CIVIL ENGINEERING

(PAPER–II)

1. Acidic soils are reclaimed by
   a. leaching of the solid
   b. using limestone as a soil amendment
   c. using gypsum as a soil amendment
   d. provision of drainage

2. The correct statement of comparison of ultimate BOD, COD. Theoretical oxygen demand (ThOD) and 5-day BOD (BOD_5) is
   a. $BOD_u > COD > ThOD > BOD_5$
   b. $COD > ThOD > BOD_u > BOD_5$
   c. $ThOD > COD > BOD_u > BOD_5$
   d. $COD > BOD_u > BOD_5 > ThOD$

3. At a sewage treatment plant for a flow of 3 m^2/s, the cross-sectional area of grit chamber will be about
   a. 3 m^2
   b. 10 m^2
   c. 25 m^2
   d. 30 m^2

4. Match list I (Different forms of nitrogen in water) with List II (Inferences) and select the correct answer :
   List I
   A. Nitrate nitrogen
   B. Total nitrogen
   C. Nitrite nitrogen
   D. Ammonia nitrogen
   List II
   1. Unsatisfactory microbial activity
   2. satisfactory microbial activity
   3. Europhication may result
   4. Recent organic pollution

	A	B	C	D
a.	3	2	1	4
b.	1	4	3	2
c.	3	4	1	2
d.	1	2	3	4

5. Match List I(Standards of sewage effluents for the discharge in surface) with list II (Tolerance limits) and select the correct answer :

   List I
   A. BOD_5, (mg/l)
   B. COD, (mg/l)
   C. Oil and grease
   D. Total suspended solids, (mg/l)
   List II
   1. 250
   2. 30
   3. 20
   4. 10

	A	B	C	D
a.	3	4	1	2
b.	2	4	1	3
c.	3	1	4	2
d.	2	1	4	3

6. In the preliminary treatment of wastewater, skimming tanks are often included in the treatment scheme. Various features of skimming tanks are that these :
   1. can remove general floating matter
   2. can remove oily and greasy matter
   3. have detention time of 30 min.
   4. employ compressed air blown through diffusers

   Which of these statemtns are correct ?
   a. 1 and 3
   b. 2 and 4
   c. 2 and 3
   d. 1 and 2

7. The following is a well known formula for estimating the plume rise :

$$\Delta h = \frac{V_s d}{u}\left(1.5 + 0.0096\ \frac{Q_h}{V_s d}\right)$$

   where the letters have their usual meaning

   The estimates plume rise (by the above formula) with a stack gas having heat emission rate 2000 kJ/s, the wind speed 4 m/s, stack gas speed 8 m/s inside a stack diameter of 1 m at the top is
   a. 7.8 m
   b. 8.7 m

c. 3.15 m

d. $8000/\pi (1.5 + 0.0024\pi)$

8. In sampling of stack gases for measurement of concentration of Suspended particular matter(SPM), the flue gases are sucked in the instrument at
   a. any rate of flow from mid diameter of chimney
   b. any point of chimney cross-section and at any rate of flow
   c. a constant rate of flow but at four equidistant point along the diameter
   d. controlled position and controlled velocities along the chimney diameter to get isokinetic conditions

9. Match List I with List II and select the correct answer :
   List I (Air pollutants)
   A. SPM
   B. NO
   C. CO
   D. SO_2
   List II (Harmful effects)
   1. Blood haemoglobin
   2. Vegetation
   3. Respiratory system
   4. Building materials

	A	B	C	D
a.	3	4	1	2
b.	1	2	3	4
c.	3	2	1	4
d.	1	4	3	2

10. Match List I with List II and select the correct answer :
    List I (Air pollutants)
    A. Hydrocarbons
    B. Particulates and gases
    C. Sulphur dioxide
    D. Carbon monoxide
    List II(Emitted mainly by)
    1. Coal burning
    2. Gasoline fuel
    3. Tyres
    4. Carburettor

	A	B	C	D
a.	3	4	2	1
b.	4	3	2	1
c.	3	4	1	2

    | d. | 4 | 3 | 1 | 2 |

11. 'Air binding' may occur in
    a. Sewers
    b. Artesian well
    c. Aerator
    d. Filter

12. Match List I with list II and select the correct answer :
    List I(Valves)
    A. Sluice value
    B. Check value
    C. Air inlet value
    D. Ball valve
    List II(Uses)
    1. Used where gravity flow is required through pipe line
    2. Used to maintain constant level of water
    3. Used for reversal of flow
    4. Used for isolating

	A	B	C	D
a.	1	3	4	2
b.	4	2	1	3
c.	1	2	4	3
d.	4	3	1	2

13. Consider the following statements :
    While deciding to locate an intake structure for a city situated on a river bank, intake for water supply should be locate
    1. in deep waters
    2. sufficiently away from shore lines
    3. upstream of the populated city
    4. near navigational channel
    Which of these are correct ?
    a. 1, 2 and 4
    b. 1, 2 and 3
    c. 2, 3 and 4
    d. 1, 3 and 4

