ADDITIONAL QUESTIONS

MULTIPLE CHOICE

1. Which one of the following relations is **not** correct ?

   A. $e = \frac{n}{1-n}$ **B.** $n = \frac{e}{1-e}$

   C. $e = \frac{WG}{S_1}$ **D.** $\gamma_{sat} = \frac{(G+e)}{1+e}\gamma_w$

2. If the porosity of a soil sample is 20%, the void ratio is.

   A. 0.20 **B.** 0.80

   C. 1.00 **D.** 0.25

3. A soil sample in its natural state has mass of 2.290 kg and a volume of 1.15×10^{-3} m^3. After being oven dried, the mass of the sample is 2.035 kg. G_s for soil is 2.68. The void ratio of the natural soil is

   A. 0.40 **B.** 0.45

   C. 0.55 **D.** 0.51

4. A river 5m deep consists of a sand bed with saturated unit weight of 20 kN/m^3 $\gamma_w = 9.81$ kN/m^3. The effective vertical stress at 5m below the top of the sand bed is

   A. 41kN/m^2 **B.** 51kN/m^2

   C. 55kN/m^2 **D.** 53kN/m^2

5. Principle involved in the relations between submerged unit weight and saturated unit weight of a soil is based on.

   A. Equilibrium of floating bodies **B.** Archimedes' Principle

   C. Stoke's law **D.** Darcy's Law

6. The approximate depth at which the effective vertical pressure is equal to 100 kN/m^2 in a typical deposit of submerged soil is:–

   A. 5m **B.** 10m

   C. 20m **D.** 100m

7. The consistency of a saturated cohesive soil is affected by :

   A. water content **B.** particle size distribution

   C. density index. **D.** coefficient of permeability.

8. A soil having particles of nearly the same size is said to be :

   A. well graded **B.** uniformly graded

   C. poorly graded **D.** gap graded

9. The particle size distribution curves are extremely useful for the classification of
   A. fine grained soils
   B. coarse grained soils
   C. both coarse grained and fine grained soils
   D. silts and clays

10. If soil is dried beyond its shrinkage limit, it will show.
   A. large volume change.
   B. moderate volume change
   C. low volume change
   D. no volume change

11. Consistency index for a clayey soil is
   A. $\frac{w_L - w}{I_\rho}$
   B. $\frac{w - w_L}{I_\rho}$
   C. $w_L - w_p$
   D. 0.5 w

12. The values of liquid limit and plasticity index for soils having common geological origin in a restricted locality usually define.
   A. a zone above A-line
   B. a straight line parallel to A-line
   C. a straight line perpendicular to A-line
   D. points may be anywhere in the pasticity chart.

13. The toughness index of clayey soils is given by
   A. plasticity index / flow index
   B. liquid limit / plastic limit
   C. liquidity index / plastic limit
   D. plastic limit / liquidity index.

14. The values of void ratio of a micaceous sand sample in the densest and the loosest states are 0.4 and 1.2 respectively. The density index of the soil for in place void ratio 0.6 will be :
   A. 60%
   B. 75%
   C. 65%
   D. 80%

15. Consistency, in general, is that property of soil which is manifested by its resistance to :
   A. impact
   B. rolling
   C. flow
   D. none of the above.

16. The liquid limit of saturated normally consolidated soil is 50%. The compression index of the soil for virgin compression curve will be :
   A. 0.36
   B. 0.505
   C. 0.605
   D. 0.705

17. The group index of a soil sub grade is 7. The sub grade soil is rated as.
   A. poor.
   B. very poor
   C. good
   D. fair.

