clay layer from which this sample was obtained to reach 80% consolidation? The clay layer of 8m has single drainage. [5+5]

OR

9.a) Explain about preconsolidation pressure and its determination by Casagrande's method.

b) A clay layer of 6m thick has a settlement of 25mm when the stress was increased from 50kN/m^2 to 100kN/m^2. What will be the settlement if the stress is increased from 100kN/m^2 to 150kN/m^2 for the same clay layer? [5+5]

10.a) Explain about drainage conditions in Triaxial tests.

b) Discuss about shear strength of sands. [5+5]

OR

11.a) Write about shear strength of clays.

b) In an unconfined compression test, a sample of 7.5cm long and 3.5cm in diameter fails under a load of 90N at 10% strain. Compute the unconfined compressive strength and shear strength of the sample. [5+5]

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Code No: 125EQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2017
GEOTECHNICAL ENGINEERING
(Common to CEE, CE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) A soil has bulk unit weight of 18 kN/m^3. If the water content of soil is 10%, estimate its dry unit weight. [2]
b) A clay soil has liquid limit and plastic limits 70% and 30% respectively. If the liquidity index of clay is 0.5, estimate its natural moisture content and plasticity index. [3]
c) Prove that the shear strength of soil is zero during quick sand condition. [2]
d) A soil has seepage velocity as 1×10^{-3} cm/s, and porosity 0.45, estimate its discharge velocity. [3]
e) Write the assumptions of Boussinesq's theory. [2]
f) Define compaction effort with formula. [3]
g) A soil has failure angle as 60^0, then estimate its angle of internal friction. [2]
h) Define critical void ratio and draw the void ratio variations for loose and dense sand with the strain. [3]
i) Define coefficient of volume compressibility and compression index. [2]
j) Write the reasons for pre consolidation of soil. [3]

PART - B

(50 Marks)

2.a) Define :
(i) Void ratio, (ii) Porosity, (iii) Degree of saturation, (iv) Water content, (v) Dry density, (vi) Bulk density, (vii) Submerged density.
b) Derive from fundamentals:
$S.e = w.G$,
Where; S represents degree of saturation, e represents void ratio, w represents water content, and G represents grain specific gravity.
c) A soil has porosity 40% and specific gravity 2.67, estimate its dry unit weight. Assume unit weight of water as 10 kN/m^3. [4+3+3]

OR

3.a) Sketch typical complete grain-size distribution curves for (i) well graded soil and (ii) uniform silty sand. Form the curves, determine the uniformity coefficient and effective size in each case. What qualitative inferences can you draw regarding the engineering properties of each soil?
b) The following data refer to a sample of soil:
Percent passing 4.75 mm IS Sieve = 64
Percent passing 75-μ IS Sieve = 6
Uniformity Coefficient = 7.5
Coefficient of Curvature = 2.7
Plasticity index = 2.5
Classify the soil. [4+6]

4.a) What are the various parameters that effect the permeability of soil in the field ? Critically discuss.

b) A uniform homogeneous sand deposit of specific gravity 2.60 and void ratio 0.65 extends to a large depth. The ground water table is 2 m from ground level.. Determine the effective, neutral, and total stress at depths of 2 m and 6 m. Assume that the soil from 1 m to 2 m has capillary moisture leading to degree of saturation of 60%. [4+6]

OR

5.a) Define coefficient of permeability and list four factors on which the permeability depends.

b) A concrete dam retains water to a height of 9 m. It has rows of sheet piling at both heel and toe which extend half way down to an impervious stratum. From a flow net sketched on a transformed section, it is found that there are four flow channels and sixteen head drops. The average horizontal and vertical permeabilities of the soil are 6×10^{-3} mm/s and 2×10^{-3} mm/s, respectively. What is the seepage per day, if the length of the dam is 150 metres? [4+6]

6.a) Write a brief note on the 'compaction in the field' bringing out the various types of rollers and their effectiveness with respect to different soil types.

b) The following results were obtained in a compaction test. Determine the optimum moisture content and the maximum dry density by plotting the data. [4+6]

