

**Objective Paper-II**

1. Consider the following statements:
1. Standard penetration test is commonly used for cohesionless soils.
  2. Standard penetration test results in respect of a cohesionless soil are correlated to its density index and friction angle.
  3. Use of H-value not corrected for overburden pressure leads to highly conservative design of footings at shallow depths.
- Which of these statements are correct?
- (A) 1, 2 & 3                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 1 & 3 only
2. Consider the following statements:
1. The benefit of surcharge and depth of foundation is only marginal in case of footings on purely cohesive soils.
  2. The bearing capacity of a footing in pure clay increase with increase in size of the footing.
  3. Size effects in plate load tests are more important in case of cohesionless soils.
- Which of these statements are correct?
- (A) 1, 2 & 3                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 1 & 3 only
3. The mean unconfined compressive strength of a purely cohesive soil was found to be  $50\text{kN/m}^2$ . The ultimate bearing capacity of a square footing calculated by Terzaghi's concept (bearing capacity factor  $N_c = 5.7$ ) will be
- (A)  $185.25\text{kN/m}^2$                       (B)  $390.5\text{kN/m}^2$                       (C)  $285\text{kN/m}^2$                       (D)  $142.5\text{kN/m}^2$
4. The field density and field moisture content of a soil can be determined by
1. Core cutter method                      2. Sand replacement method
  3. Proctor compaction test                      4. Modified proctor compaction test
- (A) 1, 2, 3 & 4                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 2 & 4 only
5. Consider the following statements:
1. Friction piles are also floating piles
  2. Minimum number of piles to qualify as a pile group is three
  3. The group efficiency of a pile group may be either less than 100% or more than 100%
- Which of these statements are correct?
- (A) 1, 2 & 3                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 1 & 3 only
6. Consider the following statements:
1. Strength should be improved and compressibility should be reduced.
  2. Compressibility should be increased.
  3. No stabilization should be done.
- Which of these statements is/are correct?
- (A) 1, 2 & 3                      (B) 2 only                      (C) 1 only                      (D) 3 only
7. Consider the following statements:

1. Buried service lines should be avoided in an expansive soil region.
  2. A swelling pressure less than  $20\text{kN/m}^2$  is not of much consequence.
  3. If soil is not black in colour, it is unlikely to be an expansive soil.
- Which of these statements are correct?
- (A) 1, 2 & 3                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 1 & 3 only
8. If  $L$  is the length of the chain,  $W$  is the weight of the chain and  $T$  is the tension, the sag correction for the chain line is
- (A)  $\frac{W^2L^2}{24T^3}$                       (B)  $\frac{W^2L}{24T^2}$                       (C)  $\frac{W^2L^2}{24T^2}$                       (D)  $\frac{W^2L^3}{24T^3}$
9. In an inclined terrain, if the elevation difference between the two ends of a line is  $h$  and the inclined length of the line is  $L$ , the correlation for slope is
- (A)  $\frac{h^2}{L^2}$                       (B)  $\frac{h^2}{2L^2}$                       (C)  $\frac{2h^2}{L^2}$                       (D)  $\frac{h^2}{2L}$
10. If the whole circle bearing is  $315^\circ 20'$ , its quadrantal bearing would be
- (A)  $S36^\circ 30' W$                       (B)  $N44^\circ 40' W$                       (C)  $N57^\circ 24' W$                       (D)  $S60^\circ 40' W$
11. If the observed forebearing of a line  $xy$  is  $196^\circ 26'$ , the back bearing of this line is
- (A)  $103^\circ 26'$                       (B)  $118^\circ 36'$                       (C)  $196^\circ 26'$                       (D)  $206^\circ 26'$
12. The subtense tacheometry method is adopted when the ground is
- (A) Flat                      (B) Inclined                      (C) Undulating                      (D) A waterbody
13. In an instrument, the bubble tube with divisions of 1 mm and a radius of 0.9m has the sensitivity of
- (A)  $\frac{1}{2}$                       (B)  $\frac{1}{70}$                       (C)  $\frac{1}{90}$                       (D)  $\frac{1}{900}$
14. R.L. of floor at a building is 74.4 m, staff reading on the floor is 1.625 and staff reading when it is held inverted with bottom touching the ceiling of a hall is 2.870; then the height of the ceiling above the floor is
- (A) 3.593m                      (B) 3.953m                      (C) 4.495m                      (D) 4.594m
15. Consider the following pre-conditions for correct use of a theodolite:
1. The vertical axis need not be perpendicular to the plane of the plate level bubble.
  2. The line of sight must be perpendicular to the horizontal axis.
  3. The axis of the level tube attached to the telescope need not be parallel to the line of sight.
  4. The vertical axis, the horizontal axis and the line of sight should all pass through a point known as stadia centre.
- Which of these conditions is/are necessary?
- (A) 1, 2, 3 & 4                      (B) 2 only                      (C) 1 only                      (D) 1 & 4 only