18. The coefficient of curvature (C_c) is defined by :–

A. $\frac{D_{10}^2}{D_{30} \cdot D_{60}}$ B. $\frac{D_{30}^2}{D_{10} \cdot D_{60}}$

C. $\frac{D_{30} \cdot D_{10}}{D_{60}^2}$ D. $\frac{D_{60}^2}{D_{10} \cdot D_{30}}$

19. The description 'sandy silty clay' signifies that.

A. The soil contains unequal proportions of the three constituents, in the order, sand > silt > clay.

B. The soil contains equal proportions of sand, silt and clay.

C. The soil contains unequal proportionof the three constituents such that clay > silt > sand.

D. There is no information regarding the relative proportions of the three.

20. The shape of clay particle is usually

A. angular B. flaky

C. tubular D. rounded

21. When the products of rock weathering are not transported as sediments but remain in place, the soil is :

A. alluvial soil. B. residual soil.

C. glacial soil. D. aeolian soil.

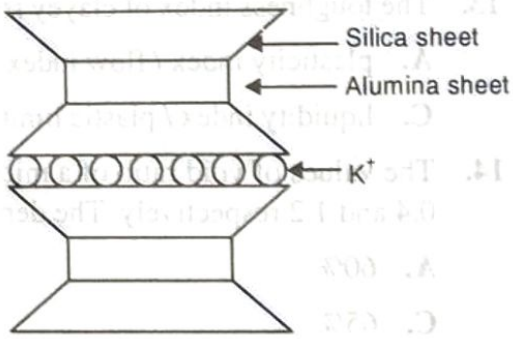
22. The structure of a clay mineral as represented in the following figure is of :–

A. kaolinite

B. montmorillonite.

C. halloysite

D. illite.



23. Amongst the clay minerals, the one having the maximum swelling tendency is :–

A. kaolinite

B. montmorillonite.

C. halloysite

D. illite

24. The swelling nature of block cotton soil is primarily due to the presence of

A. kaolinite B. lllite

C. montmorillonite D. verimiculite

25. Water chemically combined in the crystal structure of soil particles is called

A. adsorbed water B. capillary water

C. structural water D. free water

26. A soil mass has coefficients of horizontal and vertical permeability as 9×10^{-7} cm/s and 4×10^{-7} cm/s, respectively. The transformed coefficient of permeability of an equivalent isotropic soil mass is.

A. 9×10^{-7} cm/s
B. 4×10^{-7} cm/s
C. 13×10^{-7} cm/s
D. 6×10^{-7} cm/s.

27. According to Darcy's law for flow through porous media, the velocity is proportional to :
A. effective stress
B. hydraulic gradient
C. cohesion
D. stability number.

28. For anistropic soil, permeabilities in x and y directions are k_x and k_y respectively. In two dimensional flow the effective permeability K_{eq} for the soil is given by
A. $k_x + k_y$
B. k_x / k_y
C. $\sqrt{(k_x^2 + k_y^2)}$
D. $\sqrt{k_x k_y}$

29. The coefficient of permeability of a soil is 5×10^{-5} cm/sec for a certain pore fluid. If the viscosity of the pore fluid is reduced to half, the coefficient of permeability will be
A. 5×10^{-5} cm/sec.
B. 10×10^{-5} cm/sec.
C. 2.5×10^{-5} cm/sec.
D. 1.25×10^{-5} cm/sec.

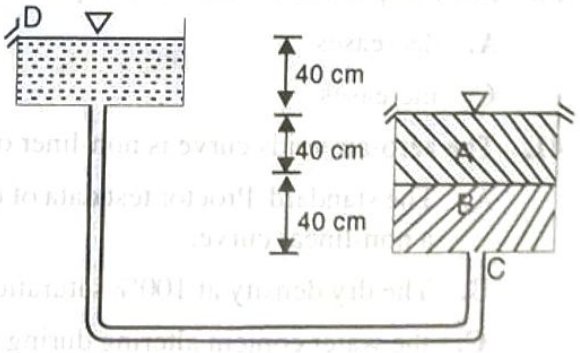
30. The soils most susceptible to liquefaction are
A. saturated dense sands
B. saturated fine and medium sands of uniform particle size.
C. saturated clays of uniform size.
D. saturated gravels and cobbles.