Moisture Content (%)	7.4	9.7	10.5	11.5	13.1	14.4
Bulk Unit Weight (kN/m^3)	18.81	20.07	20.52	21.06	21.06	20.07

OR

7.a) Write a brief critical note on 'Newmark's influence chart'.

b) A ring foundation is of 3 m external diameter and 2.00 m internal diameter. It transmits a uniform pressure of 90 kPa. Calculate the vertical stress at a depth of 1.5 m directly beneath the centre of the loaded area. [6+4]

8.a) Distinguish between normally consolidated and over consolidated soils. Explain in detail any one method for determining the coefficient of consolidation of a soil.

b) A clay stratum is 4.5 m thick and rests on a rock surface. The coefficient of consolidation of a sample of this clay was found to be 4.5×10^{-8} m^2/s in the laboratory. Determine probable period of time required for the clay stratum to undergo 50% of the ultimate settlement expected under a certain increment of pressure. [5+5]

OR

9.a) What is preconsolidation pressure? Explain the Casagrande's graphical method for its evaluation.

b) A soft, normally consolidated clay layer is 18 m thick. The natural water content is 45%. The saturated unit weight is 18 kN/m^3; the grain specific gravity is 2.70 and the liquid limit is 63%. The vertical stress increment at the centre of the layer due to the foundation load is 9 kN/m^2. The ground water level is at the surface of the clay layer. Determine the settlement of the foundation at the centre of the layer. [4+6]

10.a) What are the advantages and disadvantages of a triaxial compression test? Briefly explain how you conduct the test and compute the shear parameters for the soil from the test data.

b) From a direct shear test on an undisturbed soil sample, the following data have been obtained. Evaluate the undrained strength parameters by plotting the results. [5+5]

Normal Stress (kPa)	70	96	114
Shear Stress (kPa)	138	156	170

OR

11.a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes?

b) An embankment consists of clay fill for which cohesion is 25 kPa and angle of internal friction is 27^0 (from consolidated undrained tests with pore-pressure measurement). The average bulk unit-weight of the fill is 20 kN/m^3. Estimate the shear-strength of the material on a horizontal plane at a point 20 m below the surface of the embankment, if the pore pressure at this point is 180 kPa as shown by a piezometer. [5+5]

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2018
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Draw typical grain-size distribution curves for (i) uniform (ii) gap graded (iii) well graded soils. [2]
b) List the common clay minerals and summarize their key properties. [3]
c) Explain the terms quick condition and critical hydraulic condition. [2]
d) What are the assumptions for Darcy's law to be valid? Discuss each of them. [3]
e) State the basic requirements to be satisfied for the validity of Boussinesq's equation for stress distribution. [2]
f) Explain the concept of 'Pressure Bulb' in soils. List the various factors that influence the compaction of soils, show their influence with illustrative sketches of compaction curves. [3]
g) Define the terms 'Compression index', 'coefficient of consolidation', and 'coefficient of compressibility'. [2]
h) What are the assumption's in Terzaghi's theory of one-dimensional consolidation? [3]
i) Differentiate between unconsolidated undrained test and a drained test. [2]
j) Explain basic differences between a box shear test and a triaxial shear test for soils. [3]

PART - B

(50 Marks)

2.a) A soil sample is partially saturated. Its natural moisture content was found to be 22% and bulk density 2 g/cm^3. If the specific gravity of the solid particles be 2.65 and the density of water be taken as 1 g/cm^3., find out the degree of saturation and the void ratio. If the soil is saturated what will be its saturated unit weight?
b) An undisturbed saturated specimen of clay has a volume of 18.9 cm^3 and a mass of 30.2 g. on oven drying, the mass reduces to 18.0 g. the volume of dry specimen as determined by displacement of mercury is 9.9 cm^3. Determine shrinkage limit, specific gravity, shrinkage ratio and volumetric shrinkage. [5+5]

OR

3.a) The liquid limit of a soil is 59%, the plastic limit is 23% and the natural moisture content is 46%. What is the liquidity index? What is its significance? Define shrinkage limit and shrinkage ratio.
b) A clayey soil has natural moisture content of 15.8%. The specific gravity of soil is 2.72. Its saturation percentage is 70.8%. The soil is allowed to soak up water. After some time, the saturation increases to 90.8%. Find out the water content of the soil in latter case. [5+5]

