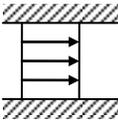**Objective Paper-II**
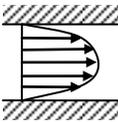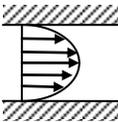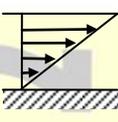
1. Match List I with List I and select the correct answer using the code given below the lists:

	List I		**List II**
P		1	Couette
Q		2	Ideal fluid
R		3	Poiseuille
S		4	Turbulent

(A) P-1, Q-3, R-4, S-2   (B) P-2, Q-3, R-4, S-1
(C) P-1, Q-4, R-3, S-2   (D) P-2, Q-4, R-3, S-1

2. An unconfined aquifer of porosity 30% and permeability 35 m/day and specific yield of 0.20 has an area of 100 km^2. If the water table falls by 0.25 m during a drought, the volume of water lost from storage, in million cubic metres, is
(A) 2.0   (B) 5.0   (C) 1.0   (D) 4.0

3. Consider the following statements:
    High water training is undertaken to protect against damage due to floods.
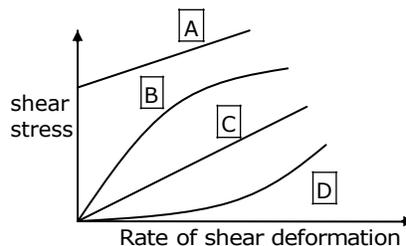   Low water training is undertaken to provide sufficient depth for navigation.
    Mean water training is undertaken to provide efficient disposal of sediment load.
    Which of the above statements is/are correct?
(A) 1 and 2 only   (B) 1, 2 and 3   (C) 2 and 3 only   (D) 2 only

4. Match List I with List I and select the correct answer using the code given below the lists:

List I		List II	
P	Curve A	1	Newtonian
Q	Curve B	2	Dilatant
R	Curve C	3	Ideal Bingham plastic
S	Curve D	4	Pseudo-plastic

(A) P-3, Q-4, R-2, S-1   (B) P-2, Q-4, R-1, S-3

(C) P-3, Q-1, R-4, S-2   (D) P-2, Q-1, R-4, S-3

5.   Shallow ponds in which dissolved oxygen is present at all depths are called

(A) Aerobic lagoons   (B) Aerobic ponds

(C) Facultative lagoons   (D) Facultative ponds

6.   Consider the following statements:

1. Each year, black cotton soil appreciably shrinks during dry season and swells during rainy season. This alternate cycle of shrinking and swelling causes severe stresses in structures supported directly by such soil.

2. Black cotton soil contains predominantly a clay mineral called kaolinite, which is responsible for causing appreciable shrinking and swelling.

3. Shrinking and swelling of black cotton soils are observed only upto a certain depth below the ground level. Below that level, there is neither shrinking nor swelling.

Which of the above statements is / are correct?

(A) 1, 2 and 3   (B) 3 only   (C) 2 and 3 only   (D) 1 and 3 only

7.   Consider the following statements:

The function of a launching apron at the end of downstream impervious apron of a weir is

1. To protect the downstream pile from the scour holes progressing in the upstream direction

2. When the scour holes are formed, to provide for the stones of the falling apron to settle down in the holes and cover them

3. To provide relief of the uplift pressure at the downstream end

4. To provide extra length for proper formation of hydraulic jump

Which of the above statements is/are correct?

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

8.   The two sides of a trapezoidal channel are lined with cement plaster, $n_w = 0.012$, while the earthen bed has $n_b = 0.025$, the area is divided into three parts as in the figure.
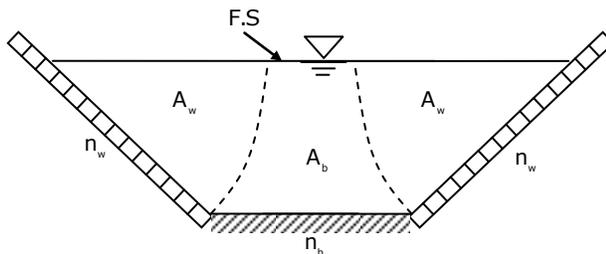
Consider the following assumptions to find the discharge through this section:

1. The average velocity is the same for all the 3 parts.
2. Discharge is the same in all the 3 parts.
3. Bed slope is the same for all the 3 parts
4. Hydraulic mean radius is the same for all the 3 parts.

Which of the above assumptions are correct?

(A) 1 and 3   (B) 1 and 4   (C) 2 and 3   (D) 2 and 4

9. Consider the following statements:

1. A differential free swell value of 40% indicates a soil with a high degree of expansiveness.
2. A swelling pressure of less than 20 kN/m^2 is not of much consequence
3. The swelling pressure is a unique parameter for a swelling soil and is not influenced by other factors.

