CIVIL ENGINEERING

(PAPER–II)

1. Match List I with List II and select the correct answer using the codes :

   List I
   A. Unit hydrograph
   B. Synthetic unit hydrograph
   C. Darcy's law
   D. Rational method

   List II
   1. Design flood
   2. Permeability
   3. Ungauged basin
   4. 1 cm runoff

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

2. Which one of the following statements is correct in respect of the two important aspects of flood forecast – (1) reliability of the forecast, and (2) the time available in between the forecast and the occurrence of flood?
   a. Meteorological forecast is least reliable and time available is also the least
   b. Hydrological forecast is most reliable but the time available is the least
   c. River forecast is least reliable and the time available is the maximum
   d. River forecast is most reliable but the time available is the least

3. The delta for a crop having base period 120 days is 70 cm. What is the duty ?
   a. 2480 hectare/cumec
   b. 1481 hectare/cumec
   c. 148 hectare/cumec
   d. 1.481 hectare/cumec

4. For a culturable command area of 1000 hectare with intensity of irrigation of 50%, the duty on field for a certain crop is 2000 hectare/cumec. What is the discharge required at head of water course with 25% losses of water ?
   a. 3/16 cumec
   b. 1/4 cumec
   c. 1/3 cumec
   d. 1/2 cumec

5. What is the moisture depth available for evapotranspiration in root zone of 1 m depth soil, if dry weight of soil is 1.5 gm/cc, field capacity is 30% and permanent wilting point is 10% ?
   a. 450 mm
   b. 300 mm
   c. 200 mm
   d. 150 mm

6. Which one of the following correctly defines aquiclude?
   a. A saturated formation of earth material which not only stores water but also yields it in sufficient quantity
   b. A formation through which only seepage is possible and thus the yield is insignificant compared to an aquifer
   c. A geological formation which is neither porous nor permeable
   d. A geological formation which is essentially impermeable to the flow of water

7. What is the regime scour depth for a channel in soil with silt factor of unity and carrying 8 m^2/s of discharge intensity in accordance with Lacey's regime theory ?
   a. 3.6 m
   b. 4 m
   c. 5.4 m
   d. 25.6 m

8. Which one of the following equations represents the downstream curve of the "Ogee' spillway (where x and y are the co-ordinates of the crest profile measured from the apex of the crest, and H is the design head) ?
   a. $x^{1.85} = 2\,H^{0.85}\,y$
   b. $x = 2\,H^{1.85}\,y^{0.85}$
   c. $x^{0.85} = 2\,H^{1.85}\,y$
   d. $x = 2\,H^{0.85}\,y^{1.85}$

9. Clark's method aims at which one of the following?

a. Developing an IUH due to an instantaneous rainfall excess over a catchment

b. Developing stage-discharge relationship

c. Measurement of infiltration

d. Flood routing through channels

10. For a saddle siphon, the maximum operative head is 6.25 m. The width and height of the throat of the siphon are 4 m and 2 m respectively. The coefficient of discharge is 0.90. How many units are required to pass a flood of 300 cumec?(Take g = 10 m/s^2)

a. One

b. Two

c. Three

d. Four

11. Consider the following statements regarding building manholes :

1. They must be provided at every change of alignment, gradient or diameter.

2. They must be provided at the head of all sewers.

3. They must be provided at every junction of two or more sewers

4. They must be provided at every 100 m along straight runs of sewers.

Which of the statements given above are correct ?

a. 1, 2, 3 and 4

b. 1, 3 and 4

c. 1, 2 and 3

d. 2 and 4

12. Match List I with List II arid select the correct answer using the codes :

List I (Parameter)

A. F/M ratio

B. Solar energy

C. Effluent recirculation

D. Volatile fatty acids

List II (Treatment Unit or Process)

1. Anaerobic digester

2. Detritus tank

3. Waste stabilization pond

4. Trickling filter

5. Activated sludge process

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

13. Which one of- the following pairs is not correctly matched ?

a. BOD / COD = 0 : Waste-water is toxic

b. BOD I COD $\leq$ 0.2 : Acclimatization of seed is necessary

c. BOD / COD $\geq$ 0.6 : Waste-water is non-biodegradable

d. BOD = COD = 0 : Waste-water is devoid of organic matter

14. In aerobic conditions, the microbial decomposition of organics results in the formation of which one of the following?

a. Stable and objectionable end products

b. Unstable and objectionable end products

c. Unstable and acceptable end products

d. Stable and unobjectionable end products

15. A waste water sample of 2 ml is made upto 300 ml in BOD bottle with distilled water. Initial DO of the sample is 8 mg/l and after 5 days it is 2 mg/l. What is its BOD ?

a. 894 mg/l

b. 900 mg/l

c. 300 mg/l

d. 1200 mg/l

16. Consider the following statements

Aeration in water treatment helps in

1. killing pathogens.

2. correcting pH.

3. precipitating dissolved iron and manganese.