4.a) In a falling head permeability test on sample 12.2 cm high and 44.41 cm^2 in cross-sectional area, the water level in a standpipe of 6.25 mm internal diameter dropped from a height of 75 cm to 24.7 cm in 15 minutes. Find the coefficient of permeability.

b) Give the characteristics of Flow nets. What is the theoretical height of capillary rise and the capillary pressure in a fine grained soil with effective size D_{10} of 0.002 mm. [5+5]

OR

5.a) In a deposit of fine sand, the water table is 3 m below the ground surface. But the sand upto a height of 1 m above the water table is saturated by capillary water. The sand above this height may be considered dry. For the sand, Gs is 2.68 and porosity is 40%. Calculate the effective stress at the depth of 8 m.

b) What are the factors affecting permeability? A horizontal stratified deposit consists of three layers each uniform in itself. The permeability of the layers are 8×10^{-6} m/s, 50×10^{-6} m/s and 15×10^{-4} m/s and their thicknesses are 6 m, 3 m and 18 m respectively. Find effective average permeability of the deposit in horizontal and vertical direction. [5+5]

6.a) Explain Newmark's influence chart for finding vertical stresses in soil.

b) During a compaction test, a soil attains MDD of 18.6 kN/m^3 at a moisture content of 15%. Taking specific gravity of soils as 2.7, find the degree of saturation and percentage air voids at MDD. What will be the dry density corresponding to zero air voids at OMC. How does compaction improve the engineering properties of soils?[5+5]

OR

7.a) A strip footing 3 m wide is loaded on the ground surface with a pressure of 100 kN/m^2. A 4m thick soft clay layer exits at a depth of 10 m below the foundation. Find the average increase in vertical stress at the clay layer under the centre line and edge of the building.

b) From Proctor's compaction test, the maximum dry density of a soil was found to be 1.75 g/cc and OMC 14.5%. The specific gravity of the soil grains was 2.6. Find out the degree of saturation and percentage air voids at the optimum state. What is zero air voids line? [5+5]

8.a) Explain square root time fitting methods for C_v estimation.

b) A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 0.25 to 0.50 kgf/cm^2. Calculate the coefficient of compressibility and the coefficient of volume compressibility. If the coefficient of consolidation determined in the test for the given stress increment was 10 m^2/ year, calculate the coefficient of permeability in cm/s. If the samples tested at the site was taken from a clay layer 3 m in thickness, determine the consolidation settlement resulting from the given stress increment. [5+5]

OR

9.a) Explain height of solids method for void ratio estimation.

b) A certain clay layer has a thickness of 5 m. After 1 year, when the clay was 50% consolidated, 8 cm of settlement had occurred. For a similar and loading conditions, how much settlement would occur at the end of 1 year and 4 years respectively, if the thickness of this new layer is 25 m? [5+5]

10.a) In an insitu vane shear test on a saturated clay, a torque of 35 Nm was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 5 Nm. Determine the sensitivity of the clay.

b) Explain unconfined compression test and Vane shear test. [5+5]

OR

11.a) In a direct shear test on a sand sample, the normal stress was 200 kN/m^2 and the sample failed at a shear stress of 120 kN/m^2. Draw the mohr circle and the strength envelope. Determine (i) the angle of shearing resistance of the soil, (ii) the magnitude of the major and the minor principle stresses, (iii) the orientation of the principal planes.

b) Write the Mohr Coulomb failure criterion. [5+5]

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, January/February - 2023
GEOTECHNICAL ENGINEERING
(Civil Engineering)

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PART - A

(25 Marks)

1.a)	Comment on significance and importance for Toughness Index.	[2]
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i)	What is Mohr-Coulomb theory of failure?	[2]
j)	Define critical void ratio and draw the void ratio variations for loose and dense sand with the strain.	[3]

PART - B

(50 Marks)

2.a) A sheet of water of thickness 1 m is available to fill the voids of cohesionless soil to a degree of saturation of 80%. The soil has a void ratio of 0.5. Determine the thickness of soil layer required to accommodate this amount of water.

