Code No: R2031013 **R20** SET - 1

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
GEOTECHNICAL ENGINEERING -I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1. a) Explain the transported soils and soil formation. [7M]
   b) Describe the formation of soil due to mechanical weathering with neat sketches. [7M]

(OR)

2. a) Define the following terms (i) Adsorbed water (ii) Diffused double layer [7M]
   b) What do you mean by Weathering? Explain how soils are formed by the weathering process. [7M]

UNIT-II

3. a) Explain permeability also describe various factors affecting the permeability. [7M]
   b) Explain in detail about Laplace equation [7M]

(OR)

4. a) In a hydrometer test, the initial reading is 1.08. After one hour, the corrected hydrometer reading is 1.03 and the corresponding effective depth is 12cm. Find the initial weight of soil placed in 1000cc suspension, the particle size corresponding to the 15min reading, and the percentage of particles finer than this size. Take G =2.65, and μ=0.1 poise. [7M]
   b) Explain the laboratory determination of coefficient of permeability? [7M]

UNIT-III

5. a) A Newmark's chart was prepared with the influence coefficient of 0.005 with the desired scale the stress concentrated area is drawn on tracing paper. Then the tracing paper is placed on top of the influence chart with the desired position. Then the number of sectors covered by the stress area is 31.Compute the stress at the given position for the desired stress area. Applied on the area is 200 kN./m^2. [7M]
   b) Compare and contrast Boussinesq's and Westergaard's theories? [7M]

(OR)

6. a) Write a brief critical note on 'Newmark's influence chart [7M]
   b) Two concentrated loads of 500 kN and 900 kN. are situated 5 m apart on the ground surface. Find out the vertical stresses at 3.0 m below each load. [7M]

UNIT-IV

7. a) Explain concept of consolidation using Spring Analogy. [7M]
   b) An Oedometer test is performed on a 2 cm thick clay sample. After 5 minutes, 50% consolidation is reached. After how long time would the same degree of consolidation is achieved in the field where the clay layer is 3.70 m thick? Assume the sample and the clay layers have the same drainage boundary conditions (double drainage). [7M]

(OR)

8. a) Illustrate the effects of compaction on soil properties. [7M]

   b) A soil is to be excavated from a borrow pit which has a density of 1.75 g/cc and water content of 14%. The specific gravity of solid particles is 2.7. The soil is to be compacted to a water content of 20% and dry density of 1.7 g/cc. For 1000 m^3 of soil in fill estimate (i) Quantity of soil to be excavated from the pit in m^3 (ii) Amount of water to be added to increase the water content from 12% to 18% [7M]

UNIT-V

9. a) Explain the detailed procedure of the laboratory triaxial shear v-Test. [7M]

   b) Explain different drainage conditions adopted in shear tests with their suitability. [7M]

(OR)

10. a) In an unconfined compression test, a sample of sandy clay 8cmlong and 40mm in diameter fails under a load of 120N at 10%strain. Compute the shearing resistance taking into account the effect of change in the cross-section of the sample. [7M]

    b) In a direct shear test on a specimen of clean dry sand, normal stress of 180kPawas applied and failure occurred at a shear stress of 100kPa. Determine analytically the angle of shearing resistance, the principal stresses during failure, and directions of the principal planes with respect to the direction of the plane of shearing. [7M]

Code No: R2031013 **R20** SET - 2

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
GEOTECHNICAL ENGINEERING -I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
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UNIT-I

1. a) The following results were recorded in a shrinkage limit test using mercury Mass of container =17.0g [7M]
Mass of wet soil and container =72.30g
Mass of dish =132.40g
Mass of dish and displaced mercury =486.10g
Mass of dry soil and container =58.20g
Volume of wet soil =32.4 cm3
Determine the shrinkage limit, the linear shrinkage and the shrinkage ratio. The density of mercury is 13.6g/cm3.

   b) Explain the Unified Classification of Soils with neat sketches, wherever necessary. [7M]

(OR)

2. a) Explain in detail about the three clay minerals. [7M]

   b) What are the different types of soil structures which can occur in nature? Describe in brief the structures of fine-grained soils. [7M]

UNIT-II

3. a) What do you mean by Capillary rise and Capillary depression? Where will you find them? Derive an expression for the capillary rise with the help of a neat sketch. [7M]

   b) Write a short note on the corrections to be applied to hydrometer test readings. [7M]