Which of the above statements is/are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 only

10. Heavy scour at the head and shank of guide banks can lead to undermining of the stone pitching and consequent failure of the guide bank. This situation is avoided by providing

(A) Spurs   (B) Vertical cutoffs

(C) Marginal bunds   (D) Launching apron

11. Noise pollution in a road-side building can be reduced by

(A) providing a ditch around the building and filling it with water

(B) providing a steel mesh around the building

(C) providing a thick bush around the building

(D) planting tall trees around the building and fencing them with barbed wires

12. A submerged pipe outlet is an example of

(A) Semi-modular outlet   (B) Non-modular outlet

(C) Rigid module   (D) Adjustable proportional module

13. A ski-jump bucket is generally used as an energy dissipater when the tail water

(A) is greater than 1.1 times the required conjugate depth for the formation of hydraulic jump; and the river bed rock is good

(B) depth is lesser than the depth required for the jump formation; and the bed of the river channel is composed of sound rock

(C) depth is equal to the depth required for the jump formation, and the river bed rock is good

(D) depth is 1.3 times the required for the jump formation and the river bed is composed of weak rock

14. The wave height, in metres, generated on the surface of a reservoir, having a fetch length F = 30km, due to wind blowing on the surface of the reservoir at a velocity of 30 km/hr, is

   (A) 0.26m   (B) 0.96m   (C) 0.52m   (D) 1.2m

15. Consider the following devices as likely to concern with water hammer phenomenon in their design/operation:

   1. Hydraulic ram
   2. Hydraulic accumulator
   3. Penstock
   4. Draft tube

   Which of the above devices is/are so concerned?

   (A) 1, 2, 3, 4 and 5   (B) 1, 3 and 4 only

   (C) 2 and 3 only   (D) 3 only

16. Consider the following statements:

   Westergaard's theory of stress distribution is more appropriate for soil deposits which exhibit large lateral strain.

   Newmark's influence chart can be used for the determination of vertical stress under any slope of a loaded area.

   Which of the above statements is/are correct?

   (A) 1 only   (B) 2 only   (C) both 1 and 2   (D) neither 1 nor 2

17. The maximum height of a low gravity dam of elementary profile made of concrete of relative density 2.5 and safe allowable stress of foundation material 3.87 MPa without considering uplift force is about

   (A) 113 m   (B) 217 m   (C) 279 m   (D) 325 m

18. In a facultative pond systems, the aerobic zone may get extended downwards due to

   (A) calm waters along with weak sunlight
   (B) mixing by wind action along with weak sunlight
   (C) mixing by wind action along with penetration by sunlight
   (D) calm waters along with penetration by sunlight

19. Consider the following statements:

   1. The yield of a retaining wall required to reach plastic equilibrium in active case is more than that in positive case.
   2. Culman's graphical method is a simplified version of the more general trial wedge method.
   3. For a masonry gravity retaining wall Coulomb's theory of earth pressure is preferred for designing.

   Which of the above statements is/are correct?

   (A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 3 only

20.   A sluice inlet in a dam with streamlined entrance is shown in figure. If cavitation is expected to occur, it will first appear at the point
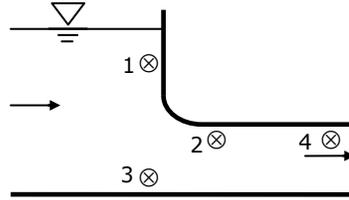
(A) 1   (B) 2   (C) 3   (D) 4

21.   A homogeneous earth dam is 43 m high with 3 m as free board and a 30 m long horizontal filter at the downstream end. The flownet drawn in the dam section consists of 5 flow channels and 15 potential drops. If the dam is 500 m long and the permeability of the material of the dam is uniformly 3×10^{-3} m/s, the total discharge permeating through the body of the dam will be

(A) $0.0004 \ m^3/s$ (B) $0.0036 \ m^3/s$ (C) $0.0039 \ m^3/s$ (D) $0.20 \ m^3/s$

22.   With a bit rate of 50 bps and a cycle time of 30 seconds the total information content of a navigation data set is

(A) 80 bits   (B) 20 bits   (C) 100 bits   (D) 1500 bits

23.   In a pipe network of municipal water supply, a parallel pipe is sometimes installed over a portion of the pipe mainly for

(A) reducing water hammer pressure

(B) decreasing the pumping power need

(C) increasing the head available at the node

(D) increasing the discharge

24.   The discharge required for Rabi and Kharif crops are $0.4 \ m^3/s$ and $0.3 \ m^3/s$ respectively. The capacity and time factors are 0.8 and 0.5 respectively at each season. The design discharge of the distributary at its head is

