Test Booklet Series

C

CIVIL ENGINEERING
(OBJECCTIVE TYPE)
PAPER – II

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET DOES NOT HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.

2. ENCODE CLEARLY THE TEST BOOKLET SERIES **A, B, C** OR **D** AS THE CASE MAY BE IN THE APPROPRIATE PLACE IN THE ANSWER SHEET.

3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet

4. This Test Booklet contains 120 items (questions), 60 in PART – A and 60 in PART – B. Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose ***ONLY ONE*** response for each item.

5. You have to mark all your responses ***ONLY*** on the separate Answer Sheet provided. See directions in the Answer Sheet.

6. All items carry equal marks

7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.

8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.

10. Penalty for wrong answers:

THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE IN THE OBJECTIVE TYPE QUESTION PAPERS.

(i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0.33**) of the marks assigned to that question will be deducted as penalty.

(ii) If a candidate gives more than one answer, it will be treated as a **wrong answer** even if one of the given answers happiness to be correct and there will be same penalty as above to that question.

(iii)If a question is left blank, i.e. no answer is given by the candidate, there will be **no penalty** for that question.

DO NOT OPEN THIS TEST BOOKLET UNTIL YOU ARE ASKED TO DO SO

01. Consider the following statements:

1. Standard penetration test is commonly used for cohesionless soils.
2. Standard penetration test results in respect of a cohesionless soil are correlated to its density index and friction angle.
3. Use of H-value not corrected for overburden pressure leads to highly conservative design of footings at shallow depths.

Which of these statements are correct?

(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (a)

02. Consider the following statements:

1. The benefit of surcharge and depth of foundation is only marginal in case of footings on purely cohesive soils.
2. The bearing capacity of a footing in pure clay increases with increase in size of the footing.
3. Size effects in plate load tests are more important in case of cohesionless soils.

Which of these statements are correct?

(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (d)

03. The mean unconfined compressive strength of a purely cohesive soil was found to be 50 kN/m^2. The ultimate bearing capacity of a square footing calculated by Terzaghi's concept (bearing capacity factor $N_C = 5.7$) will be

(a) 185.25 kN/m^2 (b) 390.5 kN/m^2 (c) 285 kN/m^2 (d) 142.5 kN/m^2

Ans: (a)

04. The field density and field moisture content of a soil can be determined by

1. Core cutter method
2. Sand replacement method
3. Proctor compaction test
4. Modified proctor compaction test

(a) 1, 2, 3 & 4 (b) 1 & 2 only (c) 2 & 3 only (d) 2 & 4 only

Ans: (b)

05. Consider the following statements:

1. Friction piles are also called floating piles
2. Minimum number of piles to qualify as a pile group is three.
3. The group efficiency of a pile group may be either less than 100% or more than 100%.

Which of these statements are correct?

(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (a)

06. Consider the following statements relating to foundations on expansive soils:
1. Strength should be improved and compressibility should be reduced.
2. Compressibility should be increased.
3. No stabilization should be done.

Which of these statements is/are correct?

(a) 1, 2 & 3 (b) 2 only (c) 1 only (d) 3 only

Ans: (c)

07. Consider the following statements:
1. Buried service lines should be avoided in an expansive soil region.
2. A swelling pressure less than 20 kN/m^2 is not of much consequence.
3. If soil is not black in colour, it is unlikely to be an expansive soil.

Which of these statements are correct?

(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (b)

08. If L is the length of the chain, W is the weight of the chain and T is the tension, the sag correction for the chain line is

(a) $\frac{W^2L^2}{24T^3}$ (b) $\frac{W^2L}{24T^2}$ (c) $\frac{W^2L^2}{24T^2}$ (d) $\frac{W^2L^3}{24T^3}$

Ans: (b)

09. In an inclined terrain, if the elevation difference between the two ends of a line is h and the inclined length of the line is L, the correlation for slope is

(a) $\frac{h^2}{L^2}$ (b) $\frac{h^2}{2L^2}$ (c) $\frac{2h^2}{L^2}$ (d) $\frac{h^2}{2L}$

Ans: (d)

10. If the whole circle bearing is $315^o\ 20'$, its quadrantal bearing would be

(a) S $36^o\ 30'$ W (b) N $44^o\ 40'$ W (c) N $57^o\ 24'$ W (d) S $60^o\ 40'$ W

Ans: (b)