4. expelling excess CO_2 and H_2S.

5. expelling volatile oils.

Which of the statements given above are correct ?

a. 2, 4 and 5

b. 3, 4 and 5

c. 1, 2, 3 and 5

d. 1, 2, 3 and 4

17. Match List I with List II and select the correct answer using the codes :

List I (Fixture)

A. Surge arrester

B. Butterfly valve

C. Scour valve

D. Check valve

List II (Purpose)

1. Prevention of reversal of flow in a pipeline

2. Regulating or stopping the flow especially in large size conduits

3. Control of water hammer

4. Draining or emptying the pipeline section

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

18. Which one of the following statements is correct ?

If a sewer X is to be designed to generate equivalent self- cleansing action as in sewer Y, then

a. velocity in sewer X must be equal to velocity in sewer Y

b. slope of sewer X must be equal to slope of sewer Y

c. tractive force intensity generated in sewer X must be same as that in sewer Y

d. the roughness coefficient of X sewer material should be same as that of Y sewer material

19. Match List I with List II and select the correct answer using the codes :

List I

A. Test with sound waves in the audible frequency range

B. Fire flow tests

C. Hydraulic gradient tests

D. Coefficient tests

List II

1. To determine the ability of a distribution system to transmit water with adequate residual pressure

2. Location and isolation of leaks

3. To determine the efficiency and adequacy of a distribution system during days of high demand

4. To determine the internal condition of

5. pipeline with respect to friction loss

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

20. Two soil samples A and B have porosities $n_A = 40\%$ and $n_B = 60\%$ respectively. What is the ratio of void ratios $e_A : e_B$?

a. 2 : 3

b. 3 : 2

c. 4 : 9

d. 9 : 4

21. Match List I (Densities) with List II (Expressions) and select the correct answer using the codes given below :

(Symbols G, e, γ_w and S stand for specific gravity of soil grains, void ratio, unit weight of water and degree of saturation respectively)

List I

A. Dry density

B. Moist density

C. Submerged density

D. Saturated density

List II

1. $\{(G + Se) / (1 + e)\}\gamma_w$

2. $\{G / (1 + e)\} \gamma_w$

3. $\{(G + e) / (1 + e)\} \gamma_w$

4. $\{(G - 1) / (1 + e)\}\gamma_w$

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

22. What are the respective values of void ratio, porosity ratio and saturated density (in kN/m³) for a soil sample which has saturation moisture content of 20% and specific gravity of grains as 2.6 ?

(Take density of water 10 kN/m³)

a. 0.52, 1.08, 18.07

b. 0.52, 0.34, 18.07

c. 0.77, 1.08, 16.64

d. 0.52 0.34, 20.14

23. Embankment fill is to be compacted at a density of 18 kN/m^3. The soil of the borrow area is at a density of 15 kN/ m^3. What is the estimated number of trips of 6 Cu. m capacity truck for hauling the soil required for compacting 100 m^3 fill of the embankment ? (Assume that the soil in the borrow area and that in the embankment are at the same moisture content)

a. 14

b. 18

c. 20

d. 23

24. Match List I (Equipment) with List II (Use) and select the correct answer using the codes given below

List I

A. Vibratory rollers

B. Sheep foot rollers

C. Frog hammers

D. Vibroflots

List II

1. To compact soils in confined areas and at corners

2. To compact road and railway embankments of sandy soils

3. To densify sandy soils over a large area and to a larger depth

4. To compact clayey soil fills

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

25. Soil is compacted at which one of The following when a higher compactive effort produces highest increase in dry density ?

a. Optimum water content

b. Dry side of the optimum moisture content

c. Wet side of the optimum moisture content

d. Saturation moisture content

26. Consider the following statements

1. Coarse sand is more than a million times permeable than a high plasticity clay.

2. The permeability depends on the nature of soil and not on properties of liquid flowing through soil.

3. If a sample of sand and a sample of clay have the same void ratio, both samples will exhibit the same permeability.

4. Permeability of soil decreases as the effective stress acting on the soil increases.

Which of the statements given above are correct?

a. 1 and 2

b. 1 and 3

c. 1 and 4

d. 2 and 3

27. In a falling head permeability test on a soil, the time taken for the head to fall from h_0 to h_1 is t. The test is repeated with same initial head h_0, the final head h' is noted in time t/2. Which one of the following equations gives the relation between h', h_0 and h_1 ?