14. The population figures in a growing town are as follows :

Year	Population
1970	40,000
1980	46,000
1990	53,000
2000	58,000

    The predicted population in 2010 by Arithmetic Regression method is
    a. 62,000

b. 63,000

c. 64,000

d. 65,000

15. The description of solid waste collected is as follows :

Night soil   –   35 t

Rubbish   –   40 t

Debris   –   25 t

Garbage   –   40 t

The organic solids in the above composition is

a. 35 t

b. 60 t

c. 100 t

d. 75 t

16. In a sanitary landfill, decomposition and chemical changes within organic content of the solid wastes goes on. Consequential changes within landfill can be :

1. Temperature changes within landfill

2. Production of gases like H_2S, CO, CO_2, and CH_4

3. Destruction of pathogens

4. Production of other gases like SO_2 and NO_2

Which of these statements are correct ?

a. 1, 2, 3 and 4

b. 1, 2 and 3

c. 1 and 3

d. 2 and 3

17. In a soil specimen, 70% of particles are passing through 3.75 mm I.S. sieve and 40% of particle are passing through 75 μ I.S. sieve. Its uniformity coefficient is 8 and coefficient of curvature is 2. As per I.S. classification, this soil is classified as

a. SP

b. GP

c. SW

d. GW

18. Match List I with List II and select the correct answer :

List I(Roller type)

A. Pneumatic roller

B. Smooth wheeled roller

C. Sheep foot roller

D. Vibratory roller

List II (Soil type)

1. Cohesive and granular soils

2. Plastic soils of moderate cohesion

3. Cohesionless soils

4. Silty soils of low plasticity

	A	B	C	D
a.	4	2	1	3
b.	3	1	2	4
c.	4	1	2	3
d.	3	2	1	4

19. The correct sequence of plasticity of mineral in soil in an increasing order is

a. Silica, Kaolinite, Illite, Montmorillonite

b. Kaolinite, Silica, Illite, Montmorillonite

c. Silica, Kaolinite, Montmorillonite Illite,

d. Kaolinite, Silica, Montmorillonite Illite,

20. In a triaxial test at failure, major principal stress was 180 kPa, minor principal stress was 100 kPa, and pore pressure was 20 kPa. The tangent of the angle of shearing resistance of the sandy soil tested is

a. 1/3

b. 2/7

c. 1/2

d. 1/6

21. Laboratory vane shear test can also be used to determine

a. Shear parameters of silty sand

b. Shear parameters of sandy clay

c. Liquid limit of silty clay

d. Plastic limit of clayey silt

22. When movement of a wall under the earth pressures from the backfill was prevented the coefficient of earth pressure was recorded as 0.5. The ratio of the coefficients of passive and active earth pressure s of the backfill is

a. 1/3

b. 3

c. 1/9

d. 9

23. Taylor's stability number S_n is given by which one of the following expressions ? (C is cohesion, F_c is factor of safely, γ is density of soil and H, the height of the slope)

a. $\dfrac{C}{F_c \cdot \gamma}$

b. $\dfrac{C}{\gamma \cdot H}$

c. $\dfrac{C}{F_c \cdot \gamma \cdot H}$

d. $\dfrac{C}{F_c\,(\gamma + H)}$

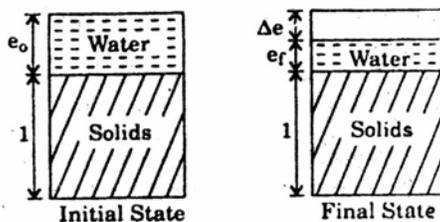24. Consider the following statements :

Theory of consolidation predicts settlement due to primary consolidation; it cannot include settlement due to initial compression nor due to secondary consolidation. This happens because of the following assumptions made by the theory:

1. Soil grains and water are incompressible
2. Soil is fully saturated
3. compression takes place in vertical direction only
4. Time lag in consolidation is entirely due to low permeability of soil

Which of these statemtns are correct ?

a. 1, 2 and 3
b. 2, and 3
c. 3 and 4
d. 1, 2 and 4

25. In the phase diagrams given, the change due to initial state changing into final state is shown due to consolidation. Depth of soil layer undergoing consolidation is H; e_0 is initial void ratio; Δe is final void ratio; is change in void ratio.

Indicate which of the following expression given settlement of the layer:

a. $H \cdot \log_{10}\left(\dfrac{\Delta e}{1+e_0}\right)$

b. $\log_{10}\left(H \cdot \dfrac{\Delta e}{1+e_0}\right)$

c. $\left(\dfrac{\Delta e}{1+e_0}\right)$

d. $H \cdot \left(\dfrac{\Delta e}{1+e_0}\right)$

26. Which one of the following statement s regarding coefficient of consolidation C_v is correct ?

a. $C_v \propto k$
b. $C_v \propto 1/k$
c. $C_v \propto m_v$
d. $C_v \propto a_v$

27. Consider the following factors :

1. Reaction time
2. Speed
3. Coefficient of longitudinal friction
4. Gradient

Which of these factors are taken into account for computing braking distance ?

a. 1 and 3
b. 1, 2 and 4
c. 2, 3 and 4
d. 2 and 3

28. Consider the following factors :

1. Period of construction, winter/summer
2. Degree of foundation roughness
3. slab thickness
4. Reinforced/unreinforced

Which of these factors are considered as per IRC for obtaining the maximum expansion joint spacing in rigid pavements?