(A) $0.8 \ m^3/s$ (B) $0.16 \ m^3/s$ (C) $1.0 \ m^3/s$ (D) $1.24 \ m^3/s$

25.   In an aerobic attached-culture system, the biomass at the biofilm-medium surface interface experiences

(A) Aerobic and endogenous metabolism

(B) Anaerobic and endogenous metabolism

(C) Anaerobic and exogenous metabolism

(D) Aerobic and exogenous metabolism

26.   Calibration of a current meter for use in channel flow measurement is done in a

(A) Wind tunnel   (B) Water tunnel   (C) Towing tank   (D) Flume

27. Considerable loss of shear strength due to shock or disturbance is exhibited by
    (A) Under-consolidated clays   (B) Normally consolidated clays
    (C) Over-consolidated clays   (D) Organic soil

28. Consider the following statements:
    In aerial photogrammetry the 'filter' is placed in front of the lens to
       1. reduce the effect of atmospheric haze
       2. protect the lens from dust
       3. provide uniform light distribution over the format
    Which of the above statements is/are correct?
    (A) 1 and 2 only   (B) 2 only   (C) 1 and 3 only   (D) 1, 2 and 3

29. A partially open sluice gate is suddenly raised to its full opening. The resulting surge waves
    at the gate are
    (A) a positive wave travels towards the gate from the upstream side while a negative wave
        travels downstream from the gate
    (B) a positive wave travels from the gate onto the upstream side while a positive wave travels
        downstream from the gate
    (C) a negative wave travels from the gate onto the upstream side while a positive wave travels
        downstream from the gate
    (D) a negative wave travels towards the gate from the upstream side whereas a positive wave
        travels downstream from the gate

30. Consider the following statements:
    Apparent cohesion in sands is exhibited mainly due to
    1. Reduction in density
    2. Increase in density
    3. Capillary moisture in pores
    Which of the above statements is/are correct?
    (A) 1, 2 and 3   (B) 1 and 3 only   (C) 2 and 3 only   (D) 2 only

31. A catchment of area 200 ha has a runoff coefficient 0.5. A storm of duration larger than the
    time of concentration of the catchment and of intensity 3.6 cm/h causes a peak discharge
    $\left(\text{m}^3/\text{s}\right)$ of
    (A) 5   (B) 10   (C) 100   (D) 360

32. Consider the following statements:
    The coefficient of permeability k depends upon:
    1. Void ratio of the soil   3. Equivalent diameter of the soil grains
    2. Duration of flow   4. Shape of the particle
    Which of the above statements are correct?
    (A) 1, 2, 3 and 4   (B) 2 and 3 only   (C) 1, 3 and 4 only   (D) 3 and 4 only

33. A culvert is designed for a flood magnitude of return period 100 years and has expected life of 20 years and has expected life of 20 years. The risk in this hydrologic design is

  (A) $1 - 0.99^{20}$ (B) $1 - 0.01^{20}$ (C) $1 - 0.09^{20}$ (D) $1 - 0.10^{20}$

34. A soil has discharge velocity of 5×10^{-7} m/s and a void ratio of 0.50. Its seepage velocity will be

  (A) 15×10^{-7} m/s   (B) 10×10^{-7} m/s   (C) 20×10^{-7} m/s   (D) 30×10^{-7} m/s

35. Zigzag deposition and movement of sand on sea beach is called

  (A) Littoral shift   (B) Beach shift   (C) Trough action   (D) Sedimentation

36. 'Iso-centre' is the point

  (A) in which the tilted axis of the camera meets the vertical photograph

  (B) in which the bisector of the angle of tilt meets the vertical photograph

  (C) in air space, the location of the optical centre of the lens of the camera at the time of exposure

  (D) where the perpendicular from the nodal point meets the photograph

37. Consider the following statements:

  The hydraulic head at a point in the soil includes piezometric head as well as datum head.

  Piping in soil occurs when effective pressure becomes equal to zero.

  Piping in soil occurs when soil is highly porous.

  Which of the above statements is/are correct?

  (A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 2 only

38. A catchment consists of 30% area with runoff coefficient 0.40 with the remaining 70% area with runoff coefficient 0.60. The equivalent runoff coefficient will be

  (A) 0.48   (B) 0.54   (C) 0.63   (D) 0.76

39. Ombrometer (pluviometer) is used to measure

  (A) Soil moisture stress of a plant   (B) Rainfall depth

  (C) Leaf area   (D) Root zone depth

40. Secondary clarifier of an activated sludge process must be designed for effluent clarification and solids thickening, both of which relate directly to the

  (A) Surface area

  (B) Transport velocity due to sludge withdrawal

  (C) Gravity settling of solids relative to the water

  (D) Underflow solids concentration

41.   A direct-runoff hydrograph due to an isolated storm was triangular in shape with a base of 80 h and peak of 200 m^3 / s. If the catchment area is 1440 km^2, the effective rainfall of the storm is

(A) 20 cm   (B) 10 cm   (C) 5 cm   (D) 2 cm

42.   Consider the following statements:

1. Poorly graded or uniform sands compact to low dry unit weights.

2. Heavy clays with high plasticity have very low maximum dry unit weight.

3. In clay soils, the maximum dry weight tends to decrease as plasticity increases.

Which of the above statements is / are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 3 only