a. $h' = h_0/h_1$

b. $h' = \sqrt{h_0/h_1}$

c. $h' = h_0 h_1$

d. $h' = \sqrt{h_0 h_1}$

28. Which one of the following statements is correct?

The one dimensional theory of consolidation proposed by Terzaghi derives its name due to the fact that

a. only vertical dimension of the soil sample is used for consolidation test and lateral dimensions are neglected

b. water in the soil sample in conventional consolidometer escapes in the lateral directions resulting into settlements only in vertical direction

c. normal stress on the sample is applied in only one (vertical) direction

d. lateral movements of soil grains are not permitted across any vertical boundary resulting into only vertical settlements to account for the decrease

in volume due to escape of water from soil sample

29. Match List I with List II and select the correct answer using the codes

List I (Protective Measure)
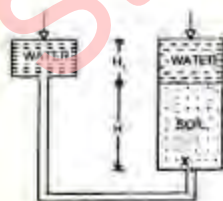
A. Inverted filter
B. Riprap
C. Clay core
D. Sand columns

List II (Purpose)

1. To protect river banks from erosion by river flow
2. To prevent escape of fine soils by seepage water
3. To reduce damage due to liquefaction of saturated granular soils during earthquakes
4. To reduce seepage of water through the body of the earth dams

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

30. For a certain loading condition, a saturated clay layer undergoes 40% consolidation ma period of 178 days. What would be the additional time required for further 20% consolidation to occur ?

a. 89 days
b. 222.5 days
c. 329.5 days
d. 400.5 days

31.

Which one of the following expressions represents the shear strength of soil at point X ? Angle of shear resistance of soil is ϕ and symbols γ_w, γ_{sat}, γ_{sub}, γ_{dry} stand for unit weights of water, saturated soil, submerged soil and dry soil respectively

a. $\gamma_{dry} H \tan \phi$
b. $[\gamma_{sat} H - (H + H_1) \gamma_w] \tan \phi$
c. $\gamma_{sub} H \tan \phi$
d. $[\gamma_{dry} H - H_1 \gamma_w] \tan \phi$

32. A shear test was conducted on a soil sample. At failure, the ratio of $\frac{\sigma_1 - \sigma_3}{2}$ to $\frac{\sigma_1 + \sigma_3}{2}$ is equal to unity.

Which one of the following shear tests represents this condition ?

a. Drained triaxial compression test
b. Undrained triaxial compression test
c. Consolidated quick triaxial compression test
d. Unconfined compression test

33. A footing of 3 m × 3 m size transmits a load of 1800 kN. The angle of load, dispersion in soil $\alpha = \tan^{-1} 0.5$. What is the stress created by the footing load at a depth of 5 m?.

a. $26.12 \ kN/m^2$
b. $27.12 \ kN/m^2$
c. $28.12 \ kN/m^2$
d. $29.12 \ kN/m^2$

34. Which one of the following statements is correct?

In dissolved oxygen sag curve, the sag results because

a. it is a function of a rate of addition of oxygen to the stream
b. it is a function of a rate of addition of oxygen from the stream
c. it is a unction of both addition and depletion of 'oxygen from the stream
d. the rate of addition of oxygen is linear, but the rate of depletion is non-linear

35. An industry manufacturing urea produces waste water, which largely contains urea and ammonia. The treatment plant consists of following units for effective control of nitrogen

1. Nitrification followed by denitrification
2. Hydrolysis unit
3. Ammonia stripping by air
4. Lime dosing and mixing unit

Which one of the following is the correct sequence of above unit operations in the treatment plant?

a. 3-2-1-4

b. 2-3-1-4

c. 2-4-3-1

d. 4-2-3-1

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

36. Which one of the following procedures is used for sampling of flue gas in a chimney for SPM ?

a. Isothermal sampling

b. Isokinetic sampling

c. Adiabatic condition

d. Variable rate of sampling

37. Which one of the following units is employed for the removal of particulate matter above 50µ in size?

a. Gravity settling chamber

b. Cycltne

c. Fabric filter

d. Electrostatic precipitator

38. Which one of the following statements is correct?

Acoustics of an auditorium is considered to be excellent when its reverberation time is between

a. 0.50 and 1.50 s

b. 1.50 and 2.00s

c. 2.00 and 3.00 s

d. 3.00 and 5.00 s

39. Which one of the following Acts/Rules has a provision for "No right to appeal"?

a. Environment (Protection) Act, 1986

b. The Hazardous Waste (Management and Handling) Rules, 1989 .

c. Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989

d. Environment (Protection) Rules, 1992

40. Match List I with List II and select the correct answer using the codes

List I

A. Protozoa

B. Bacteria

C. Presence of nitrate > 45 mg//

D. Virus

List II

1. Methamoglobinaemia

2. Poliomyelitis

3. Dysentry

4. Typhoid fever

41. Which one of the following organisms is responsible for enteric fever?

a. ECHO

b. Salmonella typhi

c. Entamoeba histolytica

d. Echinococcus

42. Which one of the following statements is correct?

If the specific gravity of a suspended particle is increased from 2 to 3, the settling velocity will

a. not change

b. get doubled

c. get increased by 1.5 times

d. get increased by 2.25 times

43. Which one of the following is not a specific criterion for calculating surface overflow rate in sedimentation tank design?

