22

Objective Testing

22.1 Multiple-choice Questions

1. Due to immense contribution in the field of soil engineering, the "father of soil mechanics" is
   (a) Coulomb (b) Rankine
   (c) Fellenius (d) Dr. Karl Terzaghi
2. Colluvial soils (talus) are transported by
   (a) gravitational forces (b) water
   (c) ice (d) wind
3. Water-formed transported soils are termed as
   (a) alluvial (lacustrine) (b) aeoline
   (c) colluvial (d) cumulose
4. Wind blown silt or silty clay having little or no stratification is termed
   (a) talus (b) peat
   (c) loess (d) drift
5. The soil which contains finest grain particles, is
   (a) fine sand (b) gravel
   (c) silt (d) clay
6. Maximum size of the particles of silty soil is
   (a) 0.002 mm (b) 0.075 mm
   (c) 0.06 mm (d) 0.425 mm
7. Moisture content for highly organic soils is determined in an oven at temperatures
   (a) about 60°C (b) about 80°C
   (c) about 105°C (d) obout 110°C

8. Pycnometer method formoisture content determination is more suitable for
   (a) fine graind soils (b) loess
   (c) coarse grained soil (d) silt and sand mixture

9. The gas formed by the reaction of calcium carbide with water present in soil is
   (a) carbon mono-oxide (b) acctylene
   (c) ethane (d) methane

10. A very rapid method of measuring moisture content in undisturbed soil in the field is by
   (a) speedy moisture tester
   (b) nuclear method
   (c) infrared heat method
   (d) Proctor needle method

11. In Stokes' law the terminal velocity of sinking particle is
   (a) proportional to the radius of particles
   (b) proportional to the square of radius of particle
   (c) inversely proprotional to the of radius of the particle
   (d) inversely proportional to the square of radius of particle.

12. Buoyant unit weight is equal to saturated unit wright
   (a) multiplied by unit weight of water
   (b) minus unit weight of water
   (c) divided by unit weight of water
   (d) plus unit weight of water

13. Degree of saturation of soil
   (a) may be less than zero
   (b) may vary from zero to 100%
   (c) may be greater than 100%
   (d) will always be less than 100%

14. The ratio of volume of voids to the total volume of soil is known as
   (a) porosity (b) voids ratio
   (c) degree of saturation (d) water void ratio

15. Accurate determination of water content is made by
   (a) calcium carbide method (b) oven drying
   (c) sand bath method (d) pycnometer method

16. Stokes' law does not hold good if the size of particles is greater than
(a) 0.2 mm (b) 0.02 mm
(c) 0.0002 mm (d) 0.002 mm

17. Pretreatment of soil to remove the organic matter of an oven dried soil sample by oxidation is done with
(a) oxygen (b) hydrogen
(c) hydrogen peroxide (d) calgon

18. Meniccus correction in hydrometer analysis is
(a) always positive
(b) always negative
(c) sometimes positive and sometimes negative
(d) none of the above

19. A soil is considered poorly graded when there is
(a) a good representation of all the particle sizes from the largest to the smallest
(b) an excess or a deficiency of certain particle sizes
(c) shape of particle size curve is higher up or to the left
(d) none of the above

20. At shrinkage limit
(a) soil is dry (b) soil is partly saturated
(c) soil is fully saturated (d) none of the above

21. The ASTM tool for liquid limit determination is most suited for
(a) more sandy soils (b) more clayey soils
(c) silty and clayey soils (d) none of the above

22. Permeabilily of the soils above 'A' line on the plasticity chart is
(a) very low (b) very high
(c) intermediate (d) none of the above

23. In India, for general engineering purposes, soils are classified by
(a) Highway Research Board classification system
(b) modified Unified Soil classification system
(c) particle size classification system
(d) textural classification system

24. The soil moisture driven off by heat is called
(a) hygroscopic water (b) free water
(c) gravity water (d) none of these

25. A critical hydraulic gradient may occur when
(a) downward effective pressure is zero
(b) seepage pressure is in upward direction
(c) flow is in upward direction
(d) all the above

26. If there is no impervious boundary below the base of a hydraulic structure, stream lines tend to follow
(a) a straight line
(b) a parabola
(c) a semi-ellipse
(d) a semi-circle