11. If the observed forebearing of a line xy is $16^o\ 26'$, the back bearing of this line is

(a) $103^o\ 26'$ (b) $118^o\ 36'$ (c) $196^o\ 26'$ (d) $206^o\ 26'$

Ans: (c)

12. The subtense tacheometry method is adopted when the ground is

(a) Flat (b) Inclined (c) Undulating (d) A waterbody

Ans: (a)

13. In an instrument, the bubble tube with divisions of 1 mm and a radius of 0.9 m has the sensitivity of

(a) $\frac{1}{2}$ (b) $\frac{1}{70}$ (c) $\frac{1}{90}$ (d) $\frac{1}{900}$

Ans: (d)

14. R.L. of floor at a building is 74.4 m, staff reading on the floor is 1.625 and staff reading when it is held inverted with bottom touching the ceiling of a hall is 2.870; then the height of the ceiling above the floor is

(a) 3.593 m (b) 3.953 m (c) 4.495 m (d) 4. 594 m

Ans: (c)

15. Consider the following pre-conditions for correct use of a theodolite:
    1. The vertical axis need not be perpendicular to the plane of the plate level bubble.
    2. The line of sight must be perpendicular to the horizontal axis.
    3. The axis of the level tube attached to the telescope need not be parallel to the line of sight.
    4. The vertical axis, the horizontal axis and the line of sight should all pass through a point known as stadia centre.

    Which of these conditions is/are necessary?

    (a) 1, 2, 3 & 4 (b) 2 only (c) 3 only (d) 1 & 4 only

Ans: (b)

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

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

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

(a) 90.8 (b) 100.8 (c) 110.8 (d) 120.8

Ans: (b)

17. Following observations were taken during a reciprocal leveling:

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

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

(a) 138.014 m (b) 139.616 m (c) 140.014 m (d) 141.616 m

Ans: (c)

18. A counter may be defined as an imaginary line passing through
(a) Points on the longitudinal section
(b) Points of equal elevation
(c) Point of equal local ground slope
(d) Points of transverse section surveys

Ans: (b)

19. A closed contour line with two or more higher contours inside it will represent a
(a) Depression (b) Hill (c) Cave (d) Well

Ans: (b)

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

Ans: (b)

21. Which of the following reasons are responsible for adoption of post-chlorination of water?
1. Chlorine demand is reduced.
2. Possibility of taste and odour formation is reduced.
3. Possibility of carcinogenic compounds is reduced.
4. Chloramines are formed.

(a) 1, 2, 3 & 4 (b) 1, 2 & 3 only (c) 1, & 4 only (d) 2, 3 & 4 only

Ans: (c)

22. Which one of the following tests employs Ethylene Diamine Tetra Acetic Acid as a titrating agent?
(a) Chlorides (b) Dissolved oxygen (c) Hardness (d) Residual chlorine

Ans: (c)

23. In case of levelling, backsight is
(a) A fixed point of known elevation
(b) The last staff reading taken before shifting the instrument
(c) The first staff reading taken after setting the instrument
(d) Any staff reading taken on a point of unknown elevation

Ans: (c)

24. The needle of a magnetic compass is generally supported on a
(a) Bush bearing (b) Ball bearing (c) Needle bearing (d) Jewel bearing

Ans: (c)

25. Consider the following statements:
For pure clay, the shear strength parameters will be
1. Cohesion c = 0; and angle of internal friction ϕ will be maximum.
2. Cohesion c is maximum; and angle of internal friction ϕ is also maximum.
3. Angle of internal friction ϕ is zero, with some value of cohesion c.

Which of these statements is/are correct?
(a) 1, 2 & 3 (b) 1 only (c) 3 only (d) 2 only

Ans: (c)

26. Consider the following statements:
1. Consolidation time increase with increasing compressibility
2. Consolidation time decreases with increasing permeability.
3. Consolidation time is dependent on the magnitude of stress increase.

Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (b)

27. On nephelometry turbidity unit (NTU) is equal to the turbidity produced by
(a) 1 mg SiO_2 dissolved in 1 *l* of distilled water with the test being run according to absorption principle
(b) 1 mg SiO_2 dissolved in 1 *l* of distilled water with the test being run according t scattering principle
(c) 1 mg Formazin dissolved in 1 *l* of distilled water with the test being run according to absorption principle
(d) 1 mg Formazin dissolved in 1 *l* o f distilled water with the test being run according to scattering principle.

Ans: (d)

28. Consider the following statements:
1. Relative density is a meaningful parameter for all types of soils
2. Relative density is a meaningful parameter only for cohesion soils.
3. Relative density is a better indicator of the denseness of an in-situ granular soil deposit than the void ratio.

Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (d)

29. An approximate estimation of total dissolved solids of a given water sample is often made by measuring
(a) Electrical conductivity of the water sample
(b) Electro-magnetic conductivity of the water sample
(c) Sound conductivity of the water sample
(d) Thermal conductivity of the water sample

Ans: (a)

30. The ratio between the adopted centrifugal ratios for roads and railways is
(a) 3:1 (b) 4:1 (c) 2:1 (d) 5:1

Ans: (-)

31. If the radius of a sample curve is R, then the length of the chord for calculating the offsets by the "method of chords produced" should not exceed
(a) $\frac{R}{5}$ (b) $\frac{R}{10}$ (c) $\frac{R}{20}$ (d) $\frac{R}{25}$

Ans: (b)

32. If R is the radius of the curve and L is the length of the long chord, the shift of the curve is (all in metre units)
(a) $\frac{L^2}{R}$ (b) $\frac{L^2}{2R}$ (c) $\frac{L^2}{24R}$ (d) $\frac{L^2}{6R}$

Ans: (c)

33. If the angle of deflection of a simple curve is θ and its radius is R, then the length of the chord is
(a) $2R\sin\theta$ (b) $2R\sin\frac{\theta}{2}$ (c) $2R\cos\theta$ (d) $2R\tan\frac{\theta}{2}$

Ans: (b)

34. The transitional property of a lemniscate curve is disrupted when its deflection angle is around
(a) 30^o (b) 45^o (c) 60^o (d) 90^o

Ans: (d)

35. An ideal horizontal transition curve is a
(a) Parabola (b) Circle (c) Clothoid spiral (d) Hyperbola

Ans: (c)

36. Total float in a planning network is
(a) Late start time – Early start time (b) Early start time – Late start time
(c) Late start time – Late finish time (d) Late finish time – Early finish time

Ans: (a & d)

37. The plotting of inaccessible points in a plane-table survey can be done by the method of
(a) Interpolation (b) Radiation (c) Intersection (d) Traversing

Ans: (c)

38. In a plane-table survey, the process of determining the plotted position of a station occupied by the plane-table by means of sights taken towards known points, the locations of which have already been plotted, is known as
(a) Radiation (b) Resection (c) Intersection (d) Traversing

Ans: (b)

39. Regarding plane-table survey, which of the following statements does ***not*** hold?
(a) All the plotting work including contouring can be done in the field
(b) It is quite suitable for small scale survey
(c) Less number of control points are required
(d) It can be done in all seasons

Ans: (d)

40. When H is the flight height, R is the appropriate radial measure and d is the relief displacement, the vertical height of an object appearing on an aerial photograph is
(a) $\frac{R}{dH}$ (b) $\frac{dH}{R}$ (c) $\frac{H}{dR}$ (d) $\frac{RH}{d}$

Ans: (b)

41. Consider the following types of turbines:
1. Francis 2. Pelton with a single jet 3. Kaplan
The correct sequence of these turbines in increasing order of their specific speeds is
(a) 1, 3 & 2 (b) 2, 1 & 3 (c) 1, 2 & 3 (d) 2, 3 & 1

Ans: (b)

42. Two Pelton turbines A and B have the same specific speed and are working under the same head. Turbine A produces 400 kW at 1000 rpm. If turbine B produces 100kW, then its rpm is
(a) 4000 (b) 2000 (c) 1500 (d) 3000

Ans: (b)

43. A turbine discharging 10 m^3/s is to be designed so that a torque of 1600 kg-m is to exerted on the impeller turning at 200 rpm under the condition that the existing liquid exerts no moment in spite of its momentum. The tangential component of the velocity at the outer periphery of the impeller of radius 1.0 m is
(a) 0.98 m/s (b) 1.57 m/s (c) 2.10 m/s (d) 2.26 m/s