a. 1, 2 and 3
b. 2, 3 and 4
c. 2 and 3
d. 1 and 4

29. Match list I(Type of construction) with List II (% Bitumen content) and select the correct answer :

List I

A. Bituminous macadam
B. Dense bituminous macadam
C. Bituminous concrete
D. Bituminous mastic

List II

1. 3 –3.5%
2. ∢4%
3. 14–17%

4. Min. 4.5%

	A	B	C	D
a.	4	2	1	3
b.	1	2	4	3
c.	4	3	1	2
d.	1	3	4	2

30. A journey from work to home made by walking to the bus, travelling by bus to the station and completing the journey by train is regarded as
  a. 4 trips
  b. 3 trips
  c. 2 trips
  d. 1 trip

31. With addition of lime in soil
  a. L.L. increases and P.L. decreases
  b. Plasticity index increase
  c. L.L. changes very slightly and P.L. increase
  d. L.L. and P.L. both decrease

32. On a National Highway pavement section mean value of Benkelman beam deflection was obtained 12 1.45 mm with standard deviation of 0.017 mm. pavement temperature measured was $37^\circ c$ and moisture correction was obtained as 1.6. What is the value of characteristic deflection considering the value of 2σ ?
  a. 2.72 mm
  b. 2.69 mm
  c. 2.63 mm
  d. 1.94 mm

33. If the curve lead of a broad gauge railway turnout is 16.76 meters, the angle of crossing of the turnout will be given by
  a. $\tan^{-1} 10$
  b. $\tan^{-1} 5$
  c. $\tan^{-1} 1/10$
  d. $\tan^{-1} 1/5$

34. Match List I with List II and select the correct answer :
  List I (Device)
  A. Pandrol clip
  B. Densometer
  C. Viseur's mire
  D. Cotters
  List II(used for)

1. Fixing the tie bars with the C.I. sleepers
2. Measurement of 'packing voids' under the sleeper ands
3. Measurement of unevenness of rail top and rectification f alignment
4. Elastic rail fastening

	A	B	C	D
a.	1	3	2	4
b.	4	2	1	3
c.	1	2	3	4
d.	4	3	2	1

35. Consider the following factors :
  1. Mass of ships to be berthed
  2. Overall transit time Speed of berthing
  3. environmental conditions of the port
  Which of these factors are taken into account while selecting the type of fender system ?
  a. 1, 2 and 3
  b. 2, 3 and 4
  c. 1, 3 and 4
  d. 1 and 4

36. Which one of these methods of Tunnel construction is not suitable in rocks ?
  a. Full face method
  b. Compressed air method
  c. Heading and benching method
  d. Drift method

37. Consider the following factors :
  1. Air traffic control measures
  2. aircraft traffic composition
  3. VFR/IFR operation
  4. Runway configuration
  Which of these factors affect the capacity of a runway?
  a. 1, 2 and 3
  b. 2 and 3
  c. 1 and 4
  d. 1, 2, 3 and 4

38. Match List I with List II and select the correct answer :
  List I (Imaginary surface)
  A. Conical
  B. Approach
  C. Primary
  D. Transitional
  List II(Characteristic)

1. Longitudinally centered on a runway
2. Longitudinally entered on the extended runway
3. Extending outward and upward from the periphery of the horizontal structure
4. Extending outward and upward at right angles to the runway centre line

	A	B	C	D
a.	3	1	2	4
b.	4	2	1	3
c.	3	2	1	4
d.	4	1	2	3

39. Assertion (A) : Abrupt rise in pressure in a pipe line results from sudden closure of a value.
    Reason (R) : Pressure wave propagates through elastic medium.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

40. Assertion (A) : Selection of turbine by specific speed criterion is more scientific.
    Reason (R) : Specific speed is independent of dimensions, size of both actual and specific turbine.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

41. Assertion (A) :Unit hydrograph theory is not applicable to catchment areas larger than
    Reason (R) : Rainfall is not uniformly distributed on large catchment areas.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

42. Assertion (A) :In routing a flood hydrograph through a reservoir, the peak of the outflow hydrograph will be smaller than the inflow hydrograph and it occurs after the peak of the inflow.
    Reason (R) : In linear reservoir routing, the storage is a fencing of both outflow and inflow discharges.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

43. Assertion (A) : cut-offs are provided on the down-stream base of hydraulic structures.
    Reason (R) : Hydraulic structures fail by overturning about the downstream based of excessive erasing oat the base caused by overflowing water.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

44. Assertion (A) : Sprinkler method of irrigation has a higher water applications use efficiency.
    Reason (R) : Sprinkler system causes less interference in cultivation and to the farming operations.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

45. Assertion (A) : U.K. Royal commission on Sewage Disposal of 1898-1915 classified British rivers on the basis 65° F, 5-day BOD.
    Reason (R) : British rivers do not have flow time to open sea more than 5 days.
    a. Both A and R are true and R is the correct explanation of A
    b. Both A and R are 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

46. Assertion (A) : Settled sewage is subjected to biological treatment .

Reason (R) : Any biological treatment is preceded by a settling tank.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

47. Assertion (A) : the surface of sea water is on the rise.

Reason (R) : A thick layer of gases enveloping the earth does not allow heat to pas into space from the earth at a rate which is as much as the rate at which the heat coming from space penetrates it towards the earth.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

48. Assertion (A) : Wet scrubber removes particulates from a gaseous stream.

Reason (R) : In the wet scrubber water droplets come into contact with the particulates.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

49. Assertion (A) : The shape of the impeller of rotodynamic pumps is such as to force the water in a radial / mixed / or axial flow patterns.