a. Total quantity of water to be treated

b. Total surface area available in the tank

c. Total length of the tank

d. Total depth of the tank

44. Which of the following remedial measures are taken negative head and air binding in a rapid sand filter?

1. Avoiding the occurrence of excessive negative head

2. Pumping in air

3. Avoiding increase in water temperature

4. Control of algae growth

Select the correct answer using the codes given below

a. 1, 3 and 4

b. 2, 3 and 4

c. 1 and 2

d. 1,2, 3 and 4

45. Match List. I with List II and select the correct answer using the codes

List I (Water/Waste Water Parameter)

A. Potability of water

B. Chloride
C. Residual chlorine
D. Hardness of water

List II (Test)
1. Mohr's method
2. Orthotolidine method
3. E.D.T.A. method
4. M. F. technique

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

46. Which one of the following problem of short circuiting due to density currents ?
a. Batch
b. Complete mix
c. Plug flow
d. Fluidized bed

47. Consider the following statements :
The basic difference between water pipes and sewer pipes
1. in the material used for the pipes
2. in the pressure of the liquid flow
3. in the suspended solids they carry
Which of the statements given above is/are correct?
a. 1 and 3
b. 1 only
c. 2 and 3
d. 1, 2 and 3

48. Which one of the following statements is correct?
A combined sewer is one, which transports domestic sewage and
a. storm water
b. industrial wastes
c. overhead flow
d. industrial wastes and storm water

49. Match List I with List II and select the correct answer using the codes

List I (Type of Pipe)
A. Steel pipe
B. Cast iron pipe
C. G. I. pipe
D. P.V.C. pipe

List II (Purpose)
1. House plumbing
2. Hot water carrying
3. Distribution main
4. Pumping main

50. Consider the following statements
1. The velocity of flow in the rising main should not be less than 0.8 m/s at any time.
2. Maximum velocity of flow is generally limited to 1.8 m/s and never allowed to exceed 3.0 m/s.
In the design of large sewage pumping stations, which of the above conditions must be satisfied ?
a. 1 only
b. 2 only
c. Both 1 and 2
d. Neither 1 nor 2

51. Match List I with List II and select the correct answer using the Codes :

List I (Type of Signals)
A. Detonating signal
B. Coloured light signal
C. Home signal
D. Calling on signal

List II (Characteristics)
1. Locational
2. Operational
3. Special
4. Functional

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

52. Match List I with List II and select the correct answer using the codes

List I (Road Drainage System)
A. Vertical sand drains
B. Causeways and culverts
C. Scuppers and catch water drains
D. Inlets and gratings

List II (Location)
1. Urban road drainage
2. Hill roads

3. High embankments in soft soils
4. Cross drainage in road alignments

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

53. Match List I with List II select the correct answer using the codes :

List I

A. Dynamometer car
B. Crossing station
C. Ruling gradient
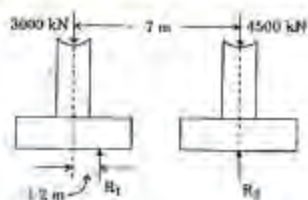D. Turn table

List II

1. Arrangement for turning the direction of an engine
2. Information about condition of railway track
3. Station on a single railway track system where Up and Down trains can pass each other
4. Maximum rising gradient of railway track depending on engine power

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

54. The installation of sand drains in clayey soil causes the soil adjacent to the sand drains to undergo which one of the following?

a. Increase in porosity
b. Increase in compressibility
c. Decrease in horizontal permeability
d. Decrease in shear strength

55. A strap footing is to be provided for the two columns shown in the diagrams given below.

What is the length L of the footing? Take width of both the footings as 3.5 m and safe bearing capacity of soil as 350 kN/m^2.

a. 2.0 m
b. 2.5 m
c. 3.5 m
d. 2.95 m

56. Assertion (A): At the standard temperature, the kinematic viscosity of air is greater than that of water at the same temperature.

Reason (R) : The dynamic viscosity of air at standard temperature is lower than that of water at the same temperature.

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

57. Assertion (A): When water flows through a long stretch of a narrow rectangular channel, the water surface at the walls is higher than that at the central axis.

Reason (R): Resistive effort of atmospheric air is felt more at the walls than away from the walls.

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

58. Assertion (A) : The yield of a well varied from 10 m^3/day to 20 m^3/day when the aquifer area changed from 50 m^2 to 75 m^2.

Reason (R) : The yield is found to be directly proportional to the area of an aquifer opening into a well.

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

59. Assertion (A) The fluoride content in drinking water should neither be too low nor too high.

Reason (R) Deficiency of fluoride content causes mottling of teeth and its excess causes dental cavities in children.

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

60. Assertion (A) : Raft foundations are the best type of shallow foundations to support heavy structures.

Reason (R): Raft foundation has the ability to redistribute load coming on weak pockets of soil below raft to the adjacent soils where the stresses are less severe for the soil at that place. This reduces the chances of differential settlements and increases the bearing capacity.