Ans: (b)

44. Given below are two lists. Which of these are properly matched?

(Types of Pump)		**(Head Discharge performance)**
1. Propeller pump	:	Large discharges and low heads with negligible percentage variation in head
2. Single stage centrifugal pump with backward curved blades	:	Medium heads, with decreasing head as discharge increases
3. Turbine pump	:	Medium to high heads with low, but constant, discharges

(a) 1 & 2 (b) 2 & 3 (c) 2 only (d) 3 only

Ans: (a)

45. Consider the following statements:

1. The specific speed for turbines is directly proportional to $H^{\frac{5}{4}}$.
2. The specific speed for turbines is inversely proportional to $H\frac{5}{4}$.
3. The specific speed for pumps is directly proportional to $H^{\frac{3}{4}}$.
4. The specific speed for pumps is inversely proportional to $H^{\frac{3}{4}}$.

Which of these statements are correct?

(a) 1 & 3 (b) 2 & 4 (c) 1 & 4 (d) 2 & 3

Ans: (b)

46. Consider the following statements:
Air vessels are fitted on the suction and delivery sides of a reciprocating pump to
1. Achieve higher speed without separation.
2. Reduce work in overcoming frictional resistance.
3. Avoid excessive vibration permanently.
4. Have nearly uniform discharge.

Which of these statements are corrects?

(a) 1, 2 & 4 only (b) 1, 2 & 3 only (c) 2, 3 & 4 only (d) 1, 2, 3 & 4

Ans: (d)

47. The velocity of pressure wave in water of infinite extent is 1414 m/s. The velocity of propagation of water hammer pressure in a pipe carrying water and having diameter = 40 cm, pipe thickness = 4 mm, with E (Modulus of elasticity) of the pipe material = 2.1×10^{11} Pa, K (Bulk modulus of water) = 2.1×10^{9} Pa, is

(a) 1410 m/s (b) 2000 m/s (c) 1000 m/s (d) 700 m/s

Ans: (c)

48. Let C_1 be the velocity of pressure wave traveling along rigid pipe carrying water with its bulk modulus 2.16×10^{9} N/m^2. Let C_2 be the velocity of pressure wave traveling along a rigid pipe carrying oil of relative density 0.600 with its bulk modulus as 1.296×10^{9} N/m^2 through a similar pipe. What will be the ratio $\frac{C_1}{C_2}$?

(a) 0.01 (b) 0.1 (c) 1.0 (d) 10.0

Ans: (c)

49. The pipes A, B and C have the following basic geometries:

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

If these pipes are connected in series, by assuming the value of friction factor f to be same for all the three pipes and the equivalent pipe, this set of pipes in series in equivalent to a pipe of length L_e and diameter D and friction factor f with the equivalent length L_e being equal to

(a) $5\frac{1}{8}L$ (b) $4\frac{1}{8}L$ (c) $26\frac{1}{8}L$ (d) $33\frac{1}{8}L$

Ans: (d)

50. Consider the following statements in respect of steady laminar flow through a circular pipe:
1. Shear stress is zero on the central axis of the pipe
2. Discharge varies directly with the viscosity of the fluid
3. Velocity is maximum at the centre of the pipe.
4. Hydraulic gradient varies as the square of the mean velocity of flow.

Which of these statements are correct?

(a) 1, 2 , 3 & 4 (b) 1 & 3 only (c) 2 & 4 only (d)3 & 4 only

Ans: (b)

51. The pressure drop in a 30 cm diameter horizontal pipe is 60 kPa in distance of 15m. The wall shear stress in kPa is

(a) 0.1 (b) 0.2 (c) 0.3 (d) 0.4

Ans: (c)

52. Consider the following statements related to water surface profile in gradually varied flow in an open channel:
1. M_1 and S_1 curves approach Y_0 line asymptotically; and tend to be horizontal as y tends to ∞.
2. M_2 and S_2 curves meet Y_0 line horizontally, and Y_0 line asymptotically.
3. M_3 and S_3 curves meet Y_0 line normally, and also meet the channel bed normally.
4. C_1 and C_2 curves will be slightly curved if Chezy's equation is used; otherwise they may tend to be straight lines.