b) Describe briefly different types of soil structures. [5+5]

OR

3.a) Explain the laboratory procedure for determining the percentage fines by Hydrometer analysis.

b) A compacted cylindrical specimen of 45 mm diameter and 90 mm length is to be prepared from oven dry soil. The specimen is required to have water content of 12% and percent air voids of 18%. Determine the weight of soil mass and mass of water required for the preparation of the above specimen (Take G=2.72). [5+5]

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OR

5.a) A uniform homogeneous sand deposit of specific gravity 2.60 and void ratio 0.65 extends to a large depth. The ground water table is 2 m from ground level. Determine the effective, neutral, and total stress at depths of 2 m and 6 m. Assume that the soil from 1 m to 2 m has capillary moisture leading to degree of saturation of 60%.

b) Discuss the characteristics of flow net. [5+5]

6.a) Discuss the assumptions of Boussinesq's theory. Explain its limitations.

b) Using Boussinesq's expression, derive the expression for vertical stress at depth 'z' under the centre of a circular area of radius, 'r' loaded uniformly with a load 'q' at the surface of the mass of soil. [5+5]

OR

7.a) Explain about field compaction equipment and their suitability with respect to type of soil.

b) Explain the contact pressure distribution beneath a rigid footing founded on cohesive and Cohesion less Soils. [5+5]

8. A 2 cm thick sample of clay was taken from field for predicting the times of settlement for a proposed building which exerts a uniform pressure of 200 kN/m^2 over the clay stratum. The sample was loaded to 200 kN/m^2 and proper drainage was allowed from top and bottom. It was seen that 50% of the total settlement occurred in 180 seconds. Find the time required for 50% of the total settlement of the building if it is to stand on 8m thick layer of clay which extends from ground surface and is underlain by sand.[10]

OR

9.a) Explain Taylor's square root of time fitting method to determine coefficient of consolidation.

b) A layer of soft saturated clay, 5m thick, lies under a newly constructed building. The effective pressure due to overlaying strata on the clay layer is 300 kN/sq.m, and the new construction increases the effective overburden pressure by 120 kN/sq.m. If the compression index of the clay is 0.45, compute the settlement, assuming the natural water content of the clay layer to be 45%, and the specific gravity of its soil grains as 2.7. [5+5]

10.a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes?

b) In an unconfined compression test, a sample of 7.5cm long and 3.5cm in diameter fails under a load of 90N at 10% strain. Compute the unconfined compressive strength and shear strength of the sample. [5+5]

OR

11.a) Explain briefly about tri-axial test. Also explain its merits.

b) In a direct shear test on a sand sample, the normal stress was 200 kN/m^2 and the sample failed at a shear stress of 120 kN/m^2. Determine (i) the angle of shearing resistance of the soil, (ii) the magnitude of the major and the minor principal stresses, (iii) the orientation of the principal planes. [5+5]

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Code No: 125EQ **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May - 2018
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) A fully saturated soil sample has a water content of 35% and specific gravity of 2.65. Determine its porosity, saturated unit weight and dry unit weight. [2]
b) A clay soil has a liquid limit of 62% and plastic limit of 34%. Classify the soil as per the IS classification. [3]
c) The effective size of a silt is 0.01 mm. The void ratio is 0.7. What is the height of capillary rise of water in this soil? [2]
d) Define the terms discharge velocity and seepage velocity. [3]
e) State the Boussinesq's and Westergaard's theories for point load. [2]
f) Explain briefly the mechanism of compaction. [3]
g) How do you determine the pre-consolidated pressure? [2]
h) Write a short note on stress history of clay. [3]
i) Define the term dilatancy. [2]
j) Explain Liquefaction. [3]

PART - B

(50 Marks)

2.a) A clay soil has a liquid limit of 52%. The volume of the soil sample in the shrinkage dish at the liquid limit is 0.0401×10^{-3} m^3 and its shrinks to a volume of 0.0261×10^{-3} m^3 at the shrinkage limit. The specific gravity of solids is 2.72. Determine the shrinkage limit of the soil.
b) Write a brief note on soil formation. [5+5]