31. The piezometric head at point C, in the experimental set-up shown in accompanying figures when the flow takes place under a constant head through the soils A ands B is
A. 0 cm
B. 40 cm
C. 80 cm
D. 120 cm

32. Seepage force per unit volume (j) can be expressed as.
A. $i\gamma_w L$
B. iL
C. $\gamma_w h$
D. $i\gamma_w$

where i=hydraulic gradient, l = length of soil sample, h=hydraulic head, γ_w=unit weight of water.

33. Flow is taking place through a non-homogeneous soil deposit from zone 1 to zone 2 having the permeabilities as shown in figure. The deflection angle (α_2) of the streamlines as shown in the figure will be.



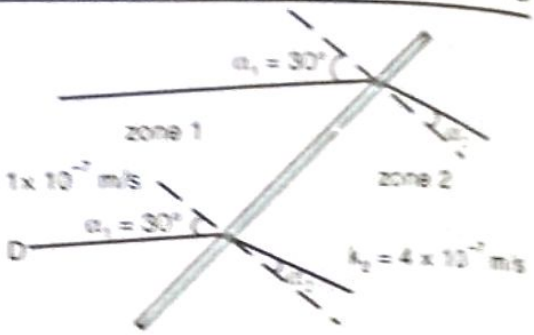
A. 66.6°
B. 14.0°
C. 8.2°
D. 76.0°

34. Piping in soil occurs when :–
A. effective stress becomes zero.
B. sudden change of permeability takes place.
C. the soil is fissured and cracked.
D. the soil is highly porous.

35. Along a phreatic line in an earth dam.

A. the total head is constant but not zero. B. the total head is everywhere zero.

C. the pressure head is everywhere zero. D. none of the above.



36. The hydraulic gradient needed to make effective stress zero at a point in fine sand will be given by :

A. $\frac{\gamma'}{\gamma_{sat}}$ B. $\frac{G+1}{1+e}$

C. $\frac{G-1}{1+e}$ D. $\frac{1+e}{G-1}$

37. A point load of 700 kN is applied on the surface of a thick layer of clay. Using Boussinesq's elastic analysis, the estimated vertical stress (O_v) at a depth of 2m and a radial distance of 1.0m from the point of application of the load is :

A. 47.5 kPa B. 47.6 kPa

C. 47.7 kPa D. 47.8 kPa

38. The vertical stress at depth, z directly below the point load Q is (k is a constant)

A. $k\frac{Q}{z}$ B. $k\frac{Q}{z^3}$

C. $k\frac{Q}{z^2}$ D. $k\frac{Q}{\sqrt{z}}$

39. The dry unit weight of soil at zero air voids depends on.

A. specific gravity B. water content

C. unit weight of water. D. all the three

40. In a compaction test, as the compactive effort is increased, the optimum moisture content.

A. decreases B. remains same

C. increases D. increases first and thereafter decreases

41. The zero-air voids curve is non-liner owing to:-

A. The standard Proctor test data of dry density and corresponding water content plotting as a non-linear curve.

B. The dry density at 100% saturation being a non-linear function of the void-ratio.

C. the water content altering during compaction.

D. The soil being compacted with an odd number of blows.

42. The time for a clay layer to achieve 90% consolidation is 15 years. The time required to achieve 90% consolidation, if the layer were twice as thick, 3 times more permeable and 4 times more compressible would be:

A. 70 Years B. 75 Years

C. 80 Years D. 85 Years.

43. The slope of the e-log p curve for a soil mass gives
   A. coefficient of permeability, k
   B. coefficient of consolidation, C_v
   C. compression index, C_c
   D. coefficient of volume compressibility, M_v

44. Consolidation in soils.
   A. is a function of the effective stress
   B. does not depend on the present stress
   C. is a function of the pore water pressure.
   D. is a function of the total stress.

45. Terzaghi's one-dimensional consolidation theory assumes that
   A. e Vs. p relation is linear.
   B. e Vs. $\log_{10}$p relation is linear
   C. p Vs. $\log_{10}$ e relation is linear.
   D. e Vs. $\log_{10}$ p/p_0 relation is linear.