Reason (R) : A rotodynamic pump has a wheel or a rotating element which rotates the water in a casing and , thus imparts energy to he water.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

50. Assertion (A) : A soil is at its liquid limit if the consistency index of the soil is equal to zero.

Reason (R) : The consistency index of a soil is defined as ratio of (liquid limit minus the natural water content) to (natural water content minus plastic limit).

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

51. Assertion (A) : A clay layer of thickness, H, with single drainage suffers an ultimate settlement of S under increase in pressure of . When a thin sand layer is present at its mid depth, the layer, under otherwise identical conditions, will have no change in ultimate settlements.

Reason (R) : The path of travel of water for the clay layer is H under single drainage. When a thin sand layer is present at mid depth of clay layer, the path of travel in lower half of the layer gets reduce to H/2 and that in upper half of the layer gets reduced to H/4. This considerably reduced the time required to realize ultimate settlement.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

52. Assertion (A) : Terzaghi's bearing capacity theory over-estimates the bearing capacity of footings.

Reason (R) : Terzaghi's theory neglects the hearing resistance of rupture surface in the soil above the foundation level.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

53. Assertion (A) : A skilful highway designer 'builds in' speed control at critical locations on horizontal curves rather than increase than increase the superelevation.

Reason (R) : A driver slows down on horizontal curve due to feeling of

discomfort because of increase in side friction with reduced superelevation.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

54. Assertion (A) : At a given station, a celestial body can be fixed by its co-altitude and co-declination.

Reason (R) : In the astronomical triangle ZPS, ZP is constant for the given place and s is the intersection of the vertical circle and declination of circle.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

55. Assertion (A) : The Marshall test, being a confined compression test has correlation with deformation as it occurs on the road.

Reason (R) : In road, loaded area is confined by the tyre, the surrounding surfacing and the road base.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

56. Assertion (A) : The principal advantage of the solid fill type of wharf substructure is that its great mass provides adequate resistance to the impact of mooring ships.

Reason (R) : solid fill substructure are inexpensive (except in deep water) and require little maintenance.

a. Both A and R are true and R is the correct explanation of A
b. Both A and R are 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

57. σ_z is the vertical stress at a depth equal to Z in the soil mass due to a surface point load q. The vertical stress at depth equal to 2Z will be

a. $0.25\,\sigma_z$
b. $0.50\,\sigma_z$
c. $1.0\,\sigma_z$
d. $2.0\,\sigma_z$

58. Which one of the following represents relative density of saturated sand deposit having moisture content of 25%, if maximum and minimum void ratio of sand are 0.95 and 0.45 respectively and specific gravity of sand particles is 2.6 ?

a. 40%
b. 50%
c. 60%
d. 70%

59. The correct sequence of the increasing order of the disturbance to soil samples obtained from chunk, piston, split spoon and remolded sampler is

a. Piston sampler, chunk sampler, split spoon sampler, remolded sampler
b. Chunk sampler, piston sampler, split spoon sampler , remolded sampler
c. Piston sampler, chunk sampler, remolded sampler, split spoon sampler
d. Chunk sampler, piston sampler, remolded sampler, split spoon sampler

60. A rigid strip footing subjected to vertical central load fails under general shear failure. The rupture surface developed is

a. Circular one sided rotational failure
b. Plane surface of failure originating at the edge of footing and extending downwards with orientation of Rankine passive state equilibrium
c. Symmetrical failure surface consisting of segment of log spiral and Rankine's passive state failure surface
d. Symmetrical failure surface consisting of segments of log spiral and plane failure surface as per Rankine active state of equilibrium

61. The change in the vertical stress in the soil mass estimated by Boussinesq's equation when Poisson's ratio of soil changes from 0.3 to 0.5 will be

a. reduction by 30%
b. increase by 50%
c. reduction by 20%
d. no change

62. A single pile, 50 cm in diameter and 15 m long is driven in clay having an average unconfined compressive strength of 100 kN/m^2. The ultimate bearing capacity of the pile, neglecting end bearing, if any, and assuming shear mobilization factor of 0.8 around the pile is
   a. 942 kN
   b. 1884 kN
   c. 1177.5 kN
   d. 1334.5 kN

63. In a plate load test on sandy soil, the test plate of 60 cm × 60 cm undergoes a settlement of 5 mm at a pressure of 12 × 10^4 N/m^2. What will be the expected settlement of 3 m 3 m footing under same pressure ?
   a. 25 mm
   b. 20 mm
   c. 15 mm
   d. 9 mm

64. Match List I (Method of estimating pile capacity) with List II (Parameter to be estimated) and select the correct answer :

   List I
   A. Dynamic formulae
   B. Static formulae
   C. Pile load test
   D. Cyclic pile load test

   List II
   1. Bearing capacity of cast-in–situ concrete pile
   2. Separating end-bearing and friction-bearing powers of a pile
   3. Bearing capacity of a timber pile
   4. Settlement of a friction–bearing pile