OR

3.a) Distinguish between the residual soil and transported soil.
b) What are building blocks of clay minerals? Explain three common groups of clay minerals. [5+5]

4.a) Discuss the different methods to determine the permeability of a soil sample?
b) A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5 m below ground level. If the bulk density of saturated sand is 1.8 g cc^{-1}, calculate the effective and neutral pressure on the top of the clay layer. [5+5]

OR

5.a) Discuss briefly the merits and demerits of different methods determining permeability and special applications.
b) Write a short on characteristics of flow net. Give its uses. [5+5]

6.a) A concentrated point load of 200 kN acts at the ground surface. Find the intensity of vertical pressure at a depth of 10 meters below the ground surface, and situated on the axis of loading. What will be the vertical pressure at a point at a depth at 5 m and at a distance of 2 m from the axis of loading? Use Westergaard analysis taking $\mu = 0$.

b) Discuss the factors which affect compaction of soils in embankments. [5+5]

OR

7. Describe briefly about Newmark's influence chart for irregular areas. [10]

8.a) How do you estimate the field e-p curve of an over consolidated clay?

b) Briefly explain the physical meaning of the coefficient of consolidation. [5+5]

OR

9.a) Why does it take infinite time for complete consolidation to occur?

b) Explain the Terzaghi's 1-D consolidation theory. [5+5]

10.a) Define critical void ratio. Explain the shear behavior of a soil whose void ratio is less than the critical ratio.

b) A vane of 80 mm diameter and 160 mm height has been pushed into an in-situ soft clay at the bottom of a bore hole. The torque required to rotate the vane was 76 N-m. Determine the undrained shear strength of the clay. After the test, the vane was rotated several times and the ultimate torque was found to be 50 N-m. Estimate the sensitivity of the clay. [5+5]

OR

11.a) Discuss the type of laboratory triaxial test you would recommend for the initial stability of a foundation on saturated clay.

b) Explain why the angle of failure plane observed in a shear test might differ more often from that predicted from Mohr diagram at failure. [5+5]

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R15

Code No: 125EQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, May/June - 2019
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a)	Define density index and consistency index.	[2]
b)	Write about consistency limits.	[3]
c)	Write about principle of effective stress.	[2]
d)	Write short notes on quick sand condition.	[3]
e)	Write about mechanism of compaction.	[2]
f)	Discuss any three factors affecting compaction.	[3]
g)	Define immediate settlement and primary consolidation settlement.	[2]
h)	Write about stress history of clay using e- logσ curves.	[3]
i)	Define liquefaction and critical void ratio.	[2]
j)	Write about laboratory vane shear test to measure undrained shear strength.	[3]

PART - B

(50 Marks)

2.a) Derive the relation between void ratio and porosity.
b) A soil sample has a liquid limit of 75% and its plasticity index is 55 with a natural water content of 18%. Determine its plastic limit and liquidity index. [5+5]

OR

3.a) Explain step by step procedure to classify coarse grained soils.
b) A partially saturated sample has a moisture content of 15% and bulk unit weight of 21.5kN/m^3. The specific gravity of solids is 2.67. Determine void ratio, degree of saturation. [5+5]

4.a) Explain the laboratory procedure to determine coefficient of permeability by constant head method.
b) Determine the effective stress at a depth of 6 m below the ground level. The water table is at 2m below ground surface. The water content of the soil above water table is 10%. Take G = 2.65, e = 0.57. Neglect capillary flow. [5+5]

OR

5.a) Write about characteristics and uses of flownets.
b) In a laboratory permeability test, the discharge of water collected from a constant head permeameter in a period of 12 minutes is 250ml. The internal diameter of the permeameter is 8cm and the measured difference in head between two gauging points 15 cm vertically apart is 90cm. Calculate the coefficient of permeability. [5+5]

6.a) Write briefly about field compaction equipment.

b) A circular area of radius 4m carries a uniformly distributed load of 150kN/m^2. Determine the intensity of vertical pressure at 5m beneath the centre of the circle using Boussinesq's theory. [5+5]

