C020513(020)

B. Tech. (Fifth Semester) Examination, Nov.-Dec. 2021

AICTE   (Old Scheme)

(Civil Branch)

GEOTECHNICAL ENGINEERING

Time Allowed : Three hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : *Attempt all questions. From all the units question a is compulsory and from remaining parts attempt any two question.*

Unit-I

1. (a) Explain the following :   4

    (i) Water content

    (ii) Degree of saturation

    (iii) Void ratio

(iv) Specific gravity

(b) A sampler with volume of 60 cm³ is filled with saturated soil sample. The specific gravity of solid is 2·65. When the oven dry soil is poured into a graduated cylinder filled with water, it displaces 40 cm³ of water. What is the natural moisture content and dry unit weight of soil.   8

(c) A soil sample of volume 320 cm³ weights 600 gm. On oven drying, the weight of sample reduced to 90% and volume reduced by 12%, calculate :   8

   (i) Shrinkage Limit

   (ii) Specific Gravity

   (iii) Shrinkage Ratio

(d) Explain the following method of classification of soil :   8

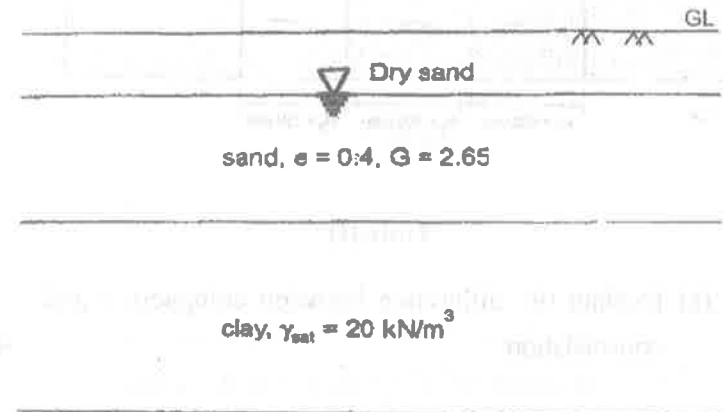   (i) Textural Classification

   (ii) AASHTO Classification

Unit-II

2. (a) Define Zero Air Void Line.   4

(b) Explain the factor affecting compaction.   8

(c) For a subsoil condition shown in figure draw the total, natural and effective stress diagram at 1 m, 3 m, and 6 m below the ground level. Assume $\gamma_w = 10 \text{ kN/m}^3$.   8
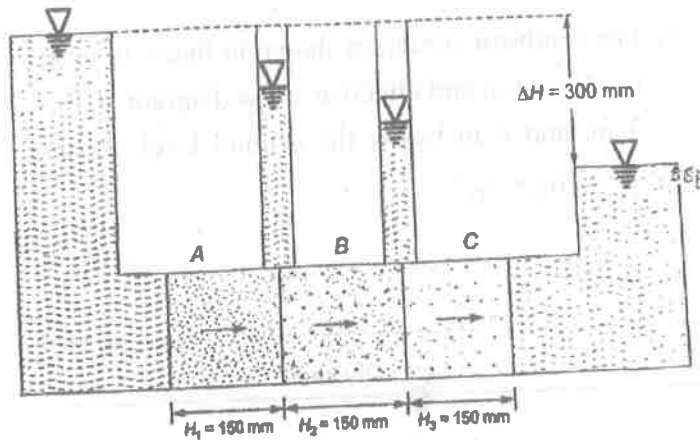

GL

Dry sand

sand, $e = 0.4$, $G = 2.65$

clay, $\gamma_{sat} = 20 \text{ kN/m}^3$

(d) The soil layers below have a cross-sectional area of 100 mm × 100 mm each. The permeability of each soil is : $k = 10^{-2}$ cm/sec; $k_a = 3 \times 10^{-3}$ cm/sec; $k_c = 4.9 \times 10^4$ cm/s. Find threrate of water supply in cm³/hr.   8

$\Delta H = 300$ mm

A   B   C

$H_1 = 150$ mm $H_2 = 150$ mm $H_3 = 150$ mm

Unit-III

3. (a) Explain the difference between compaction and consolidation.   4

(b) In a consolidation test, the void ratio of the specimen which was 1.052 under the effective pressure of 207 kN/m², changed to 0.932 when the pressure was increased to 430 kN/m². Calculate :   8

(i) Coefficient of Compressibility

(ii) Compression Index

(iii) The Coefficient of Volume Compressibility

(c) A clay layer, 8 m thick, is subjected to a pressure of 70 kN/m². If the layer a double drainage and undergoes 50% consolidation $(T_v = 0.196)$ in one year, determine the coefficient of consolidation. If the coefficient of permeability is 0.040 m/year, determine the settlement in one year. Use $\gamma_w = 9.81$ kN/m³.   8

(d) Explain the direct shear test with neat sketch.   8

Unit-IV

4. (a) Explain the types of slopes.   4

(b) An infinitely long slope having in inclination of 26° in an area is underlain by firm choesive soil (G = 2.72 and e = 0.65). There is a thin weak, layer of soil 6 m below and parallel to the slope surface (c = 25 kN/m², $\phi = 16°$). Compute the factor of safety when the slope is dry. If ground water flow could occur parallel to the slope on the ground surface, what factor of safety would result?   8

(c) Explain the assumptions of stability of slopes and also describe the types of failure with neat sketch.   8

(d) Explain Swedish circle method with neat sketch and also calculate the factor of safety with respect to the shear strength analysis by the method of slices for 1:1 slope on the critical slip gave the following results : 8

Sum of tangential forces	=	150 kN
Sum of normal forces	=	320 kN
Sum of neutral forces	=	50 kN
Length of failure surface	=	18 m
Effective angle of searing resistance	=	15°
Effective cohesion	=	20 kN/m^2

Unit-V

5. (a) Define soil exploration. 4

(b) Explain the boring method of exploration with neat sketch. 8

(c) Explain the design of sampler with neat sketch. 8

(d) Explain the SPT Test for subsurface investigation. 8