Code No: R1632012 **R16** SET - 1

III B. Tech II Semester Regular Examinations, April/May - 2019

GEOTECHNICAL ENGINEERING – I

(Civil Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Differentiate between 'residual' and 'transported' soils [2M]
   b) Sketch typical complete grain-size distribution curves for (*i*) well graded soil and (*ii*) uniform silty sand. [2M]
   c) What is the role of effective stress in soil mechanics? [2M]
   d) Give the detailed procedure of Usage of Newmark's Influence Chart. [3M]
   e) Discuss Terzaghi's theory of consolidation, stating the various assumptions and their validity. [3M]
   f) Explain the Mohr-Coulomb strength envelope. [2M]

PART –B

2. a) What are the factors that affect the compaction? Discuss in brief. [7M]
   b) A field density test was conducted by sand cone method. The observation data are given below: [7M]
   (a) Mass of jar with cone and sand (before use) = 4950 g, (b) mass of jar with cone and sand (after use) = 2280 g, (c) mass of soil from the hole = 2925 g, (d) dry density of sand = 1.48 g/cm^3, (e) water content of the wet soil = 12%. Determine the dry unit weight of compacted soil.

3. a) Write short notes on the determination of shrinkage limit test. [7M]
   b) A dried soil of 127.62 gm were subjected to a mechanical analysis with the following result: Sieve analysis gave the following quantities [7M]

Retained on sieve	2.36 mm	0 gm
	0.60 mm	42.1 gm
	0.21 mm	24.2 gm
	0.075 mm	16.6 gm

Hydrometer, sedimentation analysis gave

Amounts finer than	0.03 mm	28.3 gm
	0.003 mm	17.2 gm

Draw the grading curve and classify the material according IS Classification.

4. a) What are the various parameters that affect the permeability of soil in the field? Critically Discuss. [7M]
   b) A falling head permeability test was performed on a sample of silly sand. The time required for the head to fall in the stand pipe from 60 cm to the 30 cm mark was 70 min. The cross sectional area of the stand pipe was 1.25 cm^2. If the height and diameter of the sample were respectively 10 and 9 cm, determine the value *k* in cm/min. [7M]
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5. a) Explain the 2:1 stress distribution method. [7M]
   b) A reinforced concrete water tank of size 6 m × 6 m and resting on ground surface carries a uniformly distributed load of 200 kN/m^2. Estimate the maximum vertical pressure at a depth of 12 m vertically below the centre of the base. [7M]

6. a) Write short notes on the Log fitting method for evaluation of C_v from laboratory consolidation test. [7M]
   b) Determine the amount of settlement, given the following data: [7M]
   Thickness of compressible medium = 3 m
   Coefficient of volume decrease = 0.002 cm^2/N
   Pressure increment at the centre of the compressible medium = 75 kN/m^2.

7. a) Explain the principle of the direct shear test. What are the advantages of this test? What are its limitations? [7M]
   b) A consolidated drained tri-axial test was conducted on normally consolidated clay. The results were as follows: σ_3 = 300 kN/m^2; deviator stress, $\Delta\sigma_{df}$ = 350 kN/m^2. Determine (a) the angle of internal friction, φ (b) angle θ that the failure plane makes with the major principal plane. (c) Normal stress, τ_f, on the failure plane. [7M]

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Code No: R1632012 **R16** SET - 2

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GEOTECHNICAL ENGINEERING – I

(Civil Engineering)

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Define texture and structure of soils. [2M]
   b) Define (*i*) Stokes' law and (*ii*) Flow index. [2M]
   c) What are the assumptions made in the Darcy's law? [2M]
   d) Differentiate the Boussinesq's and Westergaard's theories, [3M]
   e) Draw a typical time-consolidation curve for an increment of load and show the process of consolidation. [3M]
   f) Sketch the stress-strain relationship for dense and loose and. [2M]

PART –B

2. a) Differentiate between consolidation and compaction. [7M]
   b) A clay sample, containing its natural moisture content, weighs 0.333 N. The specific gravity of solids of this soil is 2.70. After oven-drying, the soil sample weighs 0.2025 N. The volume of the moist sample, before oven-drying, found by displacement of mercury is 24.30 cm^3. Determine the moisture content, void ratio and degree of saturation of the soil. [7M]

3. a) Describe in detail the Indian System of soil classification. When would you use dual symbols for soils? [7M]
   b) Liquid limit test on a given sample gave the following values [7M]

Water Content (%)	48	50	52	54
Number of Blows	38	27	20	13

Plot the values on semi log-sheet and determine the liquid limit and flow index.