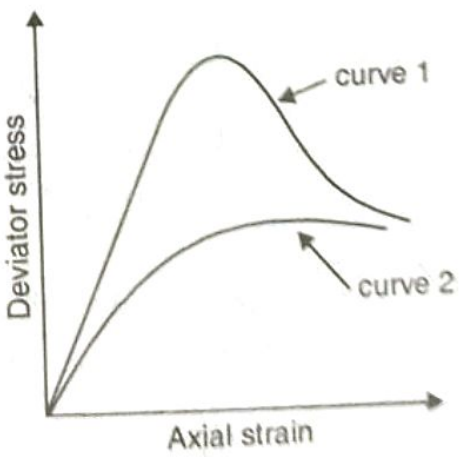
46. Consolidation time.
   A. increases with increase in compressibility.
   B. increases rapidly with decreasing size of soil mass.
   C. decreases with increase in permeability.
   D. is in dependent of the magnitude of stress.

47. The coefficient of consolidation is used for
   A. establishing the duration of primary consolidation.
   B. estimating the amount of settlement for a load increment
   C. determining the depth to which the soil is stressed when loads are applied on the surface of a soil deposit.
   D. determining the preconsolidation pressure for soil deposit known to be overconsolidated.

48. The appropriate field test to determine the insitu undrained shear strength of soft clay is
   A. plate load test.
   B. static cone penetration test
   C. standard penetration test
   D. vane shear test.

49. The unconfined compressive strength of a stiff clay falls in the range.
   A. less than 50 kN/m^2
   B. 50 to 100 kN/m^2
   C. 100 to 200 kN/m^2
   D. above 200 kN/m^2

50. The stress-strain behaviour of soils as shown in the following figure corresponds to:
   A. Curve 1 : Loose sand and normally consolidated clay.
      Curve 2 : Loose sand and over consolidated clay.
   B. Curve 1 : Dense sand and normally consolidated clay.
      Curve 2 : Loose sand and over consolidated clay.
   C. Curve 1 : Dense sand and over consolidated clay
      Curve 2 : Loose sand and normally consolidated clay.
   D. Curve 1 : Loose sand and over consolidated clay
      Curve 2 : Dense sand and normally consolidated



clay.

51. Some of the structural strength of a clayey material that is lost by remoulding is slowly recovered with time. This property of soils to undergo an isothermal gel-to sol-to-gel transformer upon agitation and subsequent rest is termed

A. isotropy B. anisotropy

C. thixotropy D. allotropy

52. The ratio of unconfined compressive strength of an undisturbed sample of soil to that of a remoulded sample, at the same water content, is known as.

A. activity B. damping

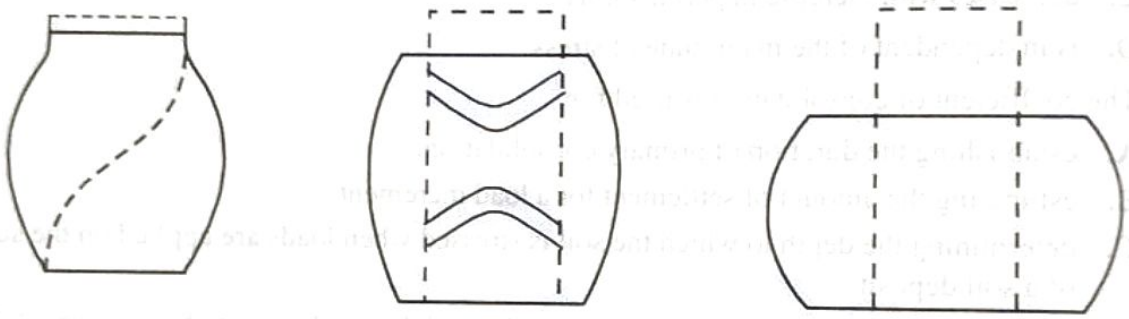
C. plasticity D. sensitivity.

