Question Paper

Exam Date & Time: 20-Nov-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
End semester theory examination November -2019
III SEMESTER B.Sc.(Applied Sciences) in Engg
GEOTECHNICAL ENGG. [ICE 233 - S2]

Marks: 100 **Duration: 180 mins.**

A

Answer 5 out of 8 questions.

1) A) Define dry density, water content and bulk density and obtain the relationship between them. (8)

B) An earthen dam has to be constructed with a void ratio of 0.90 after compaction. Near the dam, 3 borrow pits are available which are designated A, B, C. The void ratio of soil in each pit and estimated cost of moving of soil to the dam site is as shown in table. What will be the least moving cost and which pit will be most economical to use if the total earth required is 5×10^5 m^3. (12)

Pit	Void Ratio	Rs/m^3
A	0.85	0.23
B	1.86	0.16
C	1.7	0.21

2) A) A sample of clay with a weight of 7 N was coated with paraffin wax. The combined weight of clay and wax was found to be 7.1 N. The volume of wax coated sample was found by immersion in water to be 450×10^3 mm^3. The sample was then broken open and moisture content was found to be 20%. If the specific gravity of the soil particles and wax are 2.7 and 0.90, determine the bulk unit weight, void ratio and degree of saturation of the soil sample. (12)

B) Explain sedimentation analysis. Also, list the limitations of Stoke's law. (8)

3) A) The depth of water in a well is 4 m. Below the bottom of the well lies a layer of sand 6 m thick overlaying a clay deposit. The following details are available. $G_S = 2.65$, $G_C = 2.7$, $w_{sand} =$ (10)

23%, w_{clay} = 18%. Calculate the effective, neutral and total pressure at points 3 m below and 3 m above clay surface.

B) Obtain the expression for average permeability of the soil when water is flowing (i) perpendicular to the direction of bedding plane, (ii) parallel to the direction of bedding plane. (10)

4) A) A falling head permeability test is to be performed on a soil sample whose permeability is estimated to be about 3×10^{-5} cm/s. What diameter of the standpipe should be used if the head is to drop from 27.5 cm to 20.0 cm in 5 minutes and if the cross-sectional area and length of the sample are respectively 15 cm^2 and 8.5 cm respectively? What is the time taken for the head to drop from 37.7 cm to 30.0 cm? (4)

B) Explain discharge velocity and seepage velocity. Derive relation between them. (6)

C) Explain the factors affecting permeability. (10)

5) A) During a compaction test, a soil attains a maximum dry density of 19 kN/m^3 at an optimum moisture content of 10%. Determine the degree of saturation and percentage air voids at maximum dry density. Specific gravity of soil solids is 2.7. (6)

B) What are the advantages and disadvantages of direct shear test? (8)

C) Obtain the relationship between angle of failure plane and failure envelop in a triaxial test. (6)

6) A) Calculate the potential shear strength on a horizontal plane at a depth of 3 m below the surface in a formation of cohesionless soil when the water table is at a depth of 3.3 m. The degree of saturation may be taken as 0.5, void ratio = 0.5, specific gravity = 2.7 and angle of internal friction = 30°.
What will be the modified values of shear strength if the water table reaches the ground surface? (10)

B) A direct shear test was carried out on a cohesive soil sample and the following results are obtained. (10)

Normal Stress (kN/m^2)	75	125
Shear Stress at failure (kN/m^2)	55	60

What would be the deviator stress at failure if a triaxial test is carried out on the same soil with cell pressure of 75 kN/m^2?

7) A 6 m thick saturated soil stratum has a compression index of 0.25 and coefficient of permeability 3.2×10^{-3} mm/s. If the void ratio is 1.8 at vertical stress of 0.25 N/mm^2, compute the void ratio when the vertical stress is increased to 0.3 N/mm^2. Also calculate the settlement due to above stress increase and time required for 50 % consolidation. (10)

B) Explain Square root of time method to determine the coefficient of consolidation from laboratory data. (10)

8) A concentrated load of 50 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 20 meters directly under the load. Also determine the depth of a point directly under the load at which the stress is 5 kN/m^2. (10)

B) Explain the construction and uses of Newmark's Influence chart. (10)

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