	A	B	C	D
a.	3	1	4	2
b.	4	2	3	1
c.	3	2	4	1
d.	4	1	3	2

65. For designing and bearing piles of square cross-section in clays having average unconfined compressive strength of 6 t/m^2, the net ultimate bearing capacity may be taken as
   a. 15 t/m^2
   b. 18 t/m^2
   c. 20 t/m^2
   d. 27 t/m^2

66. Which one of the expressions given below correctly relates natural frequency f_n, spring stiffness k, mass m of the machine foundation vibrating system with C_u, the coefficient elastic uniform compression of the foundation soil ?
   a. $f_n = 1/2\pi \sqrt{k/m} = \sqrt{CuA/M}$
   b. $f_n = \sqrt{k/m} = 2\pi\sqrt{CuA/M}$
   c. $f_n = \sqrt{k/m} = 1/2\pi\sqrt{CuA/M}$
   d. $f_n = 1/2\pi\sqrt{k/m} = 1/2\pi\sqrt{CuA/M}$

67. Consider the following statements :
   1. Quick condition and liquefaction of saturated sands are based on similar phenomenon.
   2. Quick condition is associated with only earth dams.
   3. Liquefaction is possible in dry sand also
   4. Liquefaction is associated with increase in pore water pressure due to vibrations.

   Which of these statemtns are corrects ?
   a. 2 and 4
   b. 1 and 4
   c. 1 and 2
   d. 1, 3 and 4

68. A wooden bridge in Assam failed and was observed to have arched up in the middle after the earthquake. The right abutment settled 40 cm and left abutment 30 cm. The bridge was supported on wooden piles, which floated up during the earthquake. The most probable cause of failure is
   a. Shear failure of soil below abutments
   b. Excessive settlement below abutments due to increased forces
   c. Liquefaction of foundation soil below abutments and piles
   d. Failure of abutments due to dynamic earth pressure behind abutments

69. Which one of the following surveys is employed for collecting sufficient data in connection with sewage disposal and water supply works ?
   a. Topographic survey
   b. Cadastral survey
   c. Geodetic survey
   d. Cross-sectioning & profile levelling

70. Match List I with List II ands select te correct answer :

List I(corrections)

A. $\pm L\left(1 - \dfrac{h}{R}\right)$

B. $-\dfrac{1}{24}\left(\dfrac{W}{P}\right)^2$

C. $\pm\alpha\left(T_f - T_s\right)L$

D. $\pm\dfrac{\left(P_f - P_s\right)L}{AE}$

List II (Name)

1. Sag correction
2. Pull correction
3. Temperature correction
4. Mean sea level correction

(where the letters have their usual meaning)

	A	B	C	D
a.	4	1	3	2
b.	1	4	3	2
c.	4	1	2	3
d.		4	2	3

71. The following readings were taken with a Dumpy level and a 4 m levelling staff on a continuously sloping ground at 30 m intervals: 0.680 m, 1.455 m, 2.330 m, 2.885 m, 3.380 m, 1.055 m. The R.L. of the fourth point was calculated to be 79.100 m. The R.L. of the point that was read 0.680 m is

a. 80.750 m
b. 79.780 m
c. 78.420 m
d. 77.740 m

72. The object of chain and cross-staff survey is to

1. locate the boundaries of an area
2. plot the figure to a scale
3. find the area of the plot
4. find the reduced levels of the plot

Which of the above statements is/are correct ?

a. 1, 2, 3 and 4
b. 1, 2 and 3
c. 1 and 2
d. 4 alone

73. Match List I with List II and select the correct answer :

List I(Methods)

A. Traversing
B. Resection
C. Intersection
D. Radiation

List II (Procedures)

1. Rays are drawn to locate the station on which the table is set up
2. At least two rays are drawn from two different stations to the details to be located
3. Rays are drawn in the direction of details through the station point on which the table is set up
4. Rays are drawn on the map by setting up the table over each of the stations towards the subsequent station

	A	B	C	D
a.	4	3	2	1
b.	2	1	4	3
c.	4	1	2	3
d.	2	3	4	1

74. The process of determining the location of the station (on the map) occupied by the plane is called as

a. Intersection
b. Three-point problem
c. Traversing
d. Resection

75. Which one of the following is the angular distance between the observer's meridian and the vertical circle passing through a star measured along the celestial horizon ?

a. Right ascension
b. Azimuth
c. Declination
d. Hour angle

76. A vertical photograph of a chimney was taken from and elevation of 500 m above M.S.L. the elevation of the base of the chimney was 250 m. If the relief displacement of the chimney was 51.4 mm and the radial distance of the image of the top of the chimney was 110 mm, the height of the chimney is

a. 233.64 m
b. 133.2 m
c. 116.82 m

d. 58.41 m

77. Based on '30th hour volume', for how much percent time during the year can the designer willingly tolerate the unfavorable operating conditions ?
a. 30
b. 29
c. 2.5
d. 0.33

78. Match List I with List II and select the correct answer :

List I (Definitions)
A. Newtonian fluid
B. Ideal fluid
C. Thixotropic fluid
D. Rheological fluid

List II (Properties)
1. Frictionless and incompressible
2. Viscosity is invariant with shear stress
3. Viscosity decreases at higher shear stress
4. Viscosity increase at higher shear stress