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

61. Assertion (A) : The settling velocity of a discrete particle will become five times when its diameter doubles.

Reason (R) : The settling velocity of a discrete particle is almost proportional to the square of the particle diameter

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

62. Assertion (A) : The drained its using triaxial test apparatus are useful in the study of drainage of water through the soil sample and hence the permeability of the soil sample.

Reason (R) : The permeability of soil is an important property useful in estimation of loss of imponded water through permeable soil layers below the earth dams.

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

63. Assertion (A) Plate load test carried out at the site gives field test data which is useful in evaluation of bearing capacity and settlements. It is normally conducted at the level of the proposed foundation.

Reason (R) : Plate load test is reliable because it reflects the true behaviour of foundation stratum below the proposed level of foundation and extending up to large depth below.

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

64. Assertion (A) : A series of closed contours indicate either a valley or a hill without any outlet, when their elevations, respectively, increase or decrease towards the centre.

Reason (R) : Contour lines of different elevations can unite to form one line only at a vertical cliff.

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

65. Assertion (A) : A mosaic is large photomap assembled from two or more aerial photographs of an area.

Reason (R) : Photomap and mosaic are true planimetric representations of the area.

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

66. Assertion (A) : Open cut is economical than tunneling for depths of over burden less than 20 metres.

Reason (R) Heading and Bench method is suitable for tunneling in soft soils.

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

67. Assertion (A) : Breakwaters are common in natural harbours.

Reason (R) : Breakwaters help in controlling wave action and sand movement into the harbour area.

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

68. A strip footing having 1.5 m width founded at a depth of 3 m below ground level in a clay soil having $C = 20$ kN/m², ϕ 0° and unit weight $\gamma = 20$ kN/³. What is the net ultimate bearing capacity using Skempton's analysis ?

a. 30 kN/m²

b. 60 kN/m²

c. 100 kN/m²

d. 140 kN/m

69. Match List I with List II and select the correct answer using the codes

List I (Unit Test)

A. Casagrande's apparatus

B. B. Hydrometer

C. Plate load test

D. Oedometer

List II (Purpose)

1. Determination of grain, size distribution

2. Consolidation characteristics

3. Determination of consistency

4. Determination of safe bearing capacity of soil limits

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

70. When a load test was conducted by putting a 60 cm square plate on top of a sandy deposit, the ultimate bearing capacity was observed as 60 kN/m². What is the ultimate bearing capacity for a strip footing of 1.2 m width to be placed on the surface of the same soil ?

a. 75 kN/m²

b. 120 kN/m²

c. 150 kN/m²

d. 160 kN/m²

71. Match List I with List II and select using the codes :

List I (Situation)

A. Embankment construction

B. Excavation of a pit

C. Hydrostatic loading

D. Lateral expansion of a backfill

List II (Stress Path)

1. Stress path moves in left side upward direction

2. Stress path moves in left side downward direction

3. Stress path moves in right side upward direction

4. Stress path moves along the horizontal axis

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

72. A plate load test is conducted on a cohesionless soil with a test plate having width B_p (cm) and settlement of this plate S_p (cm) is obtained at the same load intensity as on foundation. A footing having a width B_f (cm) is to be constructed as foundation. What is the settlement S_f (cm) experienced by this footing?

a. $S_f = S_p \{[B_f (B_p + 30)] / [B_p (B_f + 30)]\}^2$

b. $S_f = S_p \{[B_p (B_f + 30)] / [B_f (B_p + 30)]\}^2$

c. $S_f = S_p [B_f / B_p]$

d. $S_f = S_p [B_p / B_f]$

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

List I (Type of Foundation)

A. Floating piles

B. Micro piles

C. Combined footing

D. Under-reamed piles

List II (Type of Soil)

1. Closed spaced columns resting on compressible soil
2. Expansive soils
3. Deep soft clays
4. Loose sands

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

74. A square pile of section 30 cm x 30 cm and length 10 m penetrates a deposit of clay having $C = 5$ kN/m^2 and the mobilizing factor m = 0.8. What is the load carried by the pile by skin friction only?

a. 192 kN

b. 75 kN

c. 60 kN

d. 48 kN

75. Match List I with List II and select the correct answer using the codes

List I(Type of Strata below Foundation)

A. Sand

B. Heterogeneous landfill

C. Black cotton soil

D. Hard rock

List II (Type of Foundation Movement)

1. Practically no movements
2. Immediate settlements
3. Large relative settlements
4. Heaving of foundations

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

76. Consider the following statements:

1. Pile foundations are usually provided when loads coming on the foundation are quite large. Such piles may often extend up to a large depth below ground level.