OR

7.a) Write briefly about compaction control.

b) Using Westergaurd's theory, determine the vertical stress at a depth of 4m directly under the point load of 400kN acting at the surface of a soil mass and also at a horizontal distance of 3m. [5+5]

8.a) Explain Taylor's square root of time fitting method to determine coefficient of consolidation.

b) A 20mm thick consolidometer clay sample reached 80% consolidation in 1.2hours with double drainage. How long would it take for the clay layer from which this sample was obtained to reach 80% consolidation? The clay layer of 8m has single drainage. [5+5]

OR

9.a) Explain about preconsolidation pressure and its determination by Casagrande's method.

b) A clay layer of 6m thick has a settlement of 25mm when the stress was increased from 50kN/m^2 to 100kN/m^2. What will be the settlement if the stress is increased from 100kN/m^2 to 150kN/m^2 for the same clay layer? [5+5]

10.a) Explain about drainage conditions in Triaxial tests.

b) Discuss about shear strength of sands. [5+5]

OR

11.a) Write about shear strength of clays.

b) In an unconfined compression test, a sample of 7.5cm long and 3.5cm in diameter fails under a load of 90N at 10% strain. Compute the unconfined compressive strength and shear strength of the sample. [5+5]

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R15

Code No: 125EQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2017
GEOTECHNICAL ENGINEERING
(Common to CEE, CE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) A soil has bulk unit weight of 18 kN/m^3. If the water content of soil is 10%, estimate its dry unit weight. [2]
b) A clay soil has liquid limit and plastic limits 70% and 30% respectively. If the liquidity index of clay is 0.5, estimate its natural moisture content and plasticity index. [3]
c) Prove that the shear strength of soil is zero during quick sand condition. [2]
d) A soil has seepage velocity as 1×10^{-3} cm/s, and porosity 0.45, estimate its discharge velocity. [3]
e) Write the assumptions of Boussinesq's theory. [2]
f) Define compaction effort with formula. [3]
g) A soil has failure angle as 60^0, then estimate its angle of internal friction. [2]
h) Define critical void ratio and draw the void ratio variations for loose and dense sand with the strain. [3]
i) Define coefficient of volume compressibility and compression index. [2]
j) Write the reasons for pre consolidation of soil. [3]

PART - B

(50 Marks)

2.a) Define :
(i) Void ratio, (ii) Porosity, (iii) Degree of saturation, (iv) Water content, (v) Dry density, (vi) Bulk density, (vii) Submerged density.
b) Derive from fundamentals:
$S.e = w.G$,
Where; S represents degree of saturation, e represents void ratio, w represents water content, and G represents grain specific gravity.
c) A soil has porosity 40% and specific gravity 2.67, estimate its dry unit weight. Assume unit weight of water as 10 kN/m^3. [4+3+3]

OR

3.a) Sketch typical complete grain-size distribution curves for (i) well graded soil and (ii) uniform silty sand. Form the curves, determine the uniformity coefficient and effective size in each case. What qualitative inferences can you draw regarding the engineering properties of each soil?
b) The following data refer to a sample of soil:
Percent passing 4.75 mm IS Sieve = 64
Percent passing 75-μ IS Sieve = 6
Uniformity Coefficient = 7.5
Coefficient of Curvature = 2.7
Plasticity index = 2.5
Classify the soil. [4+6]

4.a) What are the various parameters that effect the permeability of soil in the field ? Critically discuss.

b) A uniform homogeneous sand deposit of specific gravity 2.60 and void ratio 0.65 extends to a large depth. The ground water table is 2 m from ground level.. Determine the effective, neutral, and total stress at depths of 2 m and 6 m. Assume that the soil from 1 m to 2 m has capillary moisture leading to degree of saturation of 60%. [4+6]

OR

5.a) Define coefficient of permeability and list four factors on which the permeability depends.

b) A concrete dam retains water to a height of 9 m. It has rows of sheet piling at both heel and toe which extend half way down to an impervious stratum. From a flow net sketched on a transformed section, it is found that there are four flow channels and sixteen head drops. The average horizontal and vertical permeabilities of the soil are 6×10^{-3} mm/s and 2×10^{-3} mm/s, respectively. What is the seepage per day, if the length of the dam is 150 metres? [4+6]