	A	B	C	D
a.	2	4	1	3
b.	3	1	4	2
c.	2	1	4	3
d.	3	4	1	2

79. An isosceles triangular plate of base 3 m and altitude 3 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate coincides with the free surface of oil. The centre of pressure will lie at a distance of (from free surface)
a. 2.5 m
b. 2 m
c. 1.5 m
d. 1 m

80. One orifice is located at a distance x from the free surface while another orifice is located at the same distance x from the bottom of the tank as shown in the figure.
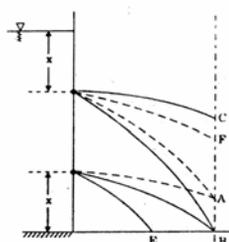

The water jets through the orifices
a. intersect at point A
b. intersect at point B
c. strike the plane at points C and B respectively
d. would be striking at E and F only

81. A spillway of an irrigation project is to be studied by means of a model constructed to a scale of 1 : 9. The prototype discharge is 1000 m^3/s. neglecting the viscous and surface tension effects, the required flow rate for the model is
a. 12.35 m^3 / s
b. 111.11 m^3 / s
c. 4.11 m^3 / s
d. 1.37 m^3 / s

82. An oil of viscosity 9 poise is flowing through a horizontal pipe of 60 mm diameter. If the flow is laminar, the pressure drop in 100 m length of the pipe is 1800 kN/m^2. The average velocity of flow of the oil is
a. 2.25 m/s
b. 0.55 m/s
c. 5.5 m/s
d. 22.5 m/s

83. Match List I (Flow pattern past a cylinder)with List II (Pressure distribution) and select the correct answer :
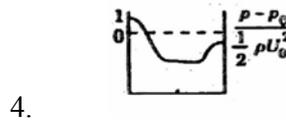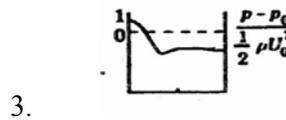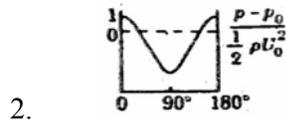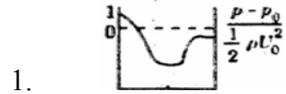
List I

A.

Re < 0·5

B.

2 < Re < 30

$10^3 \leq Re \leq 2 \times 10^5$

C.

D.

List II

1.

2.

3.

4.
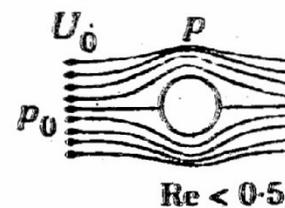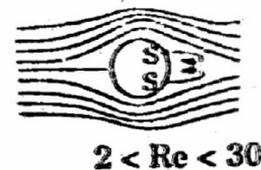
	A	B	C	D
a.	2	5	1	3
b.	4	3	5	2
c.	2	1	5	4
d.	4	3	1	2

84. Match List I with List II and select the correct answer :

List I

A. $(\partial u/\partial y)_{y=0}$ is zero
B. $(\partial u/\partial y)_{y=0}$ is +ve
C. Displacement thickness
D. Momentum thickness

List II

1. The flow is attached flow
2. The flow is on the verge of separation
3. $\int_0^\delta \dfrac{u}{U}\left(1-\dfrac{u}{U}\right)dy$
4. $\int_0^\delta \left(1-\dfrac{u}{U}\right)dy$

	A	B	C	D
a.	1	2	3	4
b.	2	1	3	4
c.	1	2	4	3
d.	2	1	4	3

85. The procedure to be followed in solving for discharge in a simple pipe problem, when h_f, l, D, v and ε are given is to

[Note : Re is Reynolds number,
f = friction coefficient,
ε/D = relative roughness,
V = velocity]

a. assume f, compute : v, R, ε/D and calculate f; and repeat is necessary
b. assume Re, compute f, check ε/D
c. assume v, compute Re and calculate f, V again
d. assume Q, compute V, Re and calculate

86. The Chezy's coefficient C is related to Darcy-Weisbach friction factor f as

a. $C = \sqrt{(g/8f)}$

b. $C = \sqrt{(8g/f^{1/4})}$

c. $C = \sqrt{(8g/f)}$

d. $C = \sqrt{(f/8g)}$

87. For a hydraulically efficient rectangular section, the ratio of width to normal depth is

a. 0.5
b. 1.0
c. 2.0
d. $2\sqrt{3}$

88. A rigid boundary rectangular channel having a bed slope of 1/800 has its width and depth of flow equal to 2 m and 1 m respectively. If the flow is uniform and the value of Chezy's constant is 60, the discharge through the channel is

a. 1.0 m³/s
b. 1.5 m³/s
c. 2.0 m³s
d. 3.0 m³/s

89. Consider the following statements in regard to the critical flow :

1. specific energy is maximum for a given discharge
2. Specific force is maximum for a given discharge
3. Discharge is maximum for a given specific force
4. Discharge is maximum for a given specific energy

Which of these statements are correct ?

a. 1, 2, 3 and 4
b. 1 and 4

c. 2 and 3

d. 3 and 4

90. Match List I with List II and select the correct answer

List I(Slope)

A. Mild

B. Adverse

C. Limit

D. Critical

List II (Description)

1. is when the flow is at Froude number one along the channel

2. is n example of non-sustaining slop

3. always sustains uniform subcritical flow

4. is one which has smallest critical slope for a given channel shape and roughness