16. Following observations were taken with a transit fitted with stadia wires. The line of sight was horizontal and the staff was held vertical.

|             | Reading on staff(m) |
|-------------|---------------------|
| Top hair    | 1.726               |
| Middle hair | 2.278               |
| Bottom hair | 2.830               |

The tacheometric constants  $k$  and  $C$  are 100 and 0.4 m respectively. The horizontal distance between staff and instrument is

- (A) 90.8                      (B) 100.8                      (C) 110.8                      (D) 120.8
17. Following observations were taken during a reciprocal leveling:

| Instrument near    | P     | Q     |
|--------------------|-------|-------|
| Staff reading at P | 1.824 | 0.928 |
| Staff reading at Q | 2.748 | 1.606 |

If reduced level of P is 140.815 m, the reduced level of Q is

- (A) 1380.014 m              (B) 139.616 m              (C) 140.014 m              (D) 141.616 m
18. A contour may be defined as an imaginary line passing through
- (A) Points on the longitudinal section  
 (B) Points of equal elevation  
 (C) Points of equal local ground slope  
 (D) Points of transverse section surveys

19. A closed contour line with two or more higher contours inside it will represent a
- (A) Depression              (B) Hill                      (C) Cave                      (D) Well

20. When compared with the co-latitude of the place of observation the declination of a circumpolar star is always,
- (A) Lesser                      (B) Greater  
 (C) Equal                      (D) Either lesser or equal

21. Which of the following reasons are responsible for adoption of post-chlorination of water?

1. Chlorine demand is reduced
2. Possibility of taste and odour formation is reduced
3. Possibility of carcinogenic compounds is reduced
4. Chloramines are formed

- (A) 1, 2, 3 & 4              (B) 1, 2 & 3 only              (C) 1 & 4 only              (D) 2, 3 & 4 only

22. Which one of the following test employs Ethylene Diamine Tetra Acetic Acid as a titrating agent?

- (A) Chlorides                      (B) Dissolved oxygen  
 (C) Hardness                      (D) Residual chlorine

23. In case of leveling, backsight is  
(A) A fixed point of known elevation  
(B) The last staff reading taken before shifting the instrument  
(C) The first staff reading taken after setting the instrument  
(D) Any staff reading taken on a point of unknown elevation
24. The needle of a magnetic compass is generally supported on a  
(A) Bush bearing (B) Ball bearing (C) Needle bearing (D) Jewel bearing
25. Consider the following statements:  
For pure clay, the shear strength parameters will be  
1. Cohesion  $c=0$ ; and angle of internal friction  $\theta$  will be maximum  
2. Cohesion  $c$  is maximum; and angle of internal friction  $\theta$  is also maximum  
3. Angle of internal friction  $\theta$  is zero, with some value of cohesion  $c$ .  
Which of these statements is/are correct?  
(A) 1, 2 & 3 (B) 1 only (C) 3 only (D) 2 only
26. Consider the following statements:  
1. Consolidation time increase with increasing compressibility  
2. Consolidation time decrease with increasing permeability  
3. Consolidation time is dependent on the magnitude of stress increase  
Which of these statements are correct?  
(A) 1, 2 & 3 (B) 1 & 2 only (C) 2 & 3 only (D) 1 & 3 only
27. On nephelometry turbidity unit (NTU) is equal to the turbidity produced by  
(A) 1 mg  $\text{SiO}_2$  dissolved in 1 litre of distilled water with the test being run according to absorption principle  
(B) 1 mg  $\text{SiO}_2$  dissolved in 1 litre of distilled water with the test being run according to scattering principle  
(C) 1 mg Formazin dissolved in 1 litre of distilled water with the test being run according to absorption principle  
(D) 1 mg Formazin dissolved in 1 litre of distilled water with the test being run according to scattering principle
28. Consider the following statements:  
1. Relative density is a meaningful parameter for all types of soils  
2. Relative density is a meaningful parameter only for cohesion soils  
3. Relative density is a better indicator of the denseness of an in-situ granular soil deposit than the void ratio  
Which of these statements are correct?  
(A) 1, 2 & 3 (B) 1 & 2 only (C) 2 & 3 only (D) 1 & 3 only