6.a) Write a brief note on the 'compaction in the field' bringing out the various types of rollers and their effectiveness with respect to different soil types.

b) The following results were obtained in a compaction test. Determine the optimum moisture content and the maximum dry density by plotting the data. [4+6]

Moisture Content (%)	7.4	9.7	10.5	11.5	13.1	14.4
Bulk Unit Weight (kN/m^3)	18.81	20.07	20.52	21.06	21.06	20.07

OR

7.a) Write a brief critical note on 'Newmark's influence chart'.

b) A ring foundation is of 3 m external diameter and 2.00 m internal diameter. It transmits a uniform pressure of 90 kPa. Calculate the vertical stress at a depth of 1.5 m directly beneath the centre of the loaded area. [6+4]

8.a) Distinguish between normally consolidated and over consolidated soils. Explain in detail any one method for determining the coefficient of consolidation of a soil.

b) A clay stratum is 4.5 m thick and rests on a rock surface. The coefficient of consolidation of a sample of this clay was found to be 4.5×10^{-8} m^2/s in the laboratory. Determine probable period of time required for the clay stratum to undergo 50% of the ultimate settlement expected under a certain increment of pressure. [5+5]

OR

9.a) What is preconsolidation pressure? Explain the Casagrande's graphical method for its evaluation.

b) A soft, normally consolidated clay layer is 18 m thick. The natural water content is 45%. The saturated unit weight is 18 kN/m^3; the grain specific gravity is 2.70 and the liquid limit is 63%. The vertical stress increment at the centre of the layer due to the foundation load is 9 kN/m^2. The ground water level is at the surface of the clay layer. Determine the settlement of the foundation at the centre of the layer. [4+6]

10.a) What are the advantages and disadvantages of a triaxial compression test? Briefly explain how you conduct the test and compute the shear parameters for the soil from the test data.

b) From a direct shear test on an undisturbed soil sample, the following data have been obtained. Evaluate the undrained strength parameters by plotting the results. [5+5]

Normal Stress (kPa)	70	96	114
Shear Stress (kPa)	138	156	170

OR

11.a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes?

b) An embankment consists of clay fill for which cohesion is 25 kPa and angle of internal friction is 27^0 (from consolidated undrained tests with pore-pressure measurement). The average bulk unit-weight of the fill is 20 kN/m^3. Estimate the shear-strength of the material on a horizontal plane at a point 20 m below the surface of the embankment, if the pore pressure at this point is 180 kPa as shown by a piezometer. [5+5]

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R15

Code No: 125EQ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2018
GEOTECHNICAL ENGINEERING
(Common to CE, CEE)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) Draw typical grain-size distribution curves for (i) uniform (ii) gap graded (iii) well graded soils. [2]
b) List the common clay minerals and summarize their key properties. [3]
c) Explain the terms quick condition and critical hydraulic condition. [2]
d) What are the assumptions for Darcy's law to be valid? Discuss each of them. [3]
e) State the basic requirements to be satisfied for the validity of Boussinesq's equation for stress distribution. [2]
f) Explain the concept of 'Pressure Bulb' in soils. List the various factors that influence the compaction of soils, show their influence with illustrative sketches of compaction curves. [3]
g) Define the terms 'Compression index', 'coefficient of consolidation', and 'coefficient of compressibility'. [2]
h) What are the assumption's in Terzaghi's theory of one-dimensional consolidation? [3]
i) Differentiate between unconsolidated undrained test and a drained test. [2]
j) Explain basic differences between a box shear test and a triaxial shear test for soils. [3]

PART - B

(50 Marks)

2.a) A soil sample is partially saturated. Its natural moisture content was found to be 22% and bulk density 2 g/cm^3. If the specific gravity of the solid particles be 2.65 and the density of water be taken as 1 g/cm^3., find out the degree of saturation and the void ratio. If the soil is saturated what will be its saturated unit weight?
b) An undisturbed saturated specimen of clay has a volume of 18.9 cm^3 and a mass of 30.2 g. on oven drying, the mass reduces to 18.0 g. the volume of dry specimen as determined by displacement of mercury is 9.9 cm^3. Determine shrinkage limit, specific gravity, shrinkage ratio and volumetric shrinkage. [5+5]