(OR)

4. a) What are the different techniques available to determine the grain size distribution of soil samples? Explain any two methods with neat sketches. [7M]

   b) A soil has a bulk unit weight of 20 KN/m^3 at a water content of 16%. Calculate the porosity, degree of saturation, and air content, if the specific gravity is 2.65. [7M]

UNIT-III

5. a) A load of 1000 kN. acts as a point load at the surface of a soil mass. Estimate the stress at a point 3m below and 4m away from the point of action of the load by Boussinesq's formula. Compare the value with the result from Westergaard's theory. [7M]

   b) Compare and contrast Boussinesq's and Westergaard's theories. [7M]

(OR)

6. a) Explain the effect of compaction on soil properties [7M]

   b) A ring foundation is of 3.0 m external diameter and 3.0 m internal diameter. It transmits a uniform pressure of 100.0 kN/m^2. Calculate the vertical stress at depth of 2.50 m directly beneath the center of the loaded area. [7M]

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UNIT-IV

7. a) An oedometer test is performed on a 4 cm thick clay sample. After 5 minutes, 50% consolidation is reached. After how long a time would the same degree of consolidation is achieved in the field where the clay layer is 8 m thick? Assume the sample and the clay layer has the same drainage boundary conditions (double drainage). [7M]

   b) What are the assumptions made in Terzaghi's one dimensional consolidation theory? [7M]

(OR)

8. a) What is compaction and how it is different from consolidation? [7M]

   b) Explain the concept of determination of coefficient of consolidation and how we determine coefficient of consolidation [7M]

UNIT-V

9. a) A shear vane of 7.5 cm in diameter and 11.0 cm in length was used to measure the shear strength of soft clay. If a torque of 600 N-m was required to shear the soil, Calculate the shear strength of the soil. The vane was rotated rapidly to cause remoulding of the soil. The torque required in the remoulded state was 300 N-m. Determine the sensitivity of the soil. [7M]

   b) Explain the stress-strain behavior of clays [7M]

(OR)

10. a) In a drained triaxial compression test, a saturated specimen of cohesion less sand fails under deviator stress of 5.35 kg/cm^2. When the cell pressure is 1.5 kg/cm^2. Find the effective angle of shearing resistance of sand and the approximate inclination of the failure plane to the horizontal. Represent the parameters by means of Mohr Circle. [7M]

    b) Explain the shear strength of sands with suitable examples. [7M]

Code No: R2031013 **R20** SET - 3

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
GEOTECHNICAL ENGINEERING -I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Explain about textural classification of soils . [7M]
   b) Explain the procedure of hydrometer analysis with neat sketches. [7M]

(OR)

2. a) What are the different soil indices used in the identification of soil? Describe each one. Give their uses. [7M]
   b) What is absorbed water, and explain structure of soils. [7M]

UNIT-II

3. a) Derive an expression to determine the coefficient of permeability of soil by laboratory falling head permeability test. [7M]
   b) The porosity of the soil sample is 35% and the specific Gravity of its particles is 2.7. Calculate its void ratio, Dry Unit weight, Saturated Unit Weight, and Submerged Unit weight. [7M]

(OR)

4. a) A soil has a liquid limit of 25% and a flow index of 12.5%, if the plastic limit of soil is 15%. Determine the plasticity index and toughness index. If the water content of the soil in its natural condition in the field is 20%, find the liquidity index and relative consistency. [7M]
   b) A soil has a bulk unit weight of 20 KN/m3 at a water content of 16%. Calculate the porosity, degree of saturation, and air content, if the specific gravity is 2.65. [7M]

UNIT-III

5. a) Write a brief critical note on 'Newmark's influence chart' [7M]
   b) Briefly explain the construction of Newmark's Influence Chart along with its usage. [7M]

(OR)

6. a) Two concentrated loads of 500 kN and 900 kN are situated 5m apart on the ground surface. Find out the vertical stresses at 3.0m below each load. [7M]
   b) A uniform homogeneous sand deposit of specific gravity 2.60and void ratio 0.65extends 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 soilfrom1 m to 2 m has capillary moisture leading to the degree of Saturation of 60%. [7M]