43.   The declination of a celestial body is the arc of the declination circle intercepted between that body and the

(A) Prime vertical through that body   (B) Azimuth of the body

(C) Equinoxes of the Earth   (D) Equator of the Earth

44.   The shape of the recession limb of a hydrograph depends on

(A) Basin as well as storm characteristics

(B) Storm characteristics only   (C) Basin characteristics only

(D) Base flow only

45.   If L is the perimeter of a closed traverse, ΔD is the closing error in departure, the correction for the departure of a traverse side of length l, according to Bowditch rule, is

(A) $\Delta D \dfrac{L}{l}$ (B) $\Delta D \dfrac{l^2}{L}$ (C) $\dfrac{Ll}{\Delta D}$ (D) $\Delta D \dfrac{l}{L}$

46.   Consider the following statements:

In clay soils, the maximum dry weight tends to decrease as plasticity increases.

In clay soils, the maximum dry unit weight tends to increase as plasticity increases.

Heavy clays with high plasticity have the minimum dry unit weight and high OMC.

Which of the above statements are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

47.   Which one of the following traffic signal systems is useful when there is continuous operation of group of vehicles along the main road?

(A) Simultaneous system   (B) Alternate system

(C) Simple progressive system   (D) Flexible progressive system

48. In accordance to Gauss rule, weights to be assigned are proportional to

   (A) $1/($Sum of the residual errors of observations$)$

   (B) $1/($Sum of the square of the residual errors of observations$)$

   (C) Sum of the square roots of the residual errors of observations

   (D) Sum of the cube roots of the residual errors of observations

49. In a wet soil mass, air occupies one-sixth of its volume and water occupies one-third of its volume. The void ratio of the soil is

   (A) 0.25   (B) 0.50   (C) 0.75   (D) 1.0

50. Consider the following statements regarding specific energy of the flow in an open channel:

   1. There is only one specific energy curve for a given channel
   2. Alternate depths are the depths of flow at which the specific energy is the same.
   3. Critical flow occurs when the specific energy is minimum for the flow rate.

   Which of the above statements is/are correct?

   (A) 1 only   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1, 2 and 3

51. The above figure shows B.O.D. curve when the experiment was conducted at $20°C$. If the experiment is conducted at 30ºC, then the portion AB of the curve

   (A) shifts to the left

   (B) shifts to the right

   (C) remains unchanged

   (D) shrinks
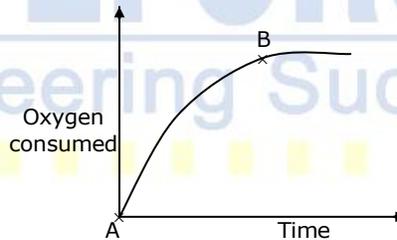
52. An S-curve hydrograph has been obtained for catchments of $270\,km^2$ from a 3-hour unit hydrograph. The equilibrium discharge $\left(m^3/s\right)$ for the S-curve is

   (A) 750   (B) 277.8   (C) 250   (D) 187

53. Consider the following statements:

   In a sewage treatment process

   1. Detention time required for anaerobic decomposition is more as compared to that for aerobic decomposition.
   2. Anaerobic decomposition is more energy-consuming as compared to aerobic decomposition.
   3. Anaerobic decomposition is a more sensitive process as compared to aerobic decomposition.

   Which of the above statements is/are correct?

   (A) 1, 2 and 3   (B) 2 only   (C) 3 only   (D) 1 and 3 only

54. Altimetry may be depicted most accurately by

(A) Hachures   (B) Relief shading   (C) Layer tinting   (D) Contour lines

55. Consider the following statements:

Peat and muck are organic soils.

Peat is an inorganic soil whereas muck is an organic soil.

Indurated clay is a type of clay which does not soften under prolonged wetting.

Which of the above statements is / are correct?

(A) 1, 2 and 3   (B) 2 only   (C) 3 only   (D) 1 and 3 only

56. Consider the following statements which are related to the phenomenon of cavitation in fluid flow:

1. Cavitation occurs when local velocity is decreased, so that local pressure increases to a high degree.

2. Cavitation occurs if elevation is high thereby decreasing ambient pressure.

3. Cavitation occurs if local velocity is increased so that the local pressure decreases.

4. Cavitation is dependent on vapour pressure of the fluid.

Which of the above statements are correct?