2. Precast piles inserted into the holes bored at the site do not get damaged while they are driven into the ground.

Which of the statements given above is/are correct?

a. 1 only

b. 2 only

c. Both 1 and 2

d. Neither 1 nor 2

77. Match List I with List II and select the correct answer using the codes :

List I (Type of Foundation)

A. Point bearing piles

B. Sheet piles

C. Compaction piles

D. Batter piles

List II (Use of Foundation)

1. To retain soil filling
2. To transfer heavy loads to strong stratum below a weak stratum
3. To resist lateral loads.
4. To densify loose soils

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

78. Consider the following statements

Prevention or elimination of swelling can be brought by

1. providing an impervious apron around the structure
2. pre-wetting the ground to a moisture content equal to equilibrium moisture content.
3. making downward loads large enough to exceed swelling pressures.
4. chemically stabilizing the soil with lime

Which of the statements given above are correct?

a. 1 and 3

b. 1 and 3

c. 2 and 3

d. 1 2, 3 and 4

79. Match List I with List II and select the correct answer using the codes :

List I (Type of Survey)

A. Topographical survey
B. Reconnaissance survey
C. Cadastral survey
D. Archaeological survey

List II (Purpose)

1. To determine boundaries of fields, houses etc.
2. To find relics of antiquity
3. To determine natural features of a country
4. To determine possibility and rough cost of the surveying system to be adopted

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

80. On which one of the following are the third generation electro-optical instruments based ?

a. Microwave
b. Infra-red
c. UV light
d. He-Laser light

81. Match List I with List II and select the correct answer using the codes :

List I (Measurements)

A. Displacement measurement from photograph
B. Electronic distance measurement
C. Base line measurement
D. Horizontal angle measurement

List II (Instruments)

1. Box sextant
2. Subtense bar
3. Tellurometer
4. Parallax bar

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

82. Consider the following statements :

Reciprocal levelling eliminates the effect of

1. errors due to earth's curvature
2. errors due to atmospheric refraction
3. mistakes in taking levelling staff readings
4. errors due to line of collimation

Which of the statements given above are correct?

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

83. Match List I with List II and select the correct answer using the codes :

List I

A. Satellite station
B. Gales traverse method
C. Invar steel tape
D. Intervisibility of adjacent stations

List II

1. Measurement of Baseline
2. Characteristic of triangulation stations
3. Auxiliary theodolite station near an inaccessible main triangulation station
4. Computation of coordinates of traverse/triangulation stations

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

84. What is the minimum number of satellites required from which signals can be recorded to enable a global positioning system receiver to determine latitude, longitude and altitude ?

a. One
b. Two
c. Three
d. Four

85. Setting off the 'proper principal distance' in the projectors of projection stereoplotters is a procedure for which one of the following?

a. Finding the focal length of the camera used

b. Evaluating the digital terrain model

c. Carrying out the interior orientation

d. Filling the quotation for the purchase of A₇ stereoplotters

86. Consider the following statements.:

IRS series satellites are

1. Low orbiting satellites
2. Geostationary satellites
3. Meteorological satellites
4. Resources survey satellites

Which of the statements given above are correct?

a. 1 and 4

b. 2 and 3

c. 1, 2 and 4

d. 2, 3 and 4

87. Which one of the following is measured by the area between the balancing line and the mass-haul curve?

a. Haul between the balancing points

b. Earthwork accumulated upto that point

c. Excess of excavation

d. Excess of filling

88. For a given road, safe stopping sight distance is 80 m and passing sight distance is 300 m. What is the intermediate sight distance ?

a. 220 m

b. 190 m

c. 160 m

d. 150 m

89. Match List I with List II and select the correct answer using the codes :

List I (Test)

A. Impact test

B. Los-Angeles abrasion test

C. Crushing test

D. Stripping test

List II (Purpose)

1. Bitumen adhesion
2. Toughness
3. Hardness
4. Strength

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

90. Consider the following statements : A transition curve is provided on a circular curve on a highway to provide

1. gradual introduction of centrifugal force
2. minimum stopping sight distance
3. gradual introduction of super elevation
4. comfort and security to passengers

Which of the statements given above are correct?

a. 1, 2 and 3

b. 1, 3 and 4

c. 2, 3 and 4

d. 1, 2 and 4

91. Which one of the following defects indicates progressive disintegration of bituminous premix carpet surfacing by loss of aggregates?

a. Potholes

b. Ravelling

c. Edge breaking

d. Rutting

92. What will be the ruling radius of a horizontal curve on a national highway for a design vehicle speed of 100 km/h, assuming allowable super elevation to be 7% and lateral friction as 0.13 ?

a. 405 m

b. 395 m

c. 385 m

d. 375 m

93. In 500 gm sample of coarse aggregate, there are 100 gm flaky particles and 80 gm elongates particles. What are the flakiness and elongation indices (total) as per I.S. ?

a. 40%

b. 36%

c. 18%

d. 4%

94. The lost time due to starting delay on a traffic signal approach is noted to be 3 seconds, the actual green time is 25 seconds and amber time is 3 seconds. How much is the effective green time?