29. An approximate estimation of total dissolved solids of a given water sample is often made by measuring  
(A) Electrical conductivity of the water sample  
(B) Electro-magnetic conductivity of the water sample  
(C) Sound conductivity of the water sample  
(D) Thermal conductivity of the water sample
30. The ratio between the adopted centrifugal ratios for roads and railways is  
(A) 3:1 (B) 4:1 (C) 2:1 (D) 5:1
31. If the radius of a sample curve is R, then the length of the chord for calculating the offsets by the "method of chords produced" should not exceed  
(A)  $\frac{R}{5}$  (B)  $\frac{R}{10}$  (C)  $\frac{R}{20}$  (D)  $\frac{R}{25}$
32. If R is the radius of the curve and L is the length of the long chord, the shift of the curve is (all in metre units)  
(A)  $\frac{L^2}{R}$  (B)  $\frac{L^2}{2R}$  (C)  $\frac{L^2}{24R}$  (D)  $\frac{L^2}{6R}$
33. If the angle of deflection of a simple curve is  $\theta$  and its radius is R, then the length of the chord is  
(A)  $2R \sin \theta$  (B)  $2R \sin \frac{\theta}{2}$  (C)  $2R \cos \theta$  (D)  $2R \tan \frac{\theta}{2}$
34. The transitional property of a lemniscates curve is disrupted when its deflection angle is around  
(A)  $30^\circ$  (B)  $45^\circ$  (C)  $60^\circ$  (D)  $90^\circ$
35. An ideal horizontal transition curve is a  
(A) Parabola (B) Circle (C) Clothoid spiral (D) Hyperbola
36. Total float in a planning network is  
(A) Late start time-Early start time (B) Early start time-Late start time  
(C) Late start time-Late finish time (D) Late finish time-Early finish time
37. The plotting of inaccessible points in a plane-table survey can be done by the method of  
(A) Interpolation (B) Radiation (C) Intersection (D) Traversing
38. In a plane-table survey, the process of determining the plotted position of a station occupied by the plane-table by means of sights taken towards known points, the locations of which have already been plotted, is known as  
(A) Radiation (B) Resection (C) Intersection (D) Traversing



46. Consider the following statements:  
Air vessels are fitted on the suction and delivery sides of a reciprocating pump to
1. Achieve higher speed without separation.
  2. Reduce work in overcoming frictional resistance.
  3. Avoid excessive vibration permanently.
  4. Have nearly uniform discharge.
- Which of these statements are corrects?  
(A) 1, 2 & 4 only      (B) 1, 2 & 3 only      (C) 2, 3 & 4 only      (D) 1, 2, 3 & 4
47. The velocity of pressure wave in water of infinite extent is 1414 m/s. The velocity of propagation of water hammer pressure in a pipe carrying water and having diameter = 40 cm pipe thickness = 4 mm, with E (Modulus of elasticity) of the pipe material =  $2.1 \times 10^{11}$  Pa, K (Bulk modulus of water) =  $2.1 \times 10^9$  Pa, is  
A) 1410 m/s      (B) 2000 m/s      (C) 1000 m/s      (D) 700 m/s
48. Let  $C_1$  be the velocity of pressure wave traveling along rigid pipe carrying water with its bulk modulus  $2.16 \times 10^9$  N/m<sup>2</sup>. Let  $C_2$  be the velocity of pressure wave traveling along a rigid pipe carrying oil of relative density 0.600 with its bulk modulus as  $1.296 \times 10^9$  N/m<sup>2</sup>. through a similar pipe. What will be the ratio  $\frac{C_1}{C_2}$  ?  
(A) 0.01      (B) 0.1      (C) 1.0      (D) 10.0
49. The pipes A, B and C have the following basic geometries:

| Pipe     | A | B   | C  |
|----------|---|-----|----|
| Diameter | D | D/2 | 2D |
| Length   | L | L   | 4L |