27. A flow line makes angles θ_1 and θ_2 with the normal to the interface of two soils having permeabilities k_1 and k_2 before and after deflection. According to the law of deflection of the flow lines at the interface of the dissimilar soils
(a) $\frac{\tan \theta_1}{\tan \theta_2} = \frac{k_1}{k_2}$
(b) $\frac{\cos \theta_1}{\cos \theta_2} = \frac{k_1}{k_2}$
(c) $\frac{\sin \theta_1}{\sin \theta_2} = \frac{k_1}{k_2}$
(d) $\frac{\tan \theta_2}{\tan \theta_1} = \frac{k_1}{k_2}$

28. The phreatic line in an earth dam may be
(a) parabolic
(b) circular
(c) elliptical
(d) all the above

29. The shear strength in plastic undrained clay, results from
(a) internal friction
(b) cohesion
(c) intergranular friction
(d) none of these

30. Through a point in a loaded soil mass, there exists 'p' typical planes mutually perpendicular to each other on which the stress is wholly normal and no shear stress acts, if 'p' is.
(a) 2
(b) 3
(c) 4
(d) 1

31. The coefficient of compressibility of soil is the ratio of
(a) strain to stress
(b) stress to strain
(c) stress to settlement
(d) rate of loading to that of settlement

32. With an increase in the liquid limit, compression index of soil
(a) increases
(b) decreases
(c) no change
(d) none of these

33. Stress taken up by the pore water in a soil mass is
    (a) effective stress (b) total stress
    (c) neutral stress (d) all the above

34. When drainage is permitted throughout the test, during the application of both normal shear strsses and no excess pore pressure is set up at any stage of the test, the test is known as
    (a) drained test
    (b) quick test
    (c) consolidated undrained test
    (d) none of these

35. On wetting, cohesive soils
    (a) lose permeability (b) gain shear strength
    (c) decrease in shear strength (d) lose elasticity

36. Cohesive soils are generally
    (a) elastic and also compressible
    (b) plastic and also compressible
    (c) plastic but incompressible
    (d) none of the above

37. The angle of internal friction is maximum for
    (a) clays
    (b) angular grained dense sand
    (c) angular grained loose sand
    (d) round grained loose sand

38. When the mass is on the verge of failure, it is said to be in
    (a) elastic stage (b) plastic stage
    (c) flowing stage (d) plastic equilibrium

39. In cohesionless soil, when it is a passive state of plastic equilibrium
    (a) minor principal stress is vertical
    (b) major principal stress is inclined
    (c) major principal stress is vertical
    (d) major and minor principal stresses are equally inclined to horizontal

40. The total active earth pressure due to dry backfill with no sur charge per unit length of a wall, acts at H/3 above the base of the wall, it is directly proportional to
    (a) H^2 (b) H
    (c) $\sqrt{H}$ (d) H^3

41. The intensity of active earth pressure at a depth of 5.0 m in dry cohesionless sand with an angle of internal friction of 30° and with a unit weight of 1.8 t/m^3 is
(a) 3 t/m^2 (b) 4 t/m^2
(c) 6 t/m^2 (d) 8 t/m^2

42. If the coefficient of passive pressure is 2.5, the coefficient of active pressure is
(a) $\frac{1}{3}$ (b) 2.5
(c) $\frac{2}{5}$ (d) $\frac{2}{3}$

43. A plane inclined at an angle ϕ to the horizontal at which the soil is expected to stay in the absence of any lateral support is known as
(a) natural slope line (b) the ϕ line
(c) respose line (d) all the above

44. If the failure of a finite slope occurs through the toe, it is known as
(a) base failure (b) slope failure
(c) face failure (d) toe failure

45. The method of slices is applicable to
(a) stratified soils (b) homogeneous soils
(c) saturated soils (d) non uniform slopes

46. The reduction in volume of soil due to squeenzing out water from the voids, is termed
(a) primary compression (b) primary time effect
(c) primary consolidation (d) all the above

47. From the following, the cohesive soil is
(a) Red sarth (b) fine sand
(c) black cotton soil (d) compacted ground.

48. The clay soil generally consists of the following minerals
(a) kaolinites (b) illites
(c) montmorillonite (d) all the above

49. The density of soil can be increased by
(a) reducing the space occupied by air
(b) expelling the water from pores
(c) elastic compression of soil grains
(d) all the above

50. The factor which effects the compaction is
    (a) moisture content (b) type of soil
    (c) method of compaction (d) all the above