UNIT-IV

7. a) How do you determine the consolidated settlement of a foundation? [7M]
   b) A cohesive soil yielded a maximum dry density of 1.8 g/cc at an OMC of 18% during a standard Proctor test with a specific gravity of 2.8. What is its void ratio, degree of saturation, Air content, and percentages of air voids in the soil? What is the maximum density it can Be further compacted to? [7M]

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(OR)

8. a) In a consolidation test, the following results have been obtained when the load was changed from 50 kN./m^2 to 100 kN./m^2, the void ratio changed from 0.65 to 0.8.Determine the coefficient of volume decrease mv and the compression index Cc [7M]

   b) State and explain compressibility of soils and classify e-p and e-log p curves. [7M]

UNIT-V

9. a) Explain the stress-strain behavior of clays. [7M]

   b) What is the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 295 kPa and the pore water pressure 120 kPa. The effective shear strength parameters of the soil are C'=12 kPa and ϕ=30°. [7M]

(OR)

10. a) The following results were obtained from a direct shear test on a sandy clay sample. If the shear box is 60mm square and the proving ring constant is 40N per division, estimate the shear strength parameters of the soil. Would failure occur on a plane [7M]

Normal load(N)	Shear load proving ring reading(divisions)
360	19
720	13
1080	26
1440	26

Within this soil at a point where the normal stress is 340kN/m^2 and the corresponding shear stress is 138kN/m^2?

   b) Explain Coulomb's law for shearing strength of soils. [7M]

Code No: R2031013 **R20** SET - 4

III B. Tech I Semester Regular/Supplementary Examinations, December -2023
GEOTECHNICAL ENGINEERING -I
(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks
*****

UNIT-I

1. a) Explain the terms adsorbed water and relative density along with their relationship if any. [7M]
   b) Describe the Indian Standard (IS) Classification of Soils with neat sketches, wherever necessary. [7M]

(OR)

2. a) Explain about consistency limits and indices. [7M]
   b) Discuss AASHTO soil classification system with neat table. [7M]

UNIT-II

3. a) What is a flow net? What are its properties and applications? [7M]
   b) Derive the expression for Darcy's law. State the assumptions made in Darcy's law and what are their practical reliability. [7M]

(OR)

4. a) What are the different techniques available to determine the grain size distribution of soil samples? Explain any two methods with neat sketches. [7M]
   b) Illustrate 2 -D flow and laplaces equation? [7M]

UNIT-III

5. a) A Newmark's chart was prepared with the influence coefficient of 0.005 with the desired scale the stress concentrated area is drawn on tracing paper. Then the tracing paper is placed on top of the influence chart with the desired position. Then the number of sectors covered by the stress area is 31. Compute the stress at the given position for the desired stress area. Applied of the area is 200 kN./m^2 [7M]
   b) Compare and contrast Boussinesq's and Westergaard's theories? [7M]

(OR)

6. a) Briefly explain the construction of Newmark's Influence Chart along with its usage. [7M]
   b) A soil profile consists of a surface layer of sand 4m thick (L=1600kg/m^3) an intermediate layer of clay 2.5 m thick (L=1900 kg/m^3) and a bottom layer of gravel 4m thick (L=1925 kg/m^3). The water table is at the upper surface of the clay layer. Compute the effective stress at various levels due to the placement of a surcharge of 5000 kg/m2 on the ground surface. [7M]

UNIT-IV

7. a) Explain the concept of stress history in consolidation. [7M]
   b) Define i) compaction ii) Spring Analogy [7M]

(OR)

|'''|'|'|''||'''||||

8. a) Explain Consolidated Soil? And types of consolidated soil. [7M]

   b) A cohesive soil yielded a maximum dry density of 1.7 g/cc at an OMC of 18% during a standard Proctor test with a specific gravity of 2.7. What is its void ratio, degree of saturation, Air content and percentages of air voids in the soil? What is the maximum density it can Be further compacted to? [7M]

UNIT-V

9. a) Explain the shear characteristics of sand? [7M]

   b) The following results were obtained from a triaxial test on two soil specimens. [7M]

Sample no.	Confining pressure(kpa)	Deviator stress at failure(kpa)	Porewater pressure(kpa)
1	300	244	55
2	400	314	107

Determine the shear strength parameters of the soil terms of
(i) Total stresses ii) effective stresses.

(OR)

10. a) Explain in detail about the laboratory box shear test. [7M]

    b) Explain about various drainage conditions. [7M]