4. a) Derive the expression for the coefficient of permeability as obtained from the variable head permeameter. [7M]
   b) A homogeneous dam is 21.5 m high and has a free board of 1.5 m. a flow net was constructed and the following results were observed. [7M]
   No of potential drops = 12. No of flow channels = 3. The dam has a horizontal filter of 15 m length. Calculate the discharge/m, length of the dam, if the coefficient of permeability of the dam material is 2.7 x 10^{-6} m/sec.

5. a) Explain in detail the construction of Newmark's chart with an influence value of 0.005. [7M]
   b) Two columns A and B are situated 6 m apart. Column, A, transfer a load of 500 kN and column B, a load of 250 kN. Determine the resultant vertical stress on a horizontal plane 2.0 m below the ground surface at points vertically below the points A and B. Use 2:1 stress distribution method. [7M]
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6. a) Differentiate between normally consolidated and over consolidated soils. How would you determine the over -consolidation pressure? [7M]
   b) There is a layer of soft clay 4 m thick under a newly constructed building. The overburden pressure over the center of the clay layer is 300 kN/m^2. Compute the settlement, if there is an increase in pressure due to construction of 100 kN/m^2. Take C_c = 0.50, G = 2.70. The water content of the deposit was found to be 50%. [7M]

7. a) What are the advantages and disadvantages of a triaxial compression test? Briefly explain how do you conduct the test and compute the shear parameters for the soil from the test data. [7M]
   b) For a normally consolidated clay $\varphi' = 25^0$. In a drained triaxial test, the specimen failed at deviator stress of 180 kN/m^2. What was the chamber confining pressure? [7M]

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Code No: R1632012 **R16** SET - 3

III B. Tech II Semester Regular Examinations, April/May - 2019

GEOTECHNICAL ENGINEERING – I

(Civil Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) What is chemical weathering of rock? What kinds of soils are formed due to this process? [2M]
   b) Write a short note on 'Relative density'. [2M]
   c) What is the quick sand condition? [2M]
   d) State the basic requirements to be satisfied for the validity of Boussinesq equation for stress distribution. [3M]
   e) Differentiate between primary consolidation and secondary consolidation. [3M]
   f) Explain the critical void ratio. What is its importance? [2M]

PART –B

2. a) What are the different methods of compaction adopted in the field? How would you select the type of roller to be used? [7M]
   b) A sample of clay having a mass of 675 g was coated with paraffin wax. The combined mass of the clay and the wax was found to be 682 g. The volume was found by immersion in water as 345 ml. The sample was then broken open and the water content and the specific gravity of soil were found to be 15% and 2.70, respectively. Calculate the bulk density of soil, its void ratio, and degree of saturation. Take specific gravity of wax as 0.89. [7M]

3. a) Draw neatly the IS plasticity chart and label the symbol of various soils. [7M]
   b) A sample of soil of mass 40 g is dispersed in 1000 ml of water. How long after the commencement of sedimentation should be the hydrometer reading is taken in order to estimate the percentage of particles less than 0.002 mm effective diameter? The center of the bulb is at an effective depth of 20 cm below the surface of the water. Take G = 2.70 and η = 0.01 poise. [7M]

4. a) Show how the effective pressure is altered when water is flowing through the soil vertically downwards and vertically upwards. [7M]
   b) A constant head permeability test was carried out on a cylindrical sample of sand of 10 cm diameter and 15 cm height. 200 cm^3 of water was collected in 2.25 min. under a head of 30 cm. Compute the hydraulic conductivity in m/sec. [7M]

5. a) Explain in detail the construction of Newmark's chart with an influence value of 0.002. [7M]
   b) A water tower is founded on a circular ring type foundation. The width of the ring is 4 m and its internal radius is 8 m. Assuming the distributed load per unit area as 300 kN/m^2, determine the vertical pressure at a depth of 6 m below the centre of the foundation. [7M]
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6. a) Define the following: (*i*) Compression Index, (*ii*) Coefficient of volume decrease, (*iii*) Coefficient of consolidation and (*iv*) Degree of consolidation. [8M]

   b) In a consolidation test, an increase of 100 kN/m^2 in the vertical pressure was applied to a saturated clay sample initially 2.5 cm thick. The thickness of the sample reduced to 2.46 cm after 24 hours. The sample was then relieved of pressure and allowed to take up water. The final thickness was 2.465 cm and the moisture content was 30%. Assuming that the sample was saturated throughout the test, calculate the following. [6M]

   (i) The initial void ratio (Take G = 2.68)
   (ii) The void ratio after consolidation
   (iii) The void ratio after expansion
   (iv) The coefficient of compressibility.
   (v)

7. a) Explain the basic differences between a box shear test and a triaxial shear test for soils. [7M]

   b) A granular soil is subjected to a minor principal stress of 200 kN/m^2. If the angle of internal friction is 30°, determine the inclination of the plane of failure with respect to the direction of the major principal stress. What are the stresses on the plane of failure and the maximum shear stress induced? [7M]