51. The Westergaard analysis is used for
    (a) sandy soil (b) cohesive soil
    (c) red soil (d) stratified soil

52. The eqation $s = c + \sigma \tan \phi$ was given by
    (a) Coulomb (b) Rankine
    (c) Terzaghi (d) Mohr

53. A decrease in water content results in a reduction in the volume of soil in
    (a) liquid state (b) plastic state
    (c) semi solid state (d) all the above

54. A partially saturated soil is classified as
    (a) one phase soil (b) two phase soil
    (c) three phase soil (d) four phase soil

55. The fluid generally used for grouting is
    (a) clay suspension (b) sodium silicate
    (c) cement and water mix (d) all the above

56. The over consolidation ratio of clay can be
    (a) less than 1 (b) 1
    (c) more than 1 (d) all of these

57. Over consolidation of soils is caused due to
    (a) melting of ice sheets after glaciation
    (b) permanent rise of water table
    (c) erosion of over burden
    (d) all the above

58. The method of slices for stability analysis
    (a) gives the factor of safety based on moments and not the forces
    (b) cannot be used when seepage and pore pressure exist within the soil
    (c) cannot be used for partially submerged soils
    (d) cannot be used for stratified soils

59. Negative skin friction on piles may occur when
    (a) the soil is undrained
    (b) the residual strength of soil is high

(c) there is constant seepage through the soil adjacent to pile
(d) fill has been around the pile after driving

60. The seepage quantity from a flow net is inversely proportional to
(a) total head loss (b) number of potential drops
(c) number of flow channels (d) none of the above

61. The inclination of one set of failure planes behind a vertical wall in a state of active pressure failure is inclined to the horizontal at
(a) $45 + \frac{\phi}{2}$ (b) $45 - \frac{\phi}{2}$
(c) $45 - \phi$ (d) $45 + \phi$

62. The yield of a retaining wall required to reach failure is
(a) more for the active state
(b) more for the passive state
(c) equal for both active and passive states
(d) no yield necessary

Answers to Question in Section 22.1

1. (d)	2. (a)	3. (a)	4. (c)	5. (d)
6. (b)	7. (a)	8. (c)	9. (b)	10. (b)
11. (b)	12. (b)	13. (b)	14. (a)	15. (b)
16. (a)	17. (c)	18. (a)	19. (b)	20. (c)
21. (a)	22. (a)	23. (b)	24. (a)	25. (d)
26. (d)	27. (a)	28. (a)	29. (b)	30. (b)
31. (a)	32. (a)	33. (c)	34. (a)	35. (c)
36. (b)	37. (b)	38. (d)	39. (a)	40. (a)
41. (a)	42. (c)	43. (d)	44. (d)	45. (b)
46. (d)	47. (c)	48. (d)	49. (d)	50. (d)
51. (d)	52. (a)	53. (d)	54. (c)	55. (d)
56. (d)	57. (d)	58. (a)	59. (d)	60. (b)
61. (a)	62. (b)			

22.2 Fill-up-the-blanks Type Questions

Fill in the blanks for the following:

1. Cohesionless soils are formed by_____
2. The water content of a soil is_____
3. Fine grained soils usually have a voids ratio_____than that of coarse grained soils.
4. The uniformity coefficient of soil is_____

5. For a granular soil to be termed well graded, the coefficient of curvature should lie between_____
6. For moisture content determination by oven the temperature higher than 105°C to 110°C may be break down the_____
7. The hydrometer measures the_____of soil suspension.
8. At the liquid limit the shearing strength of soil is_____ but definite.
9. Density index or 90% indicates that the soil is in a_____ state.
10. Toughness of soil is the resistance to moulding at the _____
11. Silt particles exhibit_____
12. Silty gravel means soil having a greater percentage of_____ and a less percentage of_____
13. Effective stress is increased when the capillary water _____ in the soil.
14. The constant head permeabillity test is used for_____only where a reasonable discharge can be collected in a given time.
15. On increasing the area of stand pipe fitted over falling head permeameter the flow of water through soil_____
16. The phreatic line in an earth dam is the line where the pressure is eqal to the _____
17. Boussinesq's equation shows that the vertical stress directly below the load is theoretically _____
18. For the pressure bulb the_____ at every point on the surface of the bulb is_____
19. A pressure bulb of 10% pressure intensity under a_____ footing penetrates deeper than that under a_____footing.
20. Compression of soil occurs due to _____ in the volume of voide.
21. The coefficient of consolidation has the unit of_____
22. Compaction is measured quantitatively in terms of_____
23. During compaction the maximum dry density is attained at____
24. Coefficient of permeability of 1×10^{-1} cm/sec denotes_____ grained soil.
25. As the compactive energy increases the optimum moisture content of soil _____
26. Triaxial shear test can be performed under all _____condi- tions with complete control.
27. In the direct shear test the failure plane is_____
28. The modified Proctor Test on a soil will indicate a _____ optimum moisture content than that given by the Standard Proctor Test.

