A   Reg. No. :

Question Paper Code: 54105

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Fourth Semester

Civil Engineering

15UCE405-SOIL MECHANICS

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Ratio of volume of voids to total volume of solids is known as   CO1-R

   (a) void ratio   (b) porosity   (c) degree of saturation   (d) air content

2. At shrinkage limit ,the soil is   CO1-R

   (a) dry   (b) partially saturated   (c) saturated   (d) none of above

3. The property of a soil which permits flow of water through its   CO2-R
   interconnected voids is called

   (a) seepability   (b) porosity   (c) permeability   (d) void ratio

4. Bossinesq solution is based on the assumption   CO2-R

   (a) soil is homogenous   (b)self weight of soil is considered

   (c) soil is initially stressed   (d) soil is fully saturated

5. Compaction of a soil is measured in terms of   CO3-R

   (a)dry density   (b)specific gravity   (c) compressibility   (d) permeability

6. The ratio of settlement at any time 't' to the final settlement is known as   CO3-R

   (a) Co-efficient of consolidation   (b) Degree of consolidation

   (c) Consolidation index   (d) Consolidation of undisturbed soil

7. ---- is a field test for determination of shear strength of soil   CO4-R

   (a) vane shear test   (b) direct shear test   (c) triaxial compression test (d) UCC test

8. The shear strength of plastic undrained clay depends on   CO4-R

    (a)Internal friction   (b) Cohesion   (c) Both (a) and (b)   (d) Neither (a) nor (b)

9. The following assumption is not made for the friction circle method of   CO5-R
    slope stability analysis

    (a) Friction is fully mobilised

    (b)Total stress analysis is applicable

    (c) The resultant is tangential to the friction circle

    (d)The resultant passes through the centre of friction circle

10. In stability analysis, the term modified shear strength is referred to as   CO5-R

    (a) shear strength   (b) maximum shear stress

    (c) applied shear stress   (d) none of these

<div align="center">PART – B (5 x 2= 10Marks)</div>

11. Define degree of saturation.   CO1-U

12. Name the various lab and field tests to determine coefficient of permeability.   CO2-U

13. Define coefficient of consolidation.   CO3-U

14. What are the shear strength parameters?   CO4-U

15. State any two assumptions made in slope stability analysis.   CO5-U

<div align="center">PART – C (5 x 16= 80Marks)</div>

16. (a) The mass of a chunk of moist soil is 20 kg, and its volume is   CO1-App   (16)
         $0.011 \ m^3$. After drying in an oven, the mass reduces to 16.5 kg.
         Determine the water content, the density of moist soil, the dry
         density, void ratio and the degree of saturation. Take G= 2.70

<div align="center">Or</div>

    (b) The following data on consistency limits are available for two   CO1-App   (16)
         soils A and B.

	Soil A	Soil B
1.Plastic limit	16%	19%
2.Liquid limit	30%	52%
3.Flow index	11	6

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| | 4.Natural water content | 32% | 40% |

Find which soil is (a) more plastic, (b) better foundation material on remoulding, (c) better shear strength as a function of water content, (d) better shear strength at plastic limit.

17. (a) A sand deposit is 10 m thick and overlies a bed of soft clay. The ground water table is 3 m below the ground surface. If the sand above the ground water table has a degree of saturation of 45%, plot the diagram showing the variation of the total stress, pore water pressure and the effective stress. The void ratio of the sand is 0.70. Take G=2.65. CO2-App (16)

Or

(b) (i) The falling head permeability test was conducted on a soil sample of 4 cm diameter and 18 cm length. The head fell from 1.0 m to 0.40 m in 20 minutes. If the cross-sectional area of the stand pipe was 1 cm^2, determine the coefficient of permeability. CO2-App (8)

(ii) Determine the vertical stress at a point P which is 3 m below and at a radial distance of 3 m from the vertical load of 100 kN. Use Westergaard's equation. CO2-App (8)

18. (a) Explain the various methods used for compaction of soil. CO3-U (16)

Or

(b) (i) A clay stratum 5 m thick has the initial void ratio of 1.50 and the effective overburden pressure of 120 kN/m^2. When the sample is subjected to an increase of pressure of120 kN/m^2, the void ratio reduces to 1.44. Determine the coefficient of volume compressibility and final settlement of stratum. CO3-App (6)

(ii) A clay layer 4 m thick is subjected to a pressure of 55 kN/m^2. If the layer has a double drainage and undergoes 50 % consolidation in one year. Determine the coefficient of consolidation. Take T_v = 0.196. C03-App (10)

If the coefficient of permeability is 0.020 m/yr. Also determine the settlement in one year.

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19. (a) A shear vane of 7.5 cm diameter and 11.0 cm 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. The vane was then rotated rapidly to cause remoulding of the soil. The torque required in the remoulded state was 200 N-m. Determine the sensitivity of the soil.   CO4-App   (16)

Or

(b) The following results were obtained from a series of consolidated undrained tests on a soil in which the pore water pressure was not determined. Determine the cohesion intercept and angle of shearing resistance.   CO4-App   (16)

Sample No.	Confining pressure kN/m^2	Deviator stress at failure kN/m^2
1	100	600
2	200	750
3	300	870

20. (a) Explain friction circle method for stability analysis of slope.   CO5-App   (16)

Or

(b) (i) Discuss the slope protection measures that can be adopted to improve the stability of slopes.   CO5-U   (8)

(ii) List and explain the types of slope failures.   CO5-U   (8)

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