

B.E. Fourth Semester (Civil Engineering) (CGS)
10181 : Geotechnical Engineering - I : 4 CE 01

P. Pages : 3

Time : Three Hours



AU - 2563

Max. Marks : 80

- Notes :
1. Due credit will be given to neatness and adequate dimensions.
 2. Assume suitable data wherever necessary.
 3. Diagrams and chemical equations should be given wherever necessary.
 4. Retain the construction lines.
 5. Illustrate your answer necessary with the help of neat sketches.

1. a) Draw the three phase diagram of moist soil mass showing all of it's components and derive relationship between moist unit wt. & moisture content w , specific gravity of soil solids G , void ratio e and unit wt of water. 6

- b) An air dried soil sample weighing 2500 gm was sieved in a laboratory. The results are given below : 7

IS Sieve mm	2.0	1.0	0.6	0.425	0.212	0.150	0.075	fin
Mass Retained 'gm'	0.0	202.0	351.0	753.0	815.0	281.0	90.0	8.0

Draw particle size distribution curve and determine the coefficient of curvature, uniformity coefficient and comment on type of soil.

OR

2. a) Draw a typical volume v/s moisture content graph for a soil mass showing atterberg's limits and differ them. 6

- b) A soil has a porosity of 40%, the specific gravity of soil solids as 2.7, Calculate - 7
- a) Voids ratio
 - b) Dry units weight
 - c) Unit wt if soil is 50% saturated
 - d) Unit weight of soil is 100% saturated.

3. a) Explain the structure of Kaolinite, Illite and Montmorillinite clay minerals. 6

- b) Following results were obtained from a standard compaction test on a sample of soil. 7

Water content	0.12	0.14	0.16	0.18	0.20	0.22
Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.87	1.85

The volume of the mould used was 1000 cm³. Draw the compaction curve and obtain maximum dry density and optimum moisture content. Also draw zero air void line.

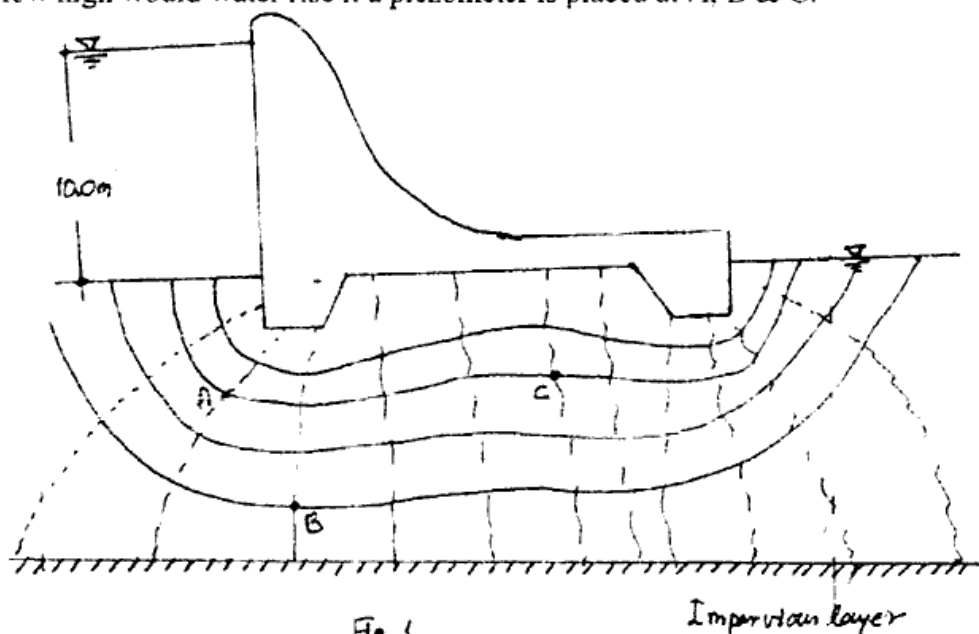
OR

4. a) Enumerate the factors affecting compaction and discuss the concept of wet of optimum and dry of optimum. 6

- b) An earth embankment is compacted at a water content of 18% to a bulk unit weight of 19.2 kN/m^3 . If specific gravity of sand is 2.7, find the voids ratio, and degree of saturation of compacted embankment. 7
5. a) In a falling head permeameter test the initial head is 40.0 cm at $t = 0$. The head drops by 5.0 cm in 10 minutes. Calculate the time required to run the test for final head to be at 20.0 cm. If sample is 6.0 cm in height and 50.0 cm^2 in x-sectional area, calculate coefficient of permeability taking area of stand pipe as 0.50 cm^2 . 7
- b) Enlist various methods for determination of coefficient of permeability and discuss any one with its suitability. 7

OR

6. a) Discuss the effective coefficient of permeability of stratified soil deposits in horizontal and vertical direction. 7
- b) A well penetrates into an unconfined aquifer having a saturated depth of 100.00 m. The discharge is 250.0 liters/minutes at 12.0 m drawdown. Assuming equilibrium flow conditions and a homogeneous aquifer, estimate the discharge at 18.0 m drawdown. The distance from the well where drawdown influences are not appreciable may be taken equal for both cases. 7
7. a) Discuss the quick sand conditions for saturated soil mass and derive the equation for critical hydraulic gradient. 7
- b) A dam section is shown in fig. 1. 7
- If $k = 0.02 \text{ mm/sec}$, determine seepage loss of the dam in m^3/day .
 - How high would water rise if a piezometer is placed at A, B & C.



OR

8. a) Discuss the design criteria of graded filter. 6

- b) The specific gravity of the particles of sand is 2.66. The porosity of a sample in the loose state was 52% and in dense state 25%. Find out the critical hydraulic gradient in both the states. Also find out saturated densities in both the cases. 7

9. a) What is Mohr stress circle and Mohr strength envelope? Explain with sketches as how such strength envelopes can be drawn for pure sands & clays respectively. 6

- b) From a direct shear test on a soil sample the following data have been obtained. 7

Normal Stress kN/m ²	Shear Stress kN/m ²
70	138
96	156
114	170

Determine the shear strength parameters if the specimen of same soil sample is subjected to a normal stress of 100 kN/m². Determine the shear strength major and minor principal stresses.

OR

10. a) What are the various drainage conditions for which Triaxial shear test is conducted. Discuss merits and demerits of triaxial shear test. http://www.sgbauonline.com 6

- b) A series of direct shear test was conducted on a soil, each test was carried out till failure of sample. 7

The following results were obtained :

Sample No.	Normal Stress kN/m ²	Shear Stress kN/m ²
1	15	18
2	30	25
3	45	32

11. a) Discuss the assumptions made in Boussinesque's solution for stresses caused by the applications of point load on surface of soil mass. 6

- b) A concentrated load of 22.5 kN acts on the surface of a homogeneous soil mass of large extent. 7

Find the stress intensities at a depth of 15.0 m and

- i) Directly under the load
ii) At a horizontal distance of 7.0 m use Boussinesque equation.

OR

12. a) Discuss the assumptions made in the Terzaghi's theory of consolidation. 6

- b) A clay layer 4.0 m thick has a final settlement of 6.0 cm. The layer has double drainage. If the coefficient of consolidation is 0.02 cm²/minute determine the time required for different 50% and 90% consolidation and corresponding settlement. 7

Take $T_v = 0.196$ and 0.848 for $u = 50\%$ and 90% respectively.