a. 19s

b. 25s

c. 27s

d. 31s

95. Which one of the following statements is correct?

The orientation of preferential runway in an airport is influenced by

a. direction of prevailing wind, adequate length. obstruction-free landing and take-off zones

b. adequate waiting and service facilities

c. convenience of terminal and control facilities

d. stable ground and adequate turning space

96. Consider the following aircraft operations:

1. Normal landing

2. Normal take-off with all engines

3. Engine failure at take-off

4. Emergency landing with all engines shut

5. Landing with maximum payload with the help of ILS

Which of the above aircraft operations are taken into consideration in deciding the basic runway length required for an aircraft?

a. 1, 2 and 3

b. 2, 3 and 4

c. 3, 4 and 5

d. 1 and 5

97. Match List 1 with List II and select the correct answer using the codes :

List I (Method)

A. Fll face method

B. Heading and Bench method

C. Drift method

D. American method

List II (Suitability)

1. For tunnelling of large cross- section area through soft ground driving a top drift and then widening the sides

2. For rock tunnelling carried out first in smaller section of the proposed tunnel and then widened

3. For driving the top portion in advance of the bottom potion for very large tunnel section in unstable rocks

4. For tunnelling of small cross- section area in stable rock attacking the whole section at time

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

98. A solid cylinder of length L. diameter D and specific gravity 0.6 floats in neutral equilibrium in water with its axis vertical. What is the ratio of L to D ?

a. $\sqrt{3}/2$

b. $2\sqrt{3}/5$

c. $4/5\sqrt{3}$

d. $5/4\sqrt{3}$

99. Match List I (Causes) with List II (Effects) pertaining to rotation and vertical horizontal motion of liquid masses at constant acceleration and select the correct answer using the codes

List I

A. The form of the free surface of liquid in a rotating open vessel

B. The form of surface of the liquid in a tanker moving in the direction of its length

C. The pressure at any point in a containers base moving with upward Acceleration

D. The pressure at any point in a container's base moving with downward acceleration

List II

1. An inclined plane

2. A paraboloid of revolution

3. Greater than the hydrostatic value

4. Less than the hydrostatic value

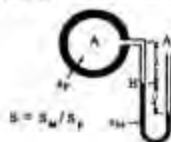|	A	B	C	D
a.	4	1	3	2
b.	4	3	1	2
c.	2	3	1	4
d.	2	1	3	4

100. Match List I with List II and select the correct answer using the codes
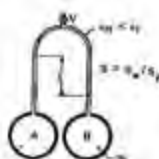
List I (Features)

A. Open ended manometer for positive pressure

B. Negative pressure manometer

C. For measuring pressure in liquids or gases
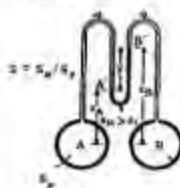
D. For measuring pressure in liquids only.

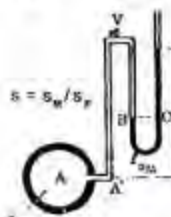**List II (Types of Manometers)**

1.

2.

3.

4.

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

101. For a turbulent boundary layer (under zero pressure gradient), the velocity profile is described by the one-fifth power law. What is the ratio of displacement thickness to boundary layer thickness ?

   a. 1/7

   b. 1/6

   c. 1/5

   d. 1/4

102. Oil ($\mu = 0.44$ Pa.s, $\rho = 888$ kg/m^3) is filled in the space between two parallel plates which are 18 mm apart. The upper plate is moving at a velocity of 4 m/s. What is the shear stress on the plate ?

   a. 97.8 Pa

   b. 48.9 Pa

   c. 79.8 Pa

   d. 87.9 Pa

103. A 1 : 30 Scale model of a submarine is to be tested in a wind tunnel for its drag when it is operating at 15 km/h in ocean. The kinematic viscosity of air is 1.51×10^{-5} m^2/s and for water 1.02×10^{-6} m^2/s. What is the velocity of air in wind tunnel that should be maintained for kinematic similarity?

   a. 1500 m/s

   b. 2000 m/s
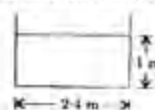
   c. 1850.5 m/s

   d. 2500.5 m/s

104. Consider the following statements regarding the conditions to be satisfied for the maximum discharge through a trapezoidal channel section with side slope 1 : n, bed width b, flow depth d and having a fixed bed slope.

  1. Sloping sides should have an angle of 300 with vertical

  2. Hydraulic mean depth equals half the flow depth

  3. Length of sloping sides should be equal to twice the bottom width

Which of the statements given above are correct ?

