

CS/B.Tech/CE/NEW/SEM-4/CE-403/2013

- iii) A soil has a bulk density of 22 kN/m^3 and water content 10%. The dry density of soil is
- a) 18.6 kN/m^3 b) 20 kN/m^3
- c) 22 kN/m^3 d) 23.2 kN/m^3 .
- iv) If the consistency index of soil exceeds unity, the soil is in
- a) Liquid state b) Plastic state
- c) Solid state d) Very stiff state.
- v) Effective stress on soil
- a) increases voids ratio and decreases permeability
- b) increases both voids ratio and permeability
- c) decreases both voids ratio and permeability
- d) decreases voids ratio and increases permeability.
- vi) Which of the following methods is more suitable for determination of permeability of clayey soil ?
- a) Constant head method
- b) Falling head method
- c) Horizontal permeability test
- d) None of these.
- vii) Phreatic line in an earthen dam is
- a) Straight line b) Parabolic
- c) Circular d) Elliptical.

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- viii) The part of water which is held under the influence of soil attractive forces is defined as
- a) Structural water b) Capillary water
 - c) Adsorbed water d) Ground water.
- ix) The pressure on a phreatic line is
- a) equal to atmospheric pressure
 - b) greater than the atmospheric pressure
 - c) less than the atmospheric pressure
 - d) not related to atmospheric pressure .
- x) The clay mineral with largest swelling and shrinkage characteristics is
- a) kaolinite b) Illite
 - c) montmorillonite d) none of these.
- xi) The soils that have been deposited from suspension in still, fresh water of lakes is known as
- a) Aeolian b) Alluvial
 - c) Lacustrine d) Glacial.
- xii) The coefficient of permeability of a soil
- a) increases with increase in temperature
 - b) increases with decrease in temperature
 - c) increases with decrease in unit weight of water
 - d) decreases with an increase in void ratio.

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GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. State Darcy's law. What do you mean by discharge velocity and seepage velocity ? Prove that the seepage velocity is always greater than discharge velocity. State and explain the variables on which the permeability of a soil depends.
3. a) What is meant by 'critical hydraulic gradient' ?
b) Calculate the value of critical hydraulic gradient for the soil having the specific gravity of solid grains as 2.65 and void ratio to be 0.7.
4. The overburden pressure on a normally consolidated 5 m thick clay structure is 250 kN/m^2 . A laboratory consolidation test followed by a suitable correction gives two points on the field curve : $e_1 = 1.12$, $p_1 = 150 \text{ kN/m}^2$, $e_2 = 1.02$, $p_2 = 450 \text{ kN/m}^2$. Calculate settlement of the clay.
5. How many cubic metres of fill can be constructed at a void ratio of 0.65 from 221000 cu.m of borrow material that have a void ratio of 1.25 ?
6. The bulk unit weight of a soil is 19.1 kN/cu.m , the water content is 12.5%, specific gravity of soil is 2.67. Determine the dry unit wt., void ratio, porosity and degree of saturation.

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7. A core cutter 12.6 cm in height and 10.2 cm in diameter weighs 1071 gm when empty. It is used to determine the *in-situ* unit weight of an embankment. The weight of core cutter full of soil is 2970 gm. (a) If the water content is 6%, what are the *in situ* dry weight and void ratio ? (b) If the embankment gets fully saturated due to heavy rains, what will be the increase in water content and bulk unit weight, if no volume change occurs ? The specific gravity of soil solids is 2.69.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Write short notes on Quick sand condition and Phreatic line.
- b) A concrete dam is constructed across a river over a permeable stratum of soil of limited thickness. The water heads are 16 m on the upstream side and 2 m on the downstream side. The flow net constructed under the dam gives $N_f = 7$ and $N_d = 21$. Calculate the seepage loss through the subsoil if the average value of the hydraulic conductivity is 6×10^{-3} cm/sec horizontally and 3×10^{-4} cm/sec vertically. Also calculate exit gradient if the average length of the last field is 0.9 m.

8 + 7

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9. a) Differentiate between compaction and consolidation.

b) The following are the results of compaction test :

Mass of mould and wet soil (g)	2925	3095	3150	3125	3070
Water content (%)	10.0	12.0	14.3	16.1	18.2

Volume of the mould = 1000 ml, Mass of mould = 1000 g.

Plot the compaction curve and find out optimum moisture content and maximum dry density. 5 + 10

10. What will be the ratio of average permeability in horizontal direction to that in vertical direction for a soil deposit consisting of three horizontal layers if the thickness and permeability of the second layer are twice of those of the first and those of the third layer twice those of second ?

11. a) Explain the terms : Total stress, Neutral stress and Effective stress

b) A sand deposit is 5 m deep over a clay deposit of 4 m deep. The ground water table is at 3 m below the ground surface. Draw the total, neutral and effective stress diagram upto a depth of 9 m, neglecting capillary rise.

Properties of sand : void ratio $e = 0.5$, $s = 40\%$, $G = 2.67$ Properties of clay : natural moisture content $W_n = 40\%$, $G = 2.7$.6 + 9

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12. a) Discuss Terzaghi's theory of consolidation, stating the various assumptions and their validity.
- b) A 2 m thick layer of saturated clay lies in between two permeable layers. The clay has the following property :
 Liquid limit = 45%, Coefficient of permeability = 2.8×10^{-7} cm/sec, initial void ratio = 1.25. The initial effective overburden pressure at the middle of clay layer is 2 kg/cm^2 and likely to increase to 4 kg/cm^2 due to construction of a new building. Determine (i) Final void ratio of clay (ii) Settlement of the building and (iii) Time required for 50 % consolidation. 7 + 8
13. a) A CU test was conducted on a normally consolidated clay for which it can be assumed that $C'_l = C'_u = 0$. A sample failed at a deviator stress of 50 kN/m^2 , when the cell pressure was 100 kN/m^2 . What is the value of ϕ'_u if $\phi' = 32^\circ$ for the soil ? What was the pore water pressure at failure ?
- b) The results of a direct shear test performed on a soil sample in a shear box of $6 \text{ cm} \times 6 \text{ cm}$ size are given below :

Normal load (kg)	30	40	50	60
Shear force at failure (kg)	18.1	25.8	33.1	39.8

Plot the failure envelope for the soil and determine its shear parameters. 6 + 9