	A	B	C	D
a.	3	2	4	1
b.	1	4	2	3
c.	3	4	2	1
d.	1	2	4	3

91. If F_1 and F_2 are the Froude numbers of flow before and after the hydraulic jump occurring in a rectangular channel, then

a. $F_2^2 = \dfrac{F_1^2}{\left(-1+\sqrt{1+8F_1^2}\right)^2}$

b. $F_2^2 = \dfrac{8F_1^2}{\left(-1+\sqrt{1+8F_1^2}\right)^2}$

c. $F_2^2 = \dfrac{F_1^2}{\left(-1/2+\sqrt{1+8F_1^2}\right)^2}$

d. $F_2^2 = \dfrac{8F_1^2}{\left(-1/2+\sqrt{1+8F_1^2}\right)^2}$

92. Consider the following statemtns about a hydraulic ram:

1. Hydraulic ram does not need external power

2. It works on the fundamental principle of water hammer

3. The efficiency of a hydraulic ram is only of the order of 8 to 10%

4. It can be termed as a low, intermittent discharge lowhead pumping installation

Which of these statements are correct ?

a. 2 and 3

b. 1, 2, 3 and 4

c. 1 and 2

d. 1 and 3

93. Consider the following statemtns related to centrifugal pumps :

1. Centrifugal pumps with blades facing backward have fast runners

2. Multistage pumps have two or more impellers installed in series so that the discharge is increase

3. Diffusion type centrifugal pumps are called turbine pumps

4. A centrifugal pump with rising characteristic is used when actual lift is small and the amount of flow is constant

Which of these statemtns are correct ?

a. 1, 2 and 3

b. 1, 2 and 4

c. 1, 3 and 4

d. 2, 3 and 4

94. The following items related to hydrologic requirements in a hydropower system. Match List I with List II and select the correct answer :

List I

A. Stream flow in order of magnitude is plotted as ordinate and percent of time as abscissa.

B. Cumulative value of stream flow is plotted against time for whose period of record

C. Plot of available power against percent of time

D. Plot of flow in a stream against time at specific interval

List II

1. Mass curve

2. Flow duration curve

3. Hydrogaraph

4. Power duration curve

	A	B	C	D
a.	2	3	4	1
b.	4	1	2	3
c.	2	1	4	3
d.	4	3	2	1

95. For a hydro-electric project with reaction turbine, the draft tube at the exist from the turbine is
    a. always immersed in water
    b. always above the water
    c. may either be above or below the water
    d. above or below the water depending on the unit speed to the turbine

96. Consider the following statemtns in case of impulse turbine:
    1. The pressure and velocity both change as the water flows through the turbine
    2. pressure throughout remains atmospheric and the velocity alone changes
    3. All the available energy is converted into kinetic energy
    4. Water is admitted over the entire circumference of the runner
    5. Water is admitted only through the nozzle
    Which of these statemtns are correct ?
    a. 2, 3 and 5
    b. 2 and 3
    c. 1, 4 and 5
    d. 1 and 4

97. In case of semi-circular vanes, the theoretical maximum efficiency of the wheel can be
    a. 50%
    b. 67%
    c. 75%
    d. 100%

98. Without residual whirl in the flow at the entrance to a draft tube, the best cone angle is
    a. $< 6^o$
    b. 9° to 11°
    c. 18°
    d. 24°

99. Two geometrically similar pumps are running at the same speed of 1000 r.p.m. and lifting water against he heads of 25 m and 16 m respectively. First pump is having an impeller diameter of 300 mm. The impeller diameter of second pump shall be
    a. 192 mm
    b. 240 mm
    c. 300 mm
    d. 469 mm

100. Which one of the following statements is correct ?
    a. Reciprocating pumps are less efficient than centrifugal pumps
    b. Delivery from a reciprocating pump is pulsating
    c. Reciprocating pumps are suitable for large discharges and smaller heads
    d. For a negative slip to occur, a reciprocating pump must have a coefficient of discharge less than unity

101. Consider the following statements:
    1. An ephemeral steam is on which has a base-flow contribution
    2. Flow characteristics of a stream depend upon rainfall and catchmetn characteristic sna dalso the climatic factor which influence evapo-transpiration
    3. sequent Peak Algorithm is used for estimating run off from rainfall
    Which of these statements is /are correct ?
    a. 1, 2 and 3
    b. 1 and 3
    c. 2 and 3
    d. 2 alone

102. Match List I with List II and select the correct answer :
    List I
    A. ϕ–index
    B. Lysimeter
    C. Dilution technique
    D. Syndel's equation
    List II
    1. Used for measurement of evapo-transpiration for given vegetation
    2. Used for flow measurement
    3. Average rainfall above which the rainfall volume is equal to the runoff volume
    4. Relates the basin lag to the basin characteristics

	A	B	C	D
a.	3	1	2	4
b.	4	2	1	3
c.	3	2	1	4
d.	4	1	2	3

103. A 6-hour rainstorm with hourly intensities of 7, 18, 25, 17, 11 and 3 mm/hour produced a runoff of 39 mm. Then, the ϕ–index is
    a. 3 mm/hour
    b. 7 mm/hour
    c. 8 mm/hour
    d. 10 mm/hour