(A) 1, 2 and 3   (B) 1, 2 and 4   (C) 1, 3 and 4   (D) 2, 3 and 4

57. In a liquid-gas system, when the water is dispersed in air, the absorption of gas is represented by
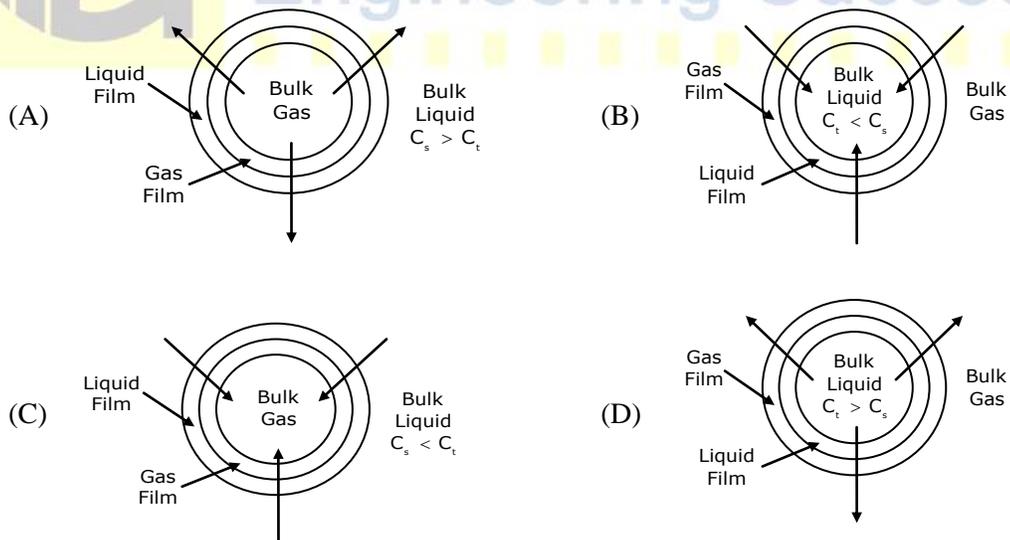
58. The coefficient of variation of the rainfall for six rain gauge stations in catchments was found to be 29.54%. The optimum number of stations in the catchments for an admissible 10% error in the estimation of the mean rainfall will be

(A) 3   (B) 6   (C) 9   (D) 12

59. A specimen of clayey silt contains 70% silt size particles. Its liquid limit = 40 and plastic limit = 20. In liquid limit test, at moisture content of 30%, required number of blows was 50. Its plasticity index, activity and consistency index will respectively be

   (A) 20, 0.67 and 0.5   (B) 20, 1.5 and 2.0

   (C) 30, 1.5 and 2.0   (D) 20, 0.286 and 0.38

60. The difference between the apparent solar time and mean solar time is known as

   (A) Real time   (B) Average time

   (C) Equation of time   (D) Sidereal time

61. Consider the following statements about theodolites:

   1. Transit theodolite is a theodolite in which the telescope can be transited.

   2. EDMI is a theodolite fitted with a micrometer for measurements

   3. A double reading theodolite is one in which diametrically opposite segments of the graduated circle are brought into view and the readings are averaged.

   Which of the above statements are correct?

   (A) 1, 2 and 3   (B) 1 and 3 only   (C) 1 and 2 only   (D) 2 and 3 only

62. Consider the following statements:

   1. Sensitivity of a natural soil deposit cannot be less than 1.0.

   2. A saturated loose sand deposit liquefies when water flows through it in upward direction under critical hydraulic gradient.

   3. A quick clay has very high sensitivity.

   Which of the above statements are correct?

   (A) 1, 2 and 3   (B) 1 and 2 only   (C) 1 and 3 only   (D) 2 and 3 only

63. The terminal velocity of a small sphere settling in a viscous fluid varies as the

   (A) inverse square of the diameter   (B) inverse of the diameter

   (C) first power of its diameter   (D) inverse of the fluid viscosity

64. Consider the following statements:

   1. At shrinkage limit, the soil remains fully saturated.

   2. The shear strength of all soils at liquid limit is the same.

   3. The shear strength of all soils at plastic limit is the same.

   Which of the above statement is/are correct?

   (A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 only

65. Refraction error is the least in case of

   (A) Stadia tacheometry   (B) Tangential tacheometry

   (C) Subtense bar tacheometry   (D) Omnimeters

66. In all reaction turbines, maximum efficiency is obtained if the

(A) Guide vane angle is 90º

(B) Blade angle is 90º at the inlet

(C) Blade angle is 90º at the outlet

(D) Angle of the absolute velocity vector at the outlet is 90º

67. Liquefaction of foundation soil during an earthquake shall not be the reason for cracking of

(A) only floors in the building   (B) walls and roof in the building

(C) beams and columns in the building   (D) only balcony in the building

68. Consider the following statements:

In a water supply system

1. Drain valves are provided at elevated, or higher, points to remove accumulated air.

2. Reflux valve allows flow in one direction only

3. Drain valves are provided at low points to remove silt and other deposits.

Which of the above statements is/are correct?

