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**Question Paper Code: U4102**

B.E./B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Civil Engineering

21UCE402- SOIL MECHANICS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer All Questions

PART A - (5 x 1 = 5 Marks)

1. The specific gravity of Sandy soil is... CO1- U  
(a) 1.2                      (b) 1.8                      (c) 2.2                      (d) 2.7
2. The relationship which defines plasticity index  $I_p$  in a better way CO2-App  
is.....  
(a)  $W_1 - W_p$               (b)  $I_f \cdot I_t$               (c)  $W - W_p / W_1 - W_p$               (d) none of the above
3. For a soil deposit having  $e = 49\%$  and  $G = 2.60$ , the critical hydraulic CO2-App  
gradient is.....  
(a) 1                      (b) 1.05                      (c) 1.07                      (d) 1.10
4. Which property of the soil is controlled by the effective stress CO1- U  
(a) Shear strength              (b) Compressibility              (c) Permeability              (d) All the above
5. Weight of Hammer used in Standard Proctor Test ..... CO1- U  
(a) 2.6 Kg                      (b) 4.6 Kg                      (c) 8 Kg                      (d) 12.5 Kg

PART – B (5 x 3= 15 Marks)

6. Define: Zero Air Voids line. CO1-U
7. Define quick sand condition. CO1-U
8. Distinguish compaction and consolidation. CO1-U
9. What are the tests available for determining the shear strength of soil? CO1 U
10. List the different type of slopes. CO1-U

PART – C (5 x 16= 80 Marks)

11. (a) The mass specific gravity of a fully saturated specimen of clay having a water content of 40% is 1.88. on oven drying the mass specific gravity drops to 1.74. calculate the specific gravity of clay and its shrinkage limit. CO2- App (16)

Or

- (b) Soil is to be excavated from a borrow pit which has a density of 2 gm/cc and water content of 14%. The specific gravity of soil particles is 2.7. the soil is compacted so that water is 20% and dry density 1.9 gm/cc for 1000 m<sup>3</sup> of soil in fill, estimate  
 i) the quantity of soil to be excavated from the pit in m<sup>3</sup>;  
 ii) The amount of water to be added. CO2- App (16)

Also determine the void ratio of soil in borrow pit and fill

12. (a) Discuss the assumptions of Boussinesq and Westerguard theory and also the expression for vertical stress due to point load. CO1- U (16)

Or

- (b) The water table in an certain area is at a depth of 4m below the ground surface to a depth of 12m of the soil consist of very fine sand ,having an average void ratio of 0.7 above water table the sand has an average degree of saturation of 50%. Estimate the effective pressure on a horizontal plane at a depth of 10m below the ground surface , Estimate the increase in effective pressure , if the soil gets saturated by capillarity, up to a height of 1m above the water table ,Assume G = 2.65. CO1- U (16)

13. (a) Derive the expression for coefficient of consolidation using Terzaghi's one dimensional consolidation theory. CO1- U (16)

Or

- (b) The following data obtained in a compaction test. Specific Gravity = 2.65. Determine OMC and Maximum Dry Density. Draw Zero Air Void Line CO1- U (16)

Moisture content (%)	2	4.2	5.5	6.6	7.5	10
Wet Density (kN/m <sup>3</sup> )	20.2	20.8	21.7	22.0	22.1	22.0

14. (a) A cylindrical specimen of dry sand was tested in triaxial test. CO4- App (16)  
Failure occurred under a cell pressure of  $2\text{kg/cm}^2$  and at a deviator stress of  $6\text{Kg/cm}^2$ . Estimate
- i) Angle of shearing resistance of soil.
  - ii) Normal and shear stresses on the failure plane
  - iii) The angle made by the plane with the minor principal plane.

The maximum shear stress on any plane in the specimen at a instant of failure.

Or

- (b) An unconfined compression test was conducted on an undisturbed sample of clay .the sample had a diameter of 38 mm and length 76mm. The load at failure was 50 N and the axial deformation of the sample 15mm. Estimate the undrained shear strength parameters, if the failure plane made an angle of  $60^\circ$ with horizontal. CO4- App (16)

15. (a) Briefly explain about the method of analysis of finite slopes. CO1- U (16)

Or

- (b) A slope is to be constructed in a soil for which  $C= 0$  and  $\Phi = 36^\circ$ , It is to be assumed that the water level may occasionally reach the surface of slope, which seepage taking place parallel to the slope .Determine the maximum slope angle for a factor of safety of 1.5, assuming a potential failure parallel to the slope, what would be the factor of safety of the slope, constructed at this angle, if the water table should be well below the surface? The saturated unit weight of the soil is  $19\text{kN/m}^3$ . CO1- U (16)