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Code No: R1632012 **R16** SET - 4

III B. Tech II Semester Regular Examinations, April/May - 2019

GEOTECHNICAL ENGINEERING – I

(Civil Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Draw typical compaction curve and draw the zero air void line. [2M]
   b) Define (*i*) flow index and (*ii*) Liquidity index [2M]
   c) What are the principles of a flow net? [2M]
   d) Explain the concept of 'Pressure Bulb' in soils. [3M]
   e) Discuss the spring analogy for primary consolidation. What are its uses? [3M]
   f) Explain the Tri-axial test and its merits. [2M]

PART -B

2. a) Write brief but critical notes on 'texture' and 'structure' of soils. [7M]
   b) A soil having a specific gravity of solids, G = 2.75, is subjected to Proctor compaction test in a mould of volume, V = 945 cm^3. The observations are as follows: [7M]

Mass of Wet sample (g)	1389	1767	1824	1784	1701
Water content (%)	7.5	12.1	17.5	21.0	25.1

What are the values of maximum dry unit weight and the optimum moisture content? Draw 100% saturation line.

3. a) Briefly describe the procedure to determine the Liquid Limit of a soil. [7M]
   b) An undisturbed sample of fine sand has a dry unit weight of 18 kN/m^3, At the maximum density, the void ratio is 0.35, and that at the minimum density, 0.90. Determine the relative density of the undisturbed soil. G = 2.65. [7M]

4. a) Differentiate between 'Constant Head type' and 'Variable Head type' permeameters. Are both of them required in the laboratory? If so, why? [7M]
   b) A concrete dam is constructed across a river over a permeable stratum of soil of limited thickness. The water heads are upstream side 16 m and 2 m on the downstream side. The flow net constructed under the dam gives N_f = 4 and N_d=*l2*. Calculate the seepage loss through the subsoil, if the average value of the hydraulic conductivity is 6 x 10^{-3} cm/sec horizontally and 3 x 10^{-4} cm/sec vertically. Calculate the exit gradient, if the average length of the last field is 0.9 m. Assuming *e* = 0.56, and *Gs* = 2.65, determine the critical gradient. Comment on the stability of the river bed on the downstream side. [7M]

5. a) Using Boussinesq's expression, derive the expression for vertical stress at depth, ***h,*** under the centre of a circular area of radius, ***a,*** loaded uniformly with a load, ***q***, at the surface of the mass of soil. [7M]
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b) *A* and *B* are two footings of size 1.5 m x 1.5 m each placed in position as shown in figure 1. Each of the footings carries a column load of 400 kN. Determine by the Boussinesq method, the excess load footing *B* carries due to the effect of the load on *A.* Assume the loads at the centre of footings act as point loads. [7M]

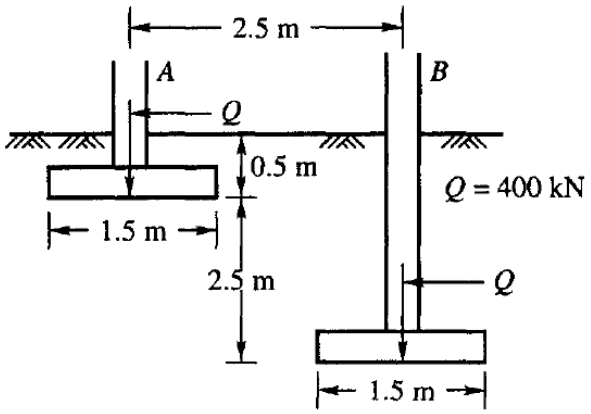

Figure:1.

6. a) Differentiate between 'compaction' and 'consolidation'. [7M]

b) A saturated soil stratum 4 m thick lies above an impervious stratum and below a previous stratum. It has a void ratio of 1.50 at an initial pressure of 150 kN/m^2. [7M]

i) Compute the change in void ratio due to an increase of stress of 50 kN/m^2. Take C_c = 0.20.

ii) Also compute the final settlement of the soil stratum due to above increase in stress.

iii) What would be the time required for 50 percent consolidation? Take k = 3.0 X 10^{-4} cm/sec.

7. a) Differentiate between shear strength parameters obtained from total and effective stress. [7M]

b) Samples of compacted, clean, dry sand were tested in a shear box, 6 cm × 6 cm, and the following observations were recorded: [7M]

Normal load (N):	100	200	300
Peak shear load (N):	90	180	270
Ultimate shear load (N):	75	150	225

Determine the angle of shearing resistance in (*a*) the dense state and in (*b*) the loose state.

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