53. Vane tester is normally used for determining in situ shear strength of

A. soft clays B. sand

C. stiff clays D. gravel

54. Triaxial compression test of three soil specimens exhibited the patterns of failure as shown in following figure. Failure modes of the samplers respectively are



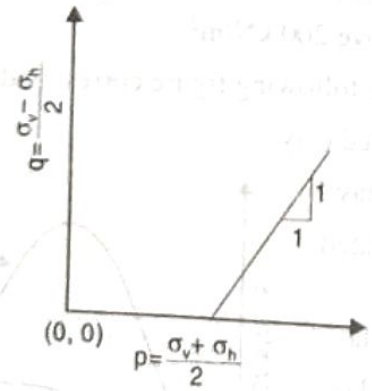
A. (*i*) brittle, (*ii*) semi-plastic, (*iii*) plastic.

B. (*i*) semi-plastic, (*ii*) brittle, (*iii*) plastic.

C. (*i*) plastic, (*ii*) brittle, (*iii*) semi-plastic.

D. (*i*) brittle, (*ii*) plastic, (*iii*) semi-plastic.

55. For a soil specimen the relation between the deviator stress (q) and the mean stress (p) is given below in the figures. Which of the following conditions satisfy ?



A. $\Delta\sigma_v = 0; \Delta h < 0$

B. $\Delta\sigma_n = -\Delta\sigma_v$

C. $\Delta\sigma_v > 0; \Delta\sigma_n = 0$

D. None of the above

56. The appropriate field test to determine the insitu undrained shear strength of a soft clay is:

A. standard penetration test. B. plate load test.

C. static cone penetration test. D. vane shear test.

57. For a very heavily over consolidated clay sample the probable value of pore pressure parameter A at failure is likely to be:

A. 0.85 B. 0.35

C. 0.0 D. – 0.20

58. For a saturated normally consolidated soil specimen the pore pressure coefficient B will be:

A. 1.0 B. 0.8

C. 0.2 D. – 0.5

59. In a drained triaxial compression test conducted on dry sand, failure occurred when the deviator stress was 218 kN/m^2 at a confining pressure of 61 kN/m^2. What is the effective angle of shearing resistance and the inclination of failure plane to major principal plane?

A. 34°, 62° B. 34°, 28°

C. 40°, 25° D. 40°, 65°

Fill in the blanks:-

60. If the saturation water content of a soil of specific gravity 2.7 is 40%, its void ratio is _____.

61. A saturated sand sample has a dry unit weight of 18kN/m^3 and specific gravity of 2.65. Taking γ_w = 10kN/m^3, the water content of soil is _____.

62. For sand of uniform spherical particles, the void ratio in the loosest and densest states are _____ and _____.

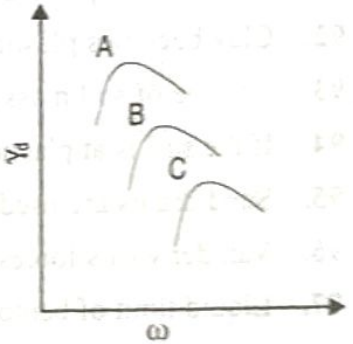
63. The maximum possible value of Group Index for a soil is _____.

64. Soils transported by wind are known as _____.

65. The hydraulic head at a point in soil is the sum of _____ and _____.

66. A 1000 kN load is uniformly distributed on an area 2m × 3m. the approximate average vertical stress at 3$_m$ depth using 2:1 dispersion is _____ kN/m^2.

67. Following curves indicate schematically three standard Proctor compaction curves.
Assuming the three soil types are from the same geological origin, the curves for silty clay, silty sand and sandy silt are _____, _____ and _____ respectively.



68. An infinite slope with a slope angle of 14°, is made up of a cohesionless soil having ϕ = 30° and γ = 20 kN/m^3. It experiences seepage with the water table at surface. If the unit weight of water is 10 kN/m^3, the factors of safety against failure without seepage and with seepage will be _____ and _____ respectively.