29. The Mohr circle of stress for the unconfined compression test should pass through _____
30. Pore pressure parameter B is equal to _____ for saturated soils.
31. The stability coefficient gives the failure surface along which the factor of safety is the _____
32. The bearing capacity of a foundation on sand is considerably reduced when the water table rises because the _____ is reduced.
33. The allowable bearing pressure for a foundation depends on ___
34. The punching shear failure occurs in _____
35. The Newmark chart is employed for computing the vertical pressure below any _____ shaped loaded area carrying a _____
36. The vane shear test is an _____ type of shear test..
37. The standard load for 2.5 mm penetration of plunger in the CBR test is _____ kg.
38. A fine grained soil with liquid limit = 20% and P.I. = 5 will be given a group symbol _____
39. Ratio of the compressive strength of unconfined undisturbed soil to that of remoulded soils is known as the _____ of the soil sample.
40. The regain of strength of a saturated clayey mass on standing after remoulding is known as _____
41. If the organic and inorganic soils are represented by nearly the same point on the plasticity chart the _____ soils will have a considerable greater dry strength compared to that of _____ soils.
42. For the same liquid limit the greater the plasticity index the _____ is the toughness and so also dry strength.
43. A soil having pH value more than 7 is _____
44. Soils containing organic matters are of _____ nature.
45. The angle between the directions of the failure and the major principal plane is equal to 45 plus _____
46. In direct shear test as the test progresses the area under shear gradually _____
47. The apparent angle of shearing resistance is least for _____
48. Rankine theory of active earth pressure assumes that back of well is vertical and _____
49. In a purely cohesive soil, the critical centre of Fellenius failure circle passing through toe lies at the intersection of

50. The compression resulting from a long term static load and consequent escape of pure water, is known as_____
51. If the length is very large as compared to width, it is_____ foundation.
52. The stresses on a shear plane can be readily found by drawing a line parallel to the plane through the_____on the Mohr circle.
53. Minimum number of piles required to support a column is____
54. For determining the ultimate bearing capacity of soil, the recommended size of a square bearing plate to be used in plate load test should be 30 cm to 75 cm square with a minimum thickness of
55. Width of the test pit for plate load test is made_____times the width of plate.
56. Silty clay loam contains highest percentage of_____
57. Plasticity index is defined as the range of water content between _____
58. The water content at which a soil sample continues to loses weight on drying without decrease in volume, is called_____
59. Kaolinite shown a very_____sign of swelling on wetting.
60. Illite bond is_____ than montmorillonite bond.
61. Illite bond is_____than kaolinite bond.
62. At critical hydraulic gradient, a saturated sand becomes
63. The critical hydraulic gradient depends on the voids ratio and the_____
64. The line which shows moisture content dry density relation for soil containing a constant percentage of air voids, is known as_____
65. The line joining the peak of three moisture content graphs obtained by using three compactive energies, is called_____
66. The initial curve on either side of the point of unloading and reloading is called_____
67. The effective size of particles of soil is denoted by_____
68. The smaller the size of pores, the_____ the water can rise above the water table.
69. At the water table the pore pressure is_____
70. The hydrostatic pressure depends on the depth below the_____
71. The attractive forces between the particles, caused due to negative pressure of water held above the water table is called.
72. The process of injecting fluids (mortar) into the pores space of the soil, is called_____
73. The rise of the ground surface due to freezing is called_____

74. The freezing of water is accompanied by increase of volume of water by about_____
75. If the present effective stress is the maximum to which the clay has ever been subjected, it is called_____
76. If the effective stress is the past was more than present effective stress, it is called_____
77. The consolidation time for soils increases with_____ compressibility.
78. The consolidation time for soils decreases with_____ permeability.
79. The pressure on the seepage line through an earth dam is_____
80. The shape of a flow net field is approximately_____