(A) 1, 2 and 3   (B) 2 only   (C) 2 and 3 only   (D) 3 only

69. Match List I with List I and select the correct answer using the code given below the lists:

	List I (Type of survey)		List II (Method / Instrument)
P	Traffic volume study	1	Workspot interview method
Q	Speed and delay study	2	Doppler radar
R	Spot-speed study	3	Floating car method
S	Multiple character studies	4	Automatic vehicle counter and classifier
		5.	Electronic detector

(A) P-5, Q-3, R-2, S-4   (B) P-1, Q-3, R-2, S-5

(C) P-5, Q-2, R-3, S-4   (D) P-1, Q-2, R-2, S-4

70. Consider the following statements:

1. The minimum value of group index for a soil can be taken as zero.

2. The maximum possible value of group index for a soil is twenty.

Which of the above statements is/are correct?

(A) Both 1 and 2   (B) 1 only

(C) 2 only   (D) neither 1 nor 2

71. A light-house is visible just above the horizon at a certain station at the sea level. Distance between the station and the light-house is 60km. The height of the light house is

(A) 243.5   (B) 4.0m   (C) 287.5m   (D) 5.4m

72.   Consider the following statements:

The disadvantages of employing steel pipes in conveyance and distribution of water are, they

1. cannot withstand high negative pressures or vacuums that may be created in them, especially the combined effects of vacuum and external loads of backfill and traffic.
2. are easily affected by acidic or alkaline waters and even atmospheric agencies may produce adverse effects on them.
3. cannot be used for high pressures. (Generally not used for pressures above 7 kg/cm^2)

Which of the above statements is/are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 only

73.   Consider the following statements:

The moment of momentum equation in fluid dynamics can be used

1. To find the torque exerted on sprinklers by water.
2. To determine the force in the flow passage, when stream changes direction / magnitude.

Which of the above statements is/are correct?

(A) 1 only   (B) 2 only
(C) both 1 and 2   (D) neither 1 nor 2

74.   Garret's diagrams are used to

(A) separate base flow from total runoff   (B) correct inconsistency in rainfall data
(C) determine reservoir capacity   (D) design channels

75.   Consider the following statements:

The critical value of Reynolds number at which the boundary layer changes from laminar to turbulent depends upon

1. Turbulence in ambient flow
2. Surface roughness

Which of the above statements is / are correct?

(A) Neither 1 nor 2   (B) 1 only   (C) 2 only   (D) Both 1 and 2

76.   In a transit theodolite, error due to eccentricity of verniers is eliminated by reading

(A) both verniers   (B) both right swing and left swing
(C) right and left faces   (D) different parts of main scale

77.   An airplane is cruising at a speed of 800 km/h at an altitude where the air temperature is 0ºC. The flight Mach number at this speed is nearly

(A) 1.3   (B) 0.67   (C) 0.25   (D) 2.4

78.   Light reflecting devices used to guide the driver along the proper alignment are called

(A) Rumble strips   (B) Delineators   (C) Attenuators   (D) Litter bin

79.   Consider the following statements:

In reciprocating pumps, the air vessels are used

    1.   To get continuous supply of liquid at a uniform rate

    2.   To save the power required to drive the pump

    3.   To run at much higher speed without any danger of separation

Which of the above statements are correct?

(A) 1 and 2 only   (B) 1 and 3 only   (C) 1, 2 and 3   (D) 2 and 3 only

80.   Consider the following statements:

    1.   For a well graded sand, the coefficient of curvature should lie between 1 and 3.

    2.   A soil having uniformity coefficient smaller than about 2.0 is considered uniform.

Which of the above statements is/are correct?

(A) Both 1 and 2   (B) Neither 1 nor 2   (C) 1 only   (D) 2 only

81.   The correct sequence of treatment of typical turbid surface water is

(A) Flocculation, Coagulation, Sedimentation, Filtration

(B) Flocculation, Coagulation, Filtration, Sedimentation

(C) Coagulation, Flocculation, Filtration, Sedimentation

(D) Coagulation, Flocculation, Sedimentation, Filtration

82.   Consider the following statements:

    1.   Mica is a clay mineral.

    2.   The shape of clay particle is usually flaky.

    3.   A particle of kaolinite is electrically charged.

Which of the above statements is/are correct?

(A) 1, 2 and 3   (B) 1 and 3 only   (C) 2 and 3 only   (D) 2 only

83.   If super-elevation is not provided on a horizontal curve of a highway, then on which portion of the road, are pot holes likely to develop?

(A) Outer edge of road   (B) Inner edge of road

(C) Centre of road   (D) Shoulder of road

84.   Consider the following statements:

The appropriate method(s) for removal of fluorides from water comprise

    1.   Addition of alum and lime followed by clarification

    2.   Passing through beds of activated alumina

Which of the above statements is/are correct?

(A) Neither 1 nor 2   (B) Both 1 and 2   (C) 1 only   (D) 2 only

85.   Consider the following statements:

      1.   Pumps in series operation can be the head to increase.

      2.   Pumps in series operation increase the flow rate

      3.   Pumps in parallel operation increase the flow rate

      4.   Pumps in parallel operation can be the head to increase.

    Which of the above statements are correct?