104. In a water-shed, four rain gauges I, II, III and IV are installed. The depths of normal annual rainfall at these stations are 60, 75, 80 and 100 cm respectively. The rain gauge at station III went out of order during a particular year. The annual rainfall for that year, recorded at the remaining three stations was 90, 60 and 70 cm. The rainfall at station III can be considered as
    a. 60 cm
    b. 70 cm
    c. 80 cm
    d. 120 cm

105. The unit-hydrograph theory is based on the assumption of
    a. Nonlinear response and time invariance
    b. Linear response and nonlinear time variance
    c. Time invariance and linear response
    d. Nonlinear response and nonlinear time variance

106. An effective storage of a flood control reservoir is
    a. The amount of water which can be supplied from it in a particular interval of time
    b. The storage between the minimum and maximum reservoir levels under ordinary operating conditions
    c. The useful storage plus the surcharge storage less the valley storage
    d. The storage volume of flood water above maximum reservoir level

107. The Penman's evapo-transpiration equation is based on
    a. Water budget method
    b. Energy balance method
    c. Mass transfer method
    d. Energy balance and mass transfer approach

108. The performance of a well is measured by its
    a. Specific capacity
    b. Specific yield
    c. Storage coefficient
    d. Permeability coefficient

109. Regional hydrological cycle is shown in the figure
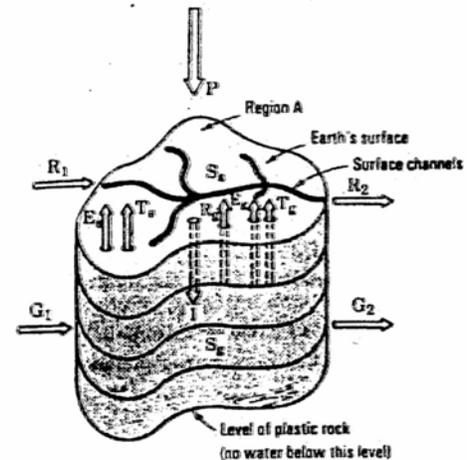
Identify the correct hydrologic budget equation :
    a. $P + R_1 - R_2 + R_2 - E_s - T_s - I = \Delta S_s$
    b. $1 + G_1 - G_2 - R_s - E_s - T_s = \Delta S_s$
    c. $P - (R_2 - R_1) - (E_s + E_S) - (T_s + T_S) - (G_2 - G_1) = \Delta(S_s - S_S)$
    d. $P - R - G - E - T = \Delta S_s$

110. A two hour storm hydrograph has 5 units of direct runoff. The two-hour units hydrograph for this storm can be obtained by dividing the ordinates of the storm hydrograph by
    a. 2
    b. 2/5
    c. 5
    d. 5/2

111. The slope area method is extensively used in
    a. development of rating curve
    b. estimation of flood discharge base on high-water marks
    c. cases where shifting control exists
    d. cases where back-water effects is present

112. Consider the following :
    Garret's diagram for the design of irrigation channel is based on
    1. Kennedy's theory

    2. Lacey's theory

    3. Kutter's formula

    4. Manning's formula

Which of these are correct?

a. 1 and 3

b. 1 and 4

c. 2 and 3

d. 2 and 4

113. The total number of independent equations that form the Lacey's regime theory is

a. 2

b. 3

c. 4

d. 6

114. Balanced depth of cutting of canal is

a. half the total depth of a canal

b. half of full supply depth

c. the maximum cut that an excavator can take

d. where volume of cutting is equal to volume of filling

115. At a certain point in the floor of weir, the uplift pressure head due to seepage is 4.5 m. If the relative density of concrete is 2.5, the minimum thickness of floor required at this point to counteract the uplift pressure is

a. 1 m

b. 2 m

c. 3 m

d. 4 m

116. A constant angle arch dam when compared to a constant radius arch dam utilizes concrete quantity of about

a. 33%

b. 43%

c. 73%

d. 143%

117. Modular limit of a canal outlet is the ratio of

a. rate of change of discharge of outlet to that of distributary

b. water depth above outlet crest to the full supply depth of the channel

c. water depth above the crest on downstream to that on upstream of outlet

d. rate of change of discharge of an outlet to the rate of change of water level of the channel

118. A canal was designed to supply the irrigation needs of 1000 ha of land growing rice of 140 days base period and having a delta of 130 cm. If the canal water is used to irrigate wheat of base period of 119 days and having delta of 50 cm, the area that can be irrigated is

a. 452 ha

b. 904 ha

c. 1105 ha

d. 2210 ha

119. A canal fall is a control structure

a. located at a place where the country slope is flatter than the canal bed slope

b. located most economically where the depth of cutting is less than the balancing depth

c. the location of which is independent of the command to be served

d. designed to secure raising of water surface on its upstream

120. Match List II(Equation) with List II(Applicability or principle of equation) and select the correct answer :

List II

A. Theim's equation

B. Dupit's assumption

C. Bernoulli's equation

D. Continuity equation

List II

1. is base on energy conservation principle

2. is based on mass conservation principle

3. is applicable to steady flow towards a well confined aquifer

4. is applicable to steady flow in an unconfined aquifer

	A	B	C	D
a.	4	3	2	1
b.	3	4	2	1
c.	4	3	1	2
d.	3	4	1	2