Answers to Questions in Section 22.2

1. physical disintegration of rocks
2. the ratio of the weight of water to the dry weight of solid particles
3. greater
4. the ratio of D_{60} and D_{10} size
5. 1 and 3
6. crystalline structure of clay particles
7. density
8. small
9. dense
10. plastic limit
11. dilatancy
12. gravel, silt
13. rises
14. coarse grained soils
15. increases
16. atmospheric pressure
17. infinite
18. vertical pressure, same
19. strip, square
20. decreases
21. cm^2/ ec
22. dry-density
23. optimum moisture content
24. coarse
25. decreases
26. three drainage
27. horizontal

28. lower
29. origin
30. unity
31. minimum
32. effective unit weight
33. both the ultimate bearing and allowable settlement
34. soils of high compressibility
35. irregular, uniform load
36. undrained (UU)
37. 1370 kg
38. CL-ML
39. sensitivity
40. Thixotropy
41. organic soil, inorganic soil
42. greater
43. alkaline soil
44. spongy
45. half of the angle of shear resistance
46. changes (decreases)
47. saturated clays
48. smooth
49. directional angles
50. consolidation
51. strip
52. pole (origin of planes)
53. 3
44. 25 mm
55. five
56. Silt
57. liquid limit and plastic limit
58. shrinkage limit
59. little
60. stronger
61. weaker
62. quick
63. specific gravity
64. air void line
65. line of optimum
66. virgin curve
67.
68. higher
69. atmospheric

70. water level
71. soil suction (capillary tension)
72. grouting
73. frost have
74. 9%
75. normally consolidated
76. over consolidated clay
77. increasing
78. increasing
79. atmospheric
80. square

22.3 True-false Type Questions

1. Failure plane does not carry maximum shear stress.
2. Shear strength of a soil increases with an increase in the normal stress.
3. The cofficient of active earth pressure $k_a = \dfrac{1 - \sin \phi}{1 + \sin \phi}$
4. The failure wedge does not develop when a retaining wall moves towards the backfill.
5. Rankine theory of active earth pressure assumes that the wall yields about the base.
6. The lateral pressure exerted by the soil when the retaining wall moves towards the soil, is generally known as 'passive earth pressure' of soil.
7. The active earth pressure of a soil is proportional to $\tan^2 \left(45 + \dfrac{\phi}{2}\right)$
8. According to Coulomb's wedge theory, a soil wedge tends to slide downwards and outwards along a slip surface during active state of failure.
9. Compression of soil occurs rapidly if voids are filled with air.
10. If the ratio of depth and width is more than 2, it is a shallow foundation.
11. Kaolinite is also called china clay.
12. The phenomenon of quick sand generally occurs in cohesive soils.
13. The dry density increases by adding of water after attaining optimum moisture content.
14. Compaction has no effect on structure of soil.
15. Permeability decreases with increase in the dry density of compacted

16. A wet side compacted soil is more compressible than a dry side compacted soil.
17. Time factor is a dimensionless quantity.
18. The permeability of coarse grained soils may be increased by grouting.
19. Below freezing point, higher soil suction develops.
20. The magnitude of frost heave decreases as the degree of saturation of soil decreases.
21. The consolidation time for soils independent of the magnitude of the stress change.
22. The consolidation time for soils increases rapidly with increasing size of soil mass.
23. The rate of settlement is inversely proportional to drainage path.
24. General failure below footings cocurs on loose soils.
25. The active prassure increases if ϕ increases.
26. The seepage pressure increases as the size of flow fields increases.
27. The bearing capacity decreases with rise of water table.
28. The intensity of contact pressure of a rigid foating on the surface of sand is maximum at the centre.
29. The pressure bulb of a particular intensity extends to greater depths for strip footings than for square footings.
30. Slope of a field consolidation line is generally smaller than that of a laboratory curve.

Answer to Questions in Section 22.3

1. True	2. True	3. True	4. False
5. True	6. True	7. False	8. True
9. True	10. False	11. True	12. False
13. False	14. False	15. True	16. True
17. True	18. False	19. True	20. True
21. False	22. True	23. False	24. False
25. False	26. False	27. True	28. True
29. True	30. False		