

A

Reg. No. :

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Question Paper Code: U4102

B.E./B.Tech. DEGREE EXAMINATION, NOV 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. If void ratio (e) of soil is 0.5, calculate the porosity (n)..... CO1- U
(a) 0.536 (b) 0.840 (c) 0.075 (d) 0.33
2. The relationship which defines plasticity index I_p in a better way CO2-App
is.....
(a) $W_L - W_p$ (b) $I_f \cdot I_t$ (c) $W - W_p / W_L - W_p$ (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. The factor of safety of an infinite slope in a sand deposit is 1.732. If the CO1- U
angle of shearing resistance is 30° , the safe slope is
(a) 19.45° (b) 75.4° (c) 18.4° (d) 71.6°

PART – B (5 x 3 = 15 Marks)

6. A soil has void ratio of 0.65 and specific gravity 2.80. Determine unit weight of CO2-App
soil.
7. Determine the value of critical hydraulic gradient for a loose sand deposit CO2-App
having void ratio of 0.67 and specific gravity of 2.67.
8. What will be empirical equation for determination of time factor, If the degree CO2-App
of consolidation is $< 60\%$ and also if it is $> 60\%$.

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 of wet soil when compacted in a mould was 19.55 kN. CO2- App (16)
The water content of the soil was 16%. If the volume of the mould was 0.95 m^3 . Determine (i) dry unit weight, (ii) Void ratio, (iii) degree of saturation and (iv) percent air voids. Take $G = 2.68$.

Or

- (b) Two clays A and B have the following properties: CO2- App (16)

Atterberg limits Clay A Clay B

Liquid limit 44 % 55%

Plastic limit 29% 35%

Natural water content 30% 50%

Which of the clays A or B would experience larger settlement under identical loads, is more plastic and is softer in consistency?

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

Or

- (b) The water table in an certain area is at a depth of 4m below the CO1- U (16)
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 $G = 2.65$.

13. (a) A 1m thick laboratory soil sample reaches 60% consolidation in CO1- U (16)
32.5secs under double drainage condition. Calculate how much time will be required for a 10 m thick layer in the field to reach the same degree of consolidation if it has drainage face on one side only.

Or

- (b) In a laboratory consolidometer test on a 20mm thick sample of saturated clay taken from a site, 50% consolidation point was reached in 10 minutes. Estimate the time required for the clay layer of 5m thickness at the site for 50% compression if there is drainage only towards the top. What is the time required for the clay layer to reach 50% consolidation if the layer has double drainage instead of single drainage. CO1- U (16)

14. (a) Direct Shear Test was conducted on Compacted Sand Shear Box Dimensions 60mm x 60 mm. The readings are listed below. CO4- App (16)

Normal load (N)	110	225	30
Peak shear load (N)	95	195	294
Ultimate shear load (N)	65	135	100

Examine the angle of shearing resistance in

- a. Dense compacted state
- b. Loose state

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° with horizontal. CO4- App (16)

15. (a) 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. Estimate 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 19kN/m^3 . CO2- App (16)

Or

- (b) A long natural slope in a $c-\Phi$ soil is inclined at 15° to the horizontal. The water table is at the surface and the seepage is parallel to the slope. CO2- App (16)

If a plane slip has developed at a depth of 4m. Determine the factor of safety ($c = 19\text{kN/m}^2$, $\Phi=28^\circ$ and $\gamma_{\text{sat}} = 25\text{kN/m}^3$),