- If these pipes are connected in series, by assuming the value of friction factor  $f$  to be same for all the three pipes and the equivalent pipe, this set of pipes in series is equivalent to a pipe of length  $L_e$  diameter  $D$  and friction factor  $f$  with the equivalent length  $L_e$  being equal to  
(A)  $5\frac{1}{8}L$       (B)  $4\frac{1}{8}L$       (C)  $26\frac{1}{8}L$       (D)  $33\frac{1}{8}L$
50. Consider the following statements in respect of steady laminar flow through a circular pipe:
1. Shear stress is zero on the central axis of the pipe
  2. Discharge varies directly with the viscosity of the fluid
  3. Velocity is maximum at the centre of the pipe.
  4. Hydraulic gradient varies as the square of the mean velocity of flow.
- Which of these statements are correct?  
(A) 1, 2, 3 & 4      (B) 1 & 3 only      (C) 2 & 4 only      (D) 3 & 4 only

51. The pressure drop in a 30 cm diameter horizontal pipe is 60 kPa in distance of 15m. The wall shear stress in kPa is  
(A) 0.1 (B) 0.2 (C) 0.3 (D) 0.4
52. Consider the following statements related to water surface profile in gradually varied flow in an open channel:
1.  $M_1$  and  $S_1$  curves approach  $Y_0$  line asymptotically; and tend to be horizontal as  $Y$  tends to  $\infty$ .
  2.  $M_2$  and  $S_2$  curves meet  $Y_0$  line horizontally, and  $Y_0$  line asymptotically.
  3.  $M_3$  and  $S_3$  curves meet  $Y_0$  line normally, and also meet the channel bed normally.
  4.  $C_1$  and  $C_2$  curves will be slightly curved if Chezy's equation is used; otherwise they may tend to be straight lines.
- Which of these statements are correct?  
(A) 1, 2, 3 & 4 (B) 1 & 4 only (C) 2 & 3 only (D) 3 & 4 only
53. The velocity with which an elementary surge wave can travel upstream in a channel with depth  $y = 1.6$  m and velocity  $V = 2.4$  m/s is (Take  $g = 10 \text{ m/s}^2$ ).  
(A) 16 m/s (B) 13.6 m/s (C) 2.4 m/s (D) 1.6 m/s
54. For hydraulically efficient rectangular channel of bed width 4.0 m, the depth of flow is  
(A) 4 m (B) 0.5 m (C) 1 m (D) 2 m
55. Consider the following statements in respect of critical flow in a wide rectangular channel:
1. The specific energy is minimum for a given discharge.
  2. The discharge is maximum for a given specific energy
  3. The specific force is minimum for a given discharge.
  4. The Froude number is equal to unity.
- Which of these statements are correct?  
(A) 1, 2 & 3 only (B) 1, 2, 3 & 4 (C) 1, 2 & 4 only (D) 2, 3 & 4 only
56. A high tension cable 5 cm in diameter is strung-out between two towers. At a wind velocity of 22.22 m/s (corresponding Reynolds number being  $7.4 \times 10^4$ ) the frequency of vortex shedding is  
(A) 100 Hz (B) 9.33 Hz (C) 93.3 Hz (D) 10.0 Hz
57. Consider the following assumption made in the analysis of a jet impinging normally on a moving plate to introduce the principle of moment of momentum:
1. Friction between jet and plate is neglected.
  2. Flow is steady
  3. Impinging momentum of jet is uncharged.
  4. Plate moves at a constant velocity.
- Which of these statements are relevant?  
(A) 1, 2 & 4 only (B) 1, 2 & 3 only (C) 2, 3 and 4 only (D) 1, 2, 3 & 4