Which of these statements are correct?

(a) 1, 2, 3 & 4 (b) 1 & 4 only (c) 2 & 3 only (d) 3 & 4 only

Ans: (c)

53. The velocity with which an elementary surge wave can travel upstream in a channel with depth y = 1.6 m and velocity V = 2.4 m/s is (Take g = 10 m/s^2)

(a) 16 m/s (b) 13.6 m/s (c) 2.4 m/s (d) 1.6 m/s

Ans: (d)

54. For hydraulically efficient rectangular channel of bed width 4.0 m, the depth of flow is
(a) 4 m (b) 0.5 m (c) 1 m (d) 2 m

Ans: (d)

55. Consider the following statements in respect of critical flow in a wide rectangular channel:
1. The specific energy is minimum for a given discharge.
2. The discharge is maximum for a given specific energy
3. The specific force is minimum for a given discharge.
4. The Froude number is equal to unity.

Which of these statements are correct?
(a) 1 , 2 & 3 only (b) 1, 2, 3 & 4 (c) 1, 2 & 4 only (d) 2, 3 & 4 only

Ans: (b)

56. A high tension cable 5 cm in diameter is strung-out between two towers. At a wind velocity of 22.22 m/s (corresponding Reynolds number being 7.4×10^4) the frequency of vortex shedding is
(a) 100 Hz (b) 9.33 Hz (c) 93.3 Hz (d) 10.0 Hz

Ans: (c)

57. Consider the following assumption made in the analysis of a jet impinging normally on a moving plate to introduce the principle of moment of momentum:
1. Friction between jet and plate is neglected.
2. Flow is steady
3. Impinging momentum of jet is uncharged.
4. Plate moves at a constant velocity.

Which of these statements are relevant?
(a) 1, 2 & 4 only (b) 1, 2 & 3 only (c) 2, 3 and 4 only (d) 1, 2, 3 & 4

Ans: (a)

58. The thickness of a laminar boundary layer over a flat plate at two different sections P and Q are 0.8 cm and 2.4 cm respectively. If the section Q is 3.6 m downstream of P, the distance of section P from the leading edge of the plate is
(a) 0.32 m (b) 0.22 m (c) 0.40 m (d) 0.53 m

Ans: (c) ***Correct Answer is: 0.45 m***

59. Which of the following pairs are correctly matched?
1. Piezometric head : Sum of datum head and pressure head
2. Dynamic head : Sum of datum head and velocity head
3. Stagnation head : Sum of Piezometric head and velocity head
4. Total head : Sum of Piezometric head and dynamic head

(a) 1, 2 & 3 only (b) 1, 3 & 4 only (c) 2, 3 & 4 only (d) 1, 2, 3 & 4

Ans: (b)

60. A rectangular tank 10 m x 5 m in plan and 3 m deep is divided by a partition wall parallel to the shorter wall of the tank. One of the compartments contains water to a depth of 3 m, and the other a lighter liquid of specific gravity 0.75 to a depth of 2 m. The resultant pressure thrust on the partition wall is

(a) 1000 kg (b) 1500 kg (c) 2000 kg (d) 2500 kg

Correct Answer is 15000 kg

61. Which of the following are pertinent to the realization of hydrological cycle?

1. Latitudinal difference in solar heating of the Earth's surface
2. Inclination of the Earth's axis
3. Uneven distribution of land and water
4. Coriolis effect

(a) 1, 2 & 3 only (b) 1, 2 & 4 only (c) 2, 3 & 4 only (d) 1, 2, 3 & 4

Ans: (b)

62. The maximum velocity U_m, the mean velocity U and shear velocity u_* in the case of turbulent flow through circular pipes are related as $\frac{(U_m - U)}{u_*}$ =

(a) 2.5 for rough boundary flow only
(b) 5.75 for smooth boundary flow only
(c) 3.75 for both smooth and rough boundary flows
(d) 5.75 for both smooth and rough boundary flows.

