



Name: _____ Index Number: _____

SECTION A: Attempt all Questions

Question 1-15: State whether the following statements are True or False

1. Consistency of a fine -grained soil is the physical state in which it exists.
2. At the liquid limit, the clay is practically like a liquid, but possesses a small shearing strength.
3. Liquidity Index is used to compare the in-situ water content with its liquidity
4. A classification system must satisfy all conditions.
5. A saturated sample of soil was found to have a water content of 27% and a bulk density of 1.97 Mg/m^3 . The dry density is 2.24 Mg/m^3 .
6. From Q5 above , the void ratio is 0.27.
7. The stress-strain behaviour of an undrained saturated mass of soil subject to loading is similar to that of an elastic solid body, providing that the strain is relatively low.
8. For reasonably homogeneous strata Young's Modulus (E_u) is considered to be constant, although it does increase with depth.
9. The compression index for a given soil may be taken as constant for settlement.
10. Resistance to shear is provided by the friction between the soil particles and is inversely proportional to the normal force between them.
11. Cohesive resistance to shearing is assumed to vary directly for a given soil independent of the applied stress.
12. It is possible, using a *reversible* shear box, to carry out tests involving large displacements, the consistency index can be negative.
13. Bearing capacity calculations should be carried out in terms of total stress equations
14. A *shallow* foundation (footing) is one with a breadth (B) \geq Depth (z).
15. As a guideline for sandcrete structures, maximum differential settlement between adjacent columns is 25 mm.

Circle or Tick the right answer Only

Que 16 According to the Stokes Law, the terminal velocity of a small sphere settling in fluid is of what extent.

- a) Infinite b) Finite c) Definite d) Indefinite

Que 17 After an initial adjustment in Sedimentation analysis a steady condition is attained and . the velocity in the fluid becomes

- a) Constant b) Laminar c) Non Laminar d) Variable

Que 18 If a spherical particle falls into a fluid through a height of 6 m in a record time of 2

minutes, what would be the intended velocity.

- a) 0.08 m/s b) 1.2 m/s c) 0.05 m/s d) 3.0 m/s

Que 19 Bernoulli's theorem states the total energy flow H possessed by water contains a number of component heads except

- a) Elevation b) Pressure c) Velocity d) Capacity

Que 20 Which of the following does not contribute to the failure of shallow foundation

- a) a) Load per unit length b) Cohesion along the face c) Pressure difference
d) Passive resistance

Que 21. Which of the following statement is wrong .

- a) The void ratio of a saturated soil can be determined from its water content
b) The boiling temperature of water is 100°
c) 100% saturation line and zero percent void lines are identical.
d) Plasticity limit is greater than plasticity index

Que. 22. The shear strength of cohesion soil is.

- a) proportional to the tangent of the angle of sharing resistance
b) inversely proportional to the angle of sharing resistance
c) proportional to the angle of sharing resistance
d) equal to the angle of sharing resistance

Que. 23 The soil which plots above the 'A' line in the plasticity chart.

- a) clays
b) silt
c) sand
d) organic

Que 24 For clay materials the maximum differential settlement between adjacent column is .

- a) 25 mm
b) 40 mm
c) 65 mm
d) 100

Que 25 Calculate the resultant active thrust on a vertical smooth retaining wall of height 5.4 m given that $\phi=30^\circ$ $C=0$ and $\gamma=20 \text{ kN/m}^2$.

- a) 97.2 kN/m b) 102.4 kN/m c) 86.4 kN/m d) 113.9 kN/

SECTION B: Attempt any two Questions out of the following

Que 1

- (a) Briefly distinguish between the following:
 - (i) Drained and Undrained test
 - (ii) Shear stress and Residual stress
- (b) Mention two each of laboratory and *in-situ* shear test methods
- (c) A shear box test on compacted sand gave the following results

Normal Pressure (kN/m ²)	Shearing Stress (KN/m ²)	
	Peak Value	Peak Value
45	29	23
90	58	45
135	87	67

Determine the angle of shearing resistance of the sand

- (i) In the compacted state
- (ii) When loose by shearing action

Que 2

- a) Sketch the variable-head permeameter
- b) Prove the Darcy's Law
- c) A permeameter of diameter 75mm has length of 150mm. The diameter of the standpipe is 15 mm. During the test, the head decreased from 1300 mm to 800 mm in 135 s. Calculate the coefficient of permeability of the soil in mm/s

Que 3

- (a) Outline the objectives of site investigation
- (b) State in logical sequence the stages of site investigation
- (c) A rectangular footing of length 8m and breadth 12 m is to be founded at a depth of 4.5m in a cohesive soil having the following properties

$$C = 40\text{kN/m}^2, \phi = 0, \gamma = 18.0 \text{ k/m}^3$$

$$N_c = 5.14, N_q = 1 \text{ and } N_y = 0$$

- i) Determine the Ultimate bearing capacity
- ii) Given that the factor of safety is 2.5, calculate allowable bearing pressure.

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