STATE WHETHER THE FOLLOWING STATEMENTS ARE TRUE OR FALSE:-

69. The void ratio of soil can exceed unity.

70. The porosity of soil can be greater than its void ratio.

71. The water content of a soil cannot be greater than one hundred percent.
72. In the IS soil classification system SM stands for sandy silt.
73. A soil having a uniformity coefficient smaller than about 2 is considered 'uniformly graded'.
74. The 'A line in the platicity chart separates organic clays from inorganic clays.
75. The charge on Kaolinite is due to one aluminium substitution for every four hundredth silicon ion.
76. The capillary pressure in a soil may be more than 5m head of water.
77. In some situations effective stress will be greater than the total applied stress.
78. In practically all seepage problems, velocity heads are disregarded.
79. The measure of soil compaction is its wet density.
80. The coefficient of volume compressibility of a soil is always less than its coefficient of compressibility.
81. The total settlement of a soil layer is dependent on the length of drainage path.
82. If the Mohr circle for a given state of stress lies entirely below the Mohr envelope for a soil, then the soil will be unstable for that state of stress.
83. The maximum possible slope angle in a granular soil is equal to the friction angle of the soil.
84. In an earth dam phreatic line is a boundary equipotential line.
85. In an earth dam shell imparts stability and protects the core.
86. In a homogeneous earth dam sudden drawdown causes instability of upstream slope.
87. In Swedish method of slices the forces of interaction between adjacent slices are not considered.
88. In the case of infinite slope the slip surface is parallel to the surface of slope.
89. The porosity of soil can never be greater than 100%.
90. The effect of stratification in soil mass will result in greater horizontal permeability than vertical permeability.
91. When soil deposit is in its densest state, its density index is zero.
92. Clay becomes plastic when mixed with kerosene.
93. Volume of soil mass at shrinkage limit is same as that at its dry state.
94. If the soil is at plastic limit the consistency index is unity.
95. Sand drains are used to decrease the rate of consolidation.
96. Van der waals forces are weaker than hydrogen bond.
97. Liquid limit of bentonite clay is more than 100%.
98. Quick sand is a type of sand.
99. Stability number is a dimensionless quantity.
100. Taylor stability number is a function of slope angle only.

QUESTIONS WITH ANSWERS

1(a). Why is a long stem hydrometer used in laboratory ?

Ans. A long stem hydrometer for which stem is about 30 to 40 cm long is used in laboratory as the

ANSWER TO ADDITIONAL QUESTIONS

1.	B	21.	B	41.	B	61.	17.8%
2.	D	22.	D	42.	C	62.	0.91, 0.35
3.	D	23.	B	43.	C	63.	20
4.	B	24.	C	44.	A	64.	aeolin soils
5.	B	25.	C	45.	B	65.	pressure head and datum head
6.	B	26.	D	46.	C	66.	2000 kN/m²
7.	A	27.	B	47.	A	67.	C, A, B
8.	B	28.	D	48.	D	68.	2.32, 1.16
9.	B	29.	B	49.	C	69.	T
10.	D	30.	B	50.	B	70.	F
11.	A	31.	D	51.	C	71.	F
12.	B	32.	D	52.	D	72.	T
13.	A	33.	A	53.	A	73.	T
14.	B	34.	A	54.	A	74.	T
15.	C	35.	C	55.	C	75.	T
16.	A	36.	C	56.	D	76.	T
17.	A	37.	D	57.	D	77.	T
18.	B	38.	C	58.	A	78.	T
19.	C	39.	D	59.	D	79.	F
20.	B	40.	A	60.	1.08	80.	T
						81.	F
						82.	F
						83.	T
						84.	F
						85.	T
						86.	T
						87.	T
						88.	T
						89.	T
						90.	T
						91.	F
						92.	F
						93.	T
						94.	T
						95.	F
						96.	T
						97.	T
						98.	F
						99.	T
						100.	F