    (A) 1 and 3   (B) 1 and 2   (C) 2 and 3   (D) 3 and 4

86.   Consider the following pairs in the context of a theodolite:

1.	Plunging:	The process of turning the telescope over its supporting axis through 180º in a vertical plane
2.	Face left:	When the vertical circle of the theodolite is on the left of the observer while taking the reading
3.	Telescope normal:	It implies 'bubble up' and face of the vertical circle left.
4.	Swinging the telescope:	It implies turning the telescope in a vertical plane

    Which of these pairs are correctly matched in case of theodolite?

   (A) 1, 2 and 4   (B) 1, 3 and 4   (C) 2, 3 and 4   (D) 1, 2 and 3

87.   In an open cylindrical tank filled with water, a hole is made at the mid-point at the bottom. The spiral motion of the outgoing water is

    (A) Rotational   (B) Irrotational   (C) Forced vortex   (D) Turbulent

88.   For setting out right angles, the instrument used is

    (A) Optical square   (B) Abney level

    (C) Alidade   (D) Ceylon ghat tracer

89.   Match List I with List I and select the correct answer using the code given below the lists:
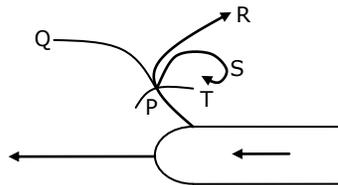
	List I (Name of curve)		List II (Curve in figure)
P	Equipotential line	1	PQ
Q	Pathline	2	PR
R	Streakline	3	PS
S	Streamline	4	PS

    (A) P-2, Q-3, R-1, S-4   (B) P-4, Q-1, R-3, S-2

    (C) P-2, Q-1, R-3, S-4   (D) P-4, Q-3, R-1, S-2

90.   Consider the following in the context of variations in magnetic declination:

1. Secular

2. Dirunal

3. Annular

4. Regular

Which of these are relevant?

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

91.   Full amount of super-elevation on a horizontal curve is provided at the

(A) beginning of the transition curve   (B) centre of the circular curve

(C) end of the transition curve   (D) centre of the transition curve

92.   For a homologous model of a pump built to a scale ratio of 1:2, fluid and speed being the same in model and prototype, the ratio of model power to prototype power is

(A) 1/2.82   (B) 1/4   (C) 1/8   (D) 1/32

93.   Consider the following statements:

In water treatment, the addition of chlorine inactivates the cells of pathogenic bacteria through

1. Penetration of the chlorine species through the cell walls

2. Suffocation of the cells

3. Reaction of the chlorine species with the enzyme system of the cells

Which of the above statements are correct?

(A) 1, 2 and 3   (B) 1 and 2 only   (C) 2 and 3 only   (D) 1 and 3 only

94.   Match List I with List I and select the correct answer using the code given below the lists:

List I (Measuring Device)		List II (Soil Parameter)	
P	Pycometer	1	Compressibility
Q	Hydrometer	2	Permeability
R	Oedometer	3	Specific gravity
S	Permeameter	4	Particle size analysis

(A) P-2, Q-4, R-1, S-3   (B) P-3, Q-1, R-4, S-2

(C) P-2, Q-1, R-4, S-3   (D) P-3, Q-4, R-1, S-2

95.   Error due to inclination of line of collimation in levelling across a river can be eliminated by

(A) Reversion   (B) Reciprocal ranging

(C) Reciprocal levelling   (D) Keeping level in middle

96. Consider the following statements:

    A streamline is an imaginary line within the flow for which the normal at any point relates to the acceleration at that point.

    Convective acceleration is the change in velocity with respect to distance only.

    Temporal acceleration expresses variation of velocity with respect to time only.

    Both convective acceleration and temporal acceleration can coexist.

    Which of these statements are correct related to fluid kinematics?

    (A) 1, 2, 3 and 4   (B) 1, 2 and 3 only

    (C) 2 and 3 only   (D) 2, 3 and 4 only

97. A centrifugal pump will start delivering the liquid only when
    (A) Manometer head is greater than total head
    (B) Head developed tends to exceed the manometric head
    (C) Head developed in a centrifugal pump is due to pressure head only
    (D) Head developed is negligible

98. Consider the following:
    1. Line ranger
    2. Reciprocal ranging
    3. Random line method
    4. Optical square

    Which of these are the correct methods of ranging employed to solve the problem of vision obstructed but with chaining free?