58. The thickness of a laminar boundary layer over a flat plate at two different section P and Q are 0.8 cm and 2.4 cm respectively. If the section Q is 3.6 m downstream of P, the distance of section P from the leading edge of the plate is  
 (A) 0.32m (B) 0.22m (C) 0.40m (D) 0.53m
59. Which of the following pairs are correctly matched?  
 1. Piezometric head : Sum of datum head and pressure head  
 2. Dynamic head : Sum of datum head and velocity head  
 3. Stagnation head : Sum of Piezometric head and velocity head  
 4. Total head : Sum of Piezometric head and dynamic head  
 (A) 1, 2 & 3 only (B) 1, 3 & 4 only (C) 2, 3 and 4 only (D) 1, 2, 3 & 4
60. A rectangular tank 10 m x 5 m in plan and 3 m deep is divided by a partition wall parallel to the shorter wall of the tank. One of the compartments contains water to a depth of 3 m, and the other a lighter liquid of specific gravity 0.75 to a depth of 2 m.  
 The resultant pressure thrust on the partition wall is  
 (A) 1000 kg (B) 1500 kg (C) 2000 kg (D) 2500 kg
61. Which of the following are pertinent to the realization of hydrological cycle?  
 1. Latitudinal difference in solar heating of the Earth's surface  
 2. Inclination of the Earth's axis  
 3. Uneven distribution of land and water  
 4. Coriolis effect  
 (A) 1, 2 & 3 only (B) 1, 2 & 4 only (C) 2, 3 & 4 only (D) 1, 2, 3 & 4
62. The maximum velocity  $U_m$ , the mean velocity  $U$  and shear velocity  $u_*$  in the case of turbulent flow through circular pipes are related as  $\frac{(U_m - U)}{u_*} =$   
 (A) 2.5 for rough boundary flow only  
 (B) 5.75 for smooth boundary flow only  
 (C) 3.75 for both smooth and rough boundary flows  
 (D) 5.75 for both smooth and rough boundary flows.
63. The rainfall on five successive days on a catchment was 3, 6, 9, 5 and 1 cm respectively. If the  $\phi$ -index for the storm can be assumed to be 3 cm/day, the total direct runoff from the catchment due to this storm is  
 (A) 11 cm (B) 24 cm (C) 9 cm (D) 20 cm
64. The excess runoff hydrograph from a catchment area  $10\text{km}^2$  due to a storm of 6 hrs duration has been observed to be triangular in shape. The peak flow is observed to be  $10\text{m}^3/\text{s}$  and the base length is 20 hrs. The rainfall excess in the catchment is  
 (A) 5.1 cm (B) 3.6 cm (C) 4.5 cm (D) 2.5 cm

65. Consider the following statements:
1. Over the oceans there is more evaporation than precipitation.
  2. On land it is more precipitation than evapo-transpiration.
- Which of these statements are correct?
- (A) Both 1 & 2            (B) Neither 1 nor 2            (C) 1 only            (D) 2 only
66. The hydrologic risk of a 100-year flood occurring during the 2-year service life of a project is
- (A) 9.8%            (B) 9.9%            (C) 19.9%            (D) 1.99%
67. The design flood commonly adopted in India for barrages and minor dams is
- (A) Probable maximum flood  
(B) A flood of 50 – 100 years return period  
(C) Peak flood  
(D) Standard project flood or a 100-year flood, whichever is higher
68. The Muskingum method of flood routing is a
- (A) Form of hydraulic routing of a flood  
(B) Form of reservoir routing  
(C) Complete numerical solution of St. Venant equations  
(D) Hydrological channel routing method
69. What would be the volume of water stored in a saturated column with a porosity of 0.35 with a cross-sectional area of  $1\text{ m}^2$  and depth of 3 m?
- (A)  $2.0\text{ m}^3$             (B)  $0.105\text{ m}^3$             (C)  $105\text{ m}^3$             (D)  $3.0\text{ m}^3$
70. The surface joining the static levels in several non-pumping wells penetrating a continuous confined aquifer represents
- (A) Water-table surface            (B) Capillary fringe  
(C) Piezometric surface of the aquifer            (D) Physical top surface of the aquifer
71. Two observation wells penetrating into a confined aquifer are located 1500 m apart in the direction of flow. Heads of 50 m and 25 m are indicated at these two observation wells. If the coefficient of permeability for the aquifer is 30 m/day and its porosity is 0.25, the time of travel of an inert tracer from one well to another is
- (A) 75 days            (B) 750 days            (C) 1200 days            (D) 3000 days
72. The local scour depth in front of a semicircular shaped rectangular pier having width equal to  $W$  aligned parallel to the flow below the surrounding bed is
- (A)  $2.0 W$             (B)  $1.5 W$             (C)  $1.2 W$             (D)  $1.0 W$