OR

3.a) The liquid limit of a soil is 59%, the plastic limit is 23% and the natural moisture content is 46%. What is the liquidity index? What is its significance? Define shrinkage limit and shrinkage ratio.
b) A clayey soil has natural moisture content of 15.8%. The specific gravity of soil is 2.72. Its saturation percentage is 70.8%. The soil is allowed to soak up water. After some time, the saturation increases to 90.8%. Find out the water content of the soil in latter case. [5+5]

4.a) In a falling head permeability test on sample 12.2 cm high and 44.41 cm^2 in cross-sectional area, the water level in a standpipe of 6.25 mm internal diameter dropped from a height of 75 cm to 24.7 cm in 15 minutes. Find the coefficient of permeability.

b) Give the characteristics of Flow nets. What is the theoretical height of capillary rise and the capillary pressure in a fine grained soil with effective size D_{10} of 0.002 mm. [5+5]

OR

5.a) In a deposit of fine sand, the water table is 3 m below the ground surface. But the sand upto a height of 1 m above the water table is saturated by capillary water. The sand above this height may be considered dry. For the sand, Gs is 2.68 and porosity is 40%. Calculate the effective stress at the depth of 8 m.

b) What are the factors affecting permeability? A horizontal stratified deposit consists of three layers each uniform in itself. The permeability of the layers are 8×10^{-6} m/s, 50×10^{-6} m/s and 15×10^{-4} m/s and their thicknesses are 6 m, 3 m and 18 m respectively. Find effective average permeability of the deposit in horizontal and vertical direction. [5+5]

6.a) Explain Newmark's influence chart for finding vertical stresses in soil.

b) During a compaction test, a soil attains MDD of 18.6 kN/m^3 at a moisture content of 15%. Taking specific gravity of soils as 2.7, find the degree of saturation and percentage air voids at MDD. What will be the dry density corresponding to zero air voids at OMC. How does compaction improve the engineering properties of soils?[5+5]

OR

7.a) A strip footing 3 m wide is loaded on the ground surface with a pressure of 100 kN/m^2. A 4m thick soft clay layer exits at a depth of 10 m below the foundation. Find the average increase in vertical stress at the clay layer under the centre line and edge of the building.

b) From Proctor's compaction test, the maximum dry density of a soil was found to be 1.75 g/cc and OMC 14.5%. The specific gravity of the soil grains was 2.6. Find out the degree of saturation and percentage air voids at the optimum state. What is zero air voids line? [5+5]

8.a) Explain square root time fitting methods for C_v estimation.

b) A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 0.25 to 0.50 kgf/cm^2. Calculate the coefficient of compressibility and the coefficient of volume compressibility. If the coefficient of consolidation determined in the test for the given stress increment was 10 m^2/ year, calculate the coefficient of permeability in cm/s. If the samples tested at the site was taken from a clay layer 3 m in thickness, determine the consolidation settlement resulting from the given stress increment. [5+5]

OR

9.a) Explain height of solids method for void ratio estimation.

b) A certain clay layer has a thickness of 5 m. After 1 year, when the clay was 50% consolidated, 8 cm of settlement had occurred. For a similar and loading conditions, how much settlement would occur at the end of 1 year and 4 years respectively, if the thickness of this new layer is 25 m? [5+5]

10.a) In an insitu vane shear test on a saturated clay, a torque of 35 Nm was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 5 Nm. Determine the sensitivity of the clay.

b) Explain unconfined compression test and Vane shear test. [5+5]

OR

11.a) In a direct shear test on a sand sample, the normal stress was 200 kN/m^2 and the sample failed at a shear stress of 120 kN/m^2. Draw the mohr circle and the strength envelope. Determine (i) the angle of shearing resistance of the soil, (ii) the magnitude of the major and the minor principle stresses, (iii) the orientation of the principal planes.

b) Write the Mohr Coulomb failure criterion. [5+5]

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