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

99. In a water treatment, the optimum time of flocculation is usually given as 30minutes. In case the time of flocculation is increased beyond this value, then the flocs will
    (A) become heavy and settle down in flocculation itself
    (B) entrap air and will float in the sedimentation tank
    (C) break up and defeat the purpose of flocculation
    (D) stick to the paddles

100. Match List I with List I and select the correct answer using the code given below the lists:

List I (Deposit)		List II (Soil structure)	
P	Coarse grained soil	1	Flocculated
Q	Silt deposit	2	Cohesive matrix
R	Clay deposit	3	Honeycomb
S	Composite soil	4	Single-grained

    (A) P-2, Q-3, R-1, S-4   (B) P-4, Q-3, R-1, S-2
    (C) P-2, Q-1, R-3, S-4   (D) P-4, Q-1, R-3, S-2

Directions: -

Each of the next Twenty (20) items consists of two statements, one labelled as the 'Assertion (A)' and the other as 'Reason (R)'. You are to examine these two statements carefully and select the answers to these items using the codes given below:

Codes:

(A) Both A and R are individually true and R is the correct explanation of A

(B) Both A and R are individually true but R is NOT the correct explanation of A

(C) A is true but R is false

(D) A is false but R is true

101.	**Assertion (A)**	:	Energy dissipation in a hydraulic jump is mainly caused by the large eddies in turbulence.
	Reason (R)	:	Large eddies transport the fluid over large distances, thus causing the mixing effect of turbulence.
102.	**Assertion (A)**	:	An economical channel section gives maximum discharge for a given cross-sectional area.
	Reason (R)	:	An economical channel section has smooth surface for reduced friction.
103.	**Assertion (A)**	:	The possibility of piping failure in earth dams is more if black cotton soil is the foundation material.
	Reason (R)	:	The highly expansive black cotton soils are the most common soils wherever Basalt rock is present.
104.	**Assertion (A)**	:	The movement of two blocks of wood welted with hot glue requires greater and greater effort as the glue is drying up.
	Reason (R)	:	Viscosity of liquids varies inversely with temperature.
105.	**Assertion (A)**	:	In the border strip method of irrigation, the size of the strip depends on the soil characteristics, slope of the land and discharge.
	Reason (R)	:	Border strip method is a controlled type of subsurface irrigation method.
106.	**Assertion (A)**	:	Reynolds number of a fluid flow is indicative of the relative dominance of the effects of momentum transfer between adjacent layers of the flow over the viscous stresses.
	Reason (R)	:	For flow at high Reynolds numbers, the velocity profile is logarithmic.
107.	**Assertion (A)**	:	A seepage passing through the body of an earth dam affects the weight of dam.
	Reason (R)	:	The specific weight of submerged soil is not dependent on the porosity of soil.

108. **Assertion (A)** : In a strainer type tube well, strainer pipes are surrounded by wire mesh.

 Reason (R) : This prevents the fine particles from entering the well pipe.

109. **Assertion (A)** : Break point chlorination ensures a residual of free available chlorine.

 Reason (R) : A super high chlorine dose inactivates the pathogens in a very short time.

110. **Assertion (A)** : Flow net is dependent on the permeability of soil through which flow is taking place.

 Reason (R) : The flow net is useful in finding the discharge

111. **Assertion (A)** : At the same voids ratio desiccated clay is stronger than saturated clay.

 Reason (R) : Desiccation impacts (induces) pre-compressive forces in the soil structure.

112. **Assertion (A)** : Lining a canal is always beneficial and economical

 Reason (R) : The seepage losses are greatly reduced and extra water is available for irrigation.

113. **Assertion (A)** : Worn out (smooth) tyres offer higher friction factors on dry pavements than new tyres with treads well intact.

 Reason (R) : Reduced pneumatic pressure is held in tubes which carry smooth tyres over them.

114. **Assertion (A)** : In a plane table photogrammetry, the areas to be mapped are taken from either end of a base line.

 Reason (R) : The position of the detail point with reference to the base line is obtained by intersection of rays drawn to it from each end of the base.

115. **Assertion (A)** : Tie bars are used in cement concrete slabs across the longitudinal joints.

 Reason (R) : Tie bars are designed to act as load transfer devices.

116. **Assertion (A)** : Traffic Smog is likely to occur in regions where vehicle mileage is considerable and there is a low incidence of sunlight.

 Reason (R) : Traffic Smog is caused by the reaction of oxides of nitrogen and some of the hydrocarbons in presence of bright sunlight.

117. **Assertion (A)** : In an intersection design, the relative speed is dependent on the absolute speed of intersecting vehicles and angles between them.

 Reason (R) : When the angle of merging is small, the relative speed will be high.

118.   **Assertion (A)**   :   The pandrol clip is a fit and forget type of fastening and is made from silicone manganese spring steel bar and heat treated.

    Reason (R)   :   The pandrol clip has a point contact and causes indentation on the rail due to heavy toe load and small contact area.

119.   **Assertion (A)**   :   In the overall design and layout of a harbour (or port), differentiation is made between entrance and channel depths.

    Reason (R)   :   The second (or pitching) of a vessel may be larger at the entrance to the channel than within the channel.

120.   **Assertion (A)**   :   The paved area adjacent to the terminal building and hangers used for loading and unloading, servicing and parking of aircraft is called as apron.

    Reason (R)   :   The size of the apron depends on the size and number of gate positions and the way the gate positions are arranged.