73. Critical shear stress of cohesive sediment
- (A) Decreases with the void ratio for a given plasticity index  
(B) Increases with the plasticity index for a given void ratio  
(C) Increases with shear strength for a given clay content  
(D) All of the above.
74. A discharge of  $72\text{m}^3/\text{s}$  is to be allowed through siphon spillways of 2 m width and 75 m depth with working head of 8 m. The number of spillways to be provided will be (Take coefficient of discharge for the spillways = 0.64)
- (A) 2 (B) 4 (C) 6 (D) 8
75. Coefficient of permeability of an underground stratum is 0.001 m/s. Discharge obtained from a well of area  $20\text{m}^2$  dug into this stratum (with drawdown of 2 m) will be
- (A) 2400 lpm (B) 2000 lpm (C) 1200 lpm (D) 1000 lpm
76. EDTA titration method of hardness determination of water sample uses an indicator which combines with hardness-causing divalent cations and forms a coloured complex. The name of the indicator and the colour of the formed complex respectively are
- (A) Ferroin and dark blue (B) Ferroin and wine red  
(C) Eriochrome Black T and dark blue (D) Eriochrome Black T and wine red
77. Consider the following statements:
1. Carbonate hardness is due to bicarbonates.
  2. Non-carbonate hardness is due to sulphates and chlorides of Ca and Mg.
  3. Both the hardnesses can be removed by lime-soda method.
  4. Both the hardnesses can be removed by ion-exchange method.
- Which of these statements are correct?
- (A) 1, 2 & 3 only (B) 1, 2 & 4 only (C) 2, 3 & 4 only (D) 1, 2, 3 & 4
78. If the velocity of flow as well as the diameter of the flowing pipe are respectively doubled through a pipe system in use since long, the head loss will thereafter be
- (A) Halved (B) Doubled (C) Increased 4 times (D) No change
79. Consider the following statements:
- The total head against which a pump has to work must include, besides any other items,
1. the suction lift.
  2. the delivery head.
  3. the head lost due to friction at entrance in the rising main.
  4. the head lost due to friction at exit in the rising main.
- Which of these statements are correct?
- (A) 1, 2 & 3 only (B) 2 & 3 only (C) 1, 2, 3 & 4 (D) 3 & 4 only

80. An urban area is located in plains having “average climatic conditions”. The impervious area thereof for which drainage must be provided is 3.6 ha and the design rainfall intensity is 2.0 cm/hr. The drains will be designed for a runoff of  
(A)  $0.05 \text{ m}^3 / \text{s}$       (B)  $0.10 \text{ m}^3 / \text{s}$       (C)  $0.20 \text{ m}^3 / \text{s}$       (D)  $0.40 \text{ m}^3 / \text{s}$
81. If water table is encountered in the standard pit while conducting plate load test  
(A) The load test should be abandoned  
(B) The pit is considered unsafe  
(C) Test should be conducted with complete dewatering continuously throughout the test duration  
(D) The bearing capacity of soil cannot be determined in this condition
82. A wall with smooth vertical back and 10 meters height retains cohesionless material with a horizontal surface. The cohesionless material weighs  $4.91 \text{ kN} / \text{m}^3$  and has an angle of internal friction of  $30^\circ$ . The total active earth pressure is  
(A)  $81.585 \text{ kN} / \text{m}$  length of wall      (B)  $91.585 \text{ kN} / \text{m}$  length of wall  
(C)  $40.743 \text{ kN} / \text{m}^2$       (D)  $81.585 \text{ kN} / \text{m}^2$
83. Consider the following statements regarding Coulomb’s theory of earth pressure:  
1. It is based on wedge theory of earth pressure.  
2. It assumes the wall surface to be rough.  
3. It may or may not satisfy the static equilibrium condition occurring in nature.  
Which of these statements are correct?  
(A) 1, 2 & 3      (B) 1 & 2 only      (C) 2 & 3 only      (D) 1 & 3 only
84. An isobar is a line which connects all points below the ground surface at which  
(A) The local ground elevation is same  
(B) The settlement is same  
(C) The vertical stress is the same  
(D) The ground elevation is varying
85. For the determination of shear strength parameters,  $C$  and  $\phi$ , of soil in the laboratory, the test to be conducted will be  
(A) Triaxial compression test      (B) Sieve analysis  
(C) Compaction test      (D) Relative density test
86. Consider the following statements:  
1. For a saturated soil, Skempton’s B-parameter is nearly equal to unity.  
2. For an undisturbed sensitive clay, the stress-strain curve shows a peak.  
3. Interlocking contributes significantly to the shearing strength in case of dense sand.  
Which of these statements are correct?  
(A) 1, 2 & 3      (B) 1 & 2 only      (C) 2 & 3 only      (D) 1 & 3 only