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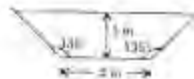
   b. 1 and 2

   c. 2 and 3

   d. 1 and 3

105. Water can flow with 1 m depth in alternatively four channels of different sections as shown below

(A) Rectangular

(B) Circular

(C) Triangular

(D) Trapezoid

Which one of the following sequences shows their hydraulic radii, arranged in descending order ?

a. D-C-B-A
b. D-A-C-B
c. A-B-C-D
d. A-B-D-C

106. In a reach of open channel flow, with q = m^2/s, depth of flow at section A is 1.5 m and at section B, 1.6 m. The difference in specific energies at two sections can be correspondingly taken as 0.09 m. The bed slope is 1 in 2000. The mean energy slope between the sections is given as 0.003. What is the length of reach AB ?

a. 54 m with A on the upstream
b. 54 m with B on the upstream
c. 36 m with A on the upstream
d. 36 m with B on the upstream

107. Two long pipes in parallel are used to carry water between two reservoirs. The diameter of one pipe is twice that of the other. Both the pipes have the same value of friction factor. Neglect minor losses. What is the ratio of flow rates through the two pipes ?

a. 2.8
b. 5.6
c. 8
d. 11.3

108. A centrifugal pump discharges 260 litres of water per second when running at 600 rpm. The impeller diameter at the outlet is 80 cm. It develops a head of 15.3 m. What is the approximate minimum starting speed?

a. 425 rpm
b. 450 rpm
c. 475 rpm
d. 500 rpm

109. A combination of centrifugal pumps of specific speed 20 and overall efficiency 80%, running at 800 rpm is to be used to pump 40 lps of water to a height of 75 m. What should be the arrangement ?

a. 3 pumps in series
b. 3 pumps in parallel
c. 4 pumps in series
d. 4 pumps in parallel

110. Match List I with List II and select the correct answer using the codes :

List I (Machines)
A. Centrifugal pump
B. Reciprocating pump
C. Francis turbine
D. Pelton wheel

List II (Associated with)
1. Percent slip
2. Bucket
3. Guide blade
4. Volute chamber

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

111. A pelton wheel operates at 630 rpm taking 3 m^3/s of water under head of 256 m with a speed ratio of 0.48. (Given =$\sqrt{19.62}$ = 4.43) What is the diameter of the impeller?

a. 0.90 m
b. 1.03 m
c. 1.42 m
d. 1.80 m

112. An impulse turbine of 3 m diameter is rated at 10000 kW at 300 rpm under a head of 500 m. The turbine is operated under the head of 400 m. What is the power developed ?

a. 15000 kW
b. 14000 kW
c. 13000 kW
d. 12000 kW

113. An impulse turbine of 3m diameter is rated at 10000 kW at 300 rpm under a head of 500 m. The turbine is operated under the

head of 400 m. What is the speed at which it would run ?

  a. 324 rpm

  b. 336 rpm

  c. 348 rpm

  d. 364 rpm

114. Which one of the following defines aridity index (AI)?

  a. $AI = \dfrac{PET - AET}{PET} \times 100$

  b. $AI = \dfrac{PET}{AET} \times 100$

  c. $AI = \dfrac{AET}{PET} \times 100$

  d. $AI = \dfrac{AET - PET}{AET} \times 100$

where AET = Actual Evapotranspiration and   PET = Potential Evapotranspiration

115. Which one of the following filters should be recommended for protected rural water supply project?

  a. Pressure filter

  b. Slow sand filter

  c. Diatomaceous earth filter

  d. Rapid sand filter

116. Which one of the following statements is correct ?

In Snyder's method of synthetic unit hydrograph development, basin lag is taken as

  a. the time interval between centroid of the rainfall excess and surface runoff

  b. the time interval from mid point of the unit rainfall excess to the peak of the unit hydrograph

  c. independent of rainfall duration

  d. independent of catchment characteristics

117. A storm with 14 cm precipitation produced a direct runoff of 8 cm. The time distribution of the storm is as shown in the table below

Time from start (h)	Incremental Rainfall in hours
1	1.0
2	2.0
3	2.8
4	3.3
5	2.5
6	1.8
7	0.6

What is the value of p-index of the storm ?

  1. 0.5 cm/h

  2. 0.7 cm/h

  3. 0.8 cm/h

  4. 0.9 cm/h

118. Which one of the following is the correct sequence in the increasing order of the Froude number of flow assumed by the bed form of an alluvial stream with movable bed material ?

  a. Ripple — Plane bed — Dune — Plane bed - Antidune

  b. Dune — Ripple — Plane bed — Antidune — Plane bed

  c. Plane bed — Ripple — Dune — Plane bed — Antidune

  d. Plane bed — Ripple — Antidune — Dune — Plane bed

119. A bridge has an expected life of 50 years and is designed for a flood magnitude of return period 100 years. What is the risk associated with this hydrologic design ?

  a. $1 - (0.99)^{50}$

  b. $(0.5)^{50}$

  c. $(0.99)^{50}$

  d. $(0.99)^{100}$

120. Match List I with List II and select the correct answer using the codes :

List I

A. Rising limb of a hydrograph

B. Falling limb of a hydrograph

C. Peak rate of flow

D. Drainage density

List II

1. Depends on intensity of rainfall

2. Function of total channel length

3. Function of catchment slope

4. Function of storage characteristics

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