87. Consider the following statements:
1. Mathematically speaking, the time taken for 100% consolidation is infinite.
  2. The time factor for a particular average degree of consolidation depends upon the distribution of initial excess hydrostatic pressure.
  3. Secondary consolidation obeys Terzaghi's one-dimensional theory of consolidation.
- Which of these statements are correct?
- (A) 1, 2 & 3                      (B) 1 & 2 only                      (C) 2 & 3 only                      (D) 1 & 3 only
88. Consider the following statements:
1. Organic matter decreases the permeability of a soil.
  2. Entrapped air decreases the permeability of a soil.
- Which of these statements are correct?
- (A) 1 only                      (B) 2 only                      (C) Both 1 & 2                      (D) Neither 1 nor 2
89. The porosity of a certain soil sample was found to be 80% and its specific gravity was 2.7; the critical hydraulic gradient will be estimated as
- (A) 0.34                      (B) 0.92                      (C) 1.0                      (D) 1.5
90. The porosity of a soil sample having its void ratio equal unity would be
- (A) 33.33%                      (B) 50.0%                      (C) 66.66%                      (D) 75.0%
91. The natural water content of the soil sample was found to be 40%, specific gravity is 2.7 and void ratio 1.2; then the degree of saturation of the soil will be
- (A) 100%                      (B) 69%                      (C) 87%                      (D) 90%
92. Environmental impact assessment includes
- (A) Environmental statement  
(B) Environmental management plan  
(C) Risk and hazard assessment and mitigation  
(D) All of the above
93. For noise measurement, formula for sound pressure level (SPL) is  $20 \log \frac{P}{P_{ref}}$ . What will be the resultant noise in dB if P is 0.0002  $\mu$  bar?
- (A) 0                      (B) 60                      (C) 90                      (D) 100
94. Consider the following statements:
1. Particulates have irregular shapes.
  2. Size can be determined by an equivalent aerodynamic diameter by comparing with a perfect sphere.
  3. Particulates larger than 10  $\mu$  are said to settle relatively quickly since their settling velocity is not less than 10 cm/min.
  4. The particles roughly the size of bacteria have aerodynamic diameter of 0.1  $\mu$ m to 10  $\mu$ m

- Which of these statements are correct?  
(A) 1, 2, 3 & 4            (B) 1 & 3 only            (C) 1, 2 & 4 only            (D) 2, 3 & 4 only
95. Which of the following factors contribute to formation of photochemical smog?  
1. Stable atmosphere  
2.  $\text{NO}_x$   
3. Solar insolation  
4. CO.  
(A) 1, 2, 3 & 4            (B) 2, 3 & 4 only            (C) 1 & 4 only            (D) 1, 2 & 3 only
96. It takes 0.4 hrs to drive from the garage to the head of the route, 0.4 hrs to drive between the route head and disposal site and 0.25 hrs to return from the disposal site. It takes 0.2 hrs to offload a truck at the disposal site. The crew is permitted two 15-minute breaks and a further 30 minutes for miscellaneous delays. It two runs are made to the deposit site each day, how much time is left in an 8-hr nominal duty duration for refuse collection before starting to return to garage from disposal site? Take loading time as 30 minutes.  
(A) 4.15 hrs            (B) 4.25 hrs            (C) 4.75 hrs            (D) 4.85 hrs
97. Consider the following statements:  
The time of BOD assimilation in a stream can be affected by  
1. Ratio of stream depth to flow width.  
2. Stream BOD value  
3. BOD rate constant.  
Which of these statements are correct?  
(A) 1, 2 & 3            (B) 1 & 2 only            (C) 2 & 3 only            (D) 1 & 3 only
98. The most common constituents of alkalinity in natural water are measured by titrating the water sample with 0.02N  $\text{H}_2\text{SO}_4$  using  
(A) Eriochrome Black T and Ferroin indicators  
(B) Ferroin and Phenolphthalein indicators  
(C) Phenolphthalein and Methyl Orange indicators  
(D) Methyl Orange and Eriochrome Black T indicators
99. A sample of sewage is estimated to have a 5 days  $20^\circ\text{C}$  BOD of 250 mg/l. If the test temperature be  $30^\circ\text{C}$ , in how many days will the same value of BOD be obtained?  
(A) 1.5 days            (B) 2.5 days            (C) 3.3 days            (D) 7.5 day
100. A sewer has a diameter of 300 mm and slop of 1 in 400. While running full it has a mean velocity of 0.7 m/s. If both the diameter and slope are doubled (to respectively be 600 mm and 1 in 200), what will be the changed mean velocity when running half-full?  
Use Manning's formula.  
(A) 1.59 m/s            (B) 2.80 m/s            (C) 0.90 m/s            (D) 1.00 m/s

101. Statement (I): In a flownet, each field must be a (curvilinear) square.  
Statement (II): Each flow channel in a flownet has the same rate of flow.  
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
102. Statement (I): Boundary layer theory is applicable only in the vicinity of the leading edge of a flat plate.  
Statement (II): Boundary layer theory is based on the assumption that its thickness is small when compared to other linear dimensions in the flow.  
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
103. Statement (I): The best hydraulic section always has the minimum excavation.  
Statement (II): The best hydraulic section gives the minimum area for a given discharge.  
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
104. Statement (I): A given channel may be classifiable as mild for one discharge, critical for another discharge, and steep for yet another discharge.  
Statement (II): Normal depth and critical depth are independent functions of the discharge along with, or without, other appropriate parameters.  
(A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true

105. Statement (I): For a hydraulic ram, D'Aubuisson's efficiency is always more than Rankine's efficiency.
- Statement (II): By definition, efficiency is always less than unity in any system of mechanics; and addition of a small value to both numerator and denominator in the ratio of such a case always improves the value.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
106. Statement (I): Air pollutant concentration and time of retention increase due to inversion.
- Statement (II): During winter, the heavy cold layer in the atmosphere retains the hot toxic pollutants for a longer period in the atmosphere.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
107. Statement (I): Chlorides are added to kill pathogens as a disinfection process in the treatment of water.
- Statement (II): It forms hypochlorous acid to oxidize the organic compounds including bacteria
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
108. Statement (I): When a tube well penetrates into a homogeneous aquifer and is then pumped, there will occur lowering of water surface. The resultant surface is designated as 'Drawdown curve'.
- Statement (II): Since the pressure on the surface of the 'Drawdown curve' is always at atmospheric level, it is called by this name



- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
109. Statement (I): Fluoride concentrations of approximately 1.0 mg/l in drinking water help to prevent dental cavities in children.
- Statement (II): During formation of permanent teeth, fluoride combines chemically with tooth enamel resulting in softer and weaker teeth that are less resistance to decay.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
110. Statement (I): Virus is living organisms in a natural environment including soil.
- Statement (II): Virus comes to life after entering the host tissue through contamination.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
111. Statement (I): The BOD test is conducted for 5 days at 20°C
- Statement (II): The amount of oxygen utilized by microorganisms anaerobically is called BOD.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
112. Statement (I): An epidemic of infection is hepatitis is transmitted by drinking contaminated water.
- Statement (II): Since infective hepatitis is transmitted by bacteria, it can be controlled by filtration and disinfection of water.

- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
113. Statement (I): The ability of water to conduct electricity, known and measured as the specific conductance, and concentration of total dissolved solids are not relatable on a one-to-one basis.
- Statement (II): Many organic molecules and compounds dissolve in water without ionizing and hence are not taken into account while measuring specific conductance.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
114. Statement (I): Water with heavy algal growth often has pH values as high as 9 to 10.
- Statement (II): Non-utilization of the bicarbonate ion as a carbon source by algae can result in substantial accumulation of OH<sup>-</sup> ions.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true
115. Statement (I): Municipal Solid Waste is disposed off in the Transport Safe Disposal Facility (TSDF) to convert it into organic compost.
- Statement (II): The organic Municipal Solid Waste is converted into compost by worms; and the process is called 'Vermi composting'
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true

116. Statement (I): Chlorophyll-bearing plants take water and carbon dioxide to synthesize carbohydrates.  
Statement (II): Wasted food ultimately leads to production of various natural resources like water and sunlight energy.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
117. Statement (I): A curved, or straight, line connecting the relevant stress points is called the stress path.  
Statement (II): All the total stress paths and the effective stress paths for the drained tests are straight lines at a slope of  $45^\circ$
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
118. Statement (I): Foundations may not be geometrically categorized as shallow, or deep, foundations.  
Statement (II): A foundation is shallow if its depth is equal to or less than its width; otherwise it is deep.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true
119. Statement (I): Different types of piles are used in construction work depending on the type of load to be carried, the sub-soil conditions and the ground water table.  
Statement (II): The load transfer mechanism from a pile to the soil is selfsame in all cases.
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)  
(B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)  
(C) Statement (I) is true but Statement (II) is false  
(D) Statement (I) is false but Statement (II) is true

120. Statement (I): Present usage of GPS for positioning includes personal navigation, aircraft navigation, offshore survey, vessel navigation, etc.
- Statement (II): GPS is a satellite navigation system designed to provide information about instantaneous velocity and time almost anywhere on the globe at any time and in any weather
- (A) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
- (B) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
- (C) Statement (I) is true but Statement (II) is false
- (D) Statement (I) is false but Statement (II) is true