Ans: (c)

63. The rainfall on five successive days on a catchment was 3, 6, 9, 5 and 1 cm respectively. If the φ-index for the storm can be assumed to be 3 cm/day, the total direct runoff from the catchment due to this storm is

(a) 11 cm (b) 24 cm (c) 9 cm (d) 20 cm

Ans: (a)

64. The excess runoff hydrograph from a catchment area $10km^2$ due to a storm of 6 hrs duration has been observed to be triangular in shape. The peak flow is observed to be $10m^3/s$ and the base length is 20 hrs. The rainfall excess in the catchment is

(a) 5.1 cm (b) 3.6 cm (c) 4.5 cm (d) 2.5 cm

Ans: (b)

65. Consider the following statements:

1. Over the oceans there is more evaporation than precipitation.
2. On land it is more precipitation than evapo-transpiration.

Which of these statements are correct?

(a) Both 1 & 2 (b) Neither 1 nor 2 (c) 1 only (d) 2 only

Ans: (a)

66. The hydrologic risk of a 100-year flood occurring during the 2-year service life of a project is
(a) 9.8% (b) 9.9% (c) 19.9% (d) 1.99%

Ans: (d)

67. The design flood commonly adopted in India for barrages and minor dams is
(a) Probable maximum flood
(b) A flood of 50 – 100 years return period
(c) Peak flood
(d) Standard project flood or a 100-year flood, whichever is higher

Ans: (d)

68. The Muskingum method of flood routing is a
(a) Form of hydraulic routing of a flood
(b) Form of reservoir routing
(c) Complete numerical solution of St. Venant equations
(d) Hydrological channel routing method

Ans: (d)

69. What would be the volume of water stored in a saturated column with a porosity of 0.35 with a cross-sectional area of 1 m^2 and depth of 3 m?
(a) 2.0 m^3 (b) 0.105 m^3 (c) 1.05 m^3 (d) 3.0 m^3

Ans: (c)

70. The surface joining the static levels in several non-pumping wells penetrating a continuous confined aquifer represents
(a) Water-table surface (b) Capillary fringe
(c) Piezometric surface of the aquifer (d) Physical top surface of the aquifer

Ans: (c)

71. Two observation wells penetrating into a confined aquifer are located 1500 m apart in the direction of flow. Heads of 50 m and 25 m are indicated at these two observation wells. If the coefficient of permeability for the aquifer is 30 m/day and its porosity is 0.25, the time of travel of an inert tracer from one well to another is
(a) 75 days (b) 750 days (c) 1200 days (d) 3000 days

Ans: (b)

72. The local scour depth in front of a semicircular shaped rectangular pier having width equal to W aligned parallel to the flow below the surrounding bed is
(a) 2.0 W (b) 1.5 W (c) 1.2 W (d) 1.0 W

Ans: (-)

73. Critical shear stress of cohesive sediment
(a) Decreases with the void ratio for a given plasticity index
(b) Increases with the plasticity index for a given void ratio
(c) Increases with shear strength for a given clay content
(d) All of the above.

Ans: (c)

74. A discharge of 72 m^3/s is to be allowed through siphon spillways of 2 m width and 75 m depth with working head of 8 m. The number of spillways to be provided will be (Take coefficient of discharge for the spillways = 0.64)
(a) 2 (b) 4 (c) 6 (d) 8

Ans: (c)

75. Coefficient of permeability of an underground stratum is 0.001 m/s. Discharge obtained from a well of area 20 m^2 dug into this stratum (with drawdown of 2 m) will be
(a) 2400 Ipm (b) 2000 Ipm (c) 1200 Ipm (d) 1000 Ipm

Ans: (a)

76. EDTA titration method of hardness determination of water sample uses an indicator which combines with hardness-causing divalent cations and forms a coloured complex. The name of the indicator and the colour of the formed complex respectively are
(a) Ferroin and dark blue (b) Ferroin and wine red
(c) Eriochrome Black T and dark blue (d) Eriochrome Black T and wine red

Ans: (d)

77. Consider the following statements:
1. Carbonate hardness is due to bicarbonates.
2. Non-carbonate hardness is due to sulphates and chlorides of Ca and Mg.
3. Both the hardnesses can be removed by lime-soda method.
4. Both the hardnesses can be removed by ion-exchange method.
Which of these statements are correct?
(a) 1, 2 & 3 only (b) 1, 2 & 4 only (c) 2, 3 & 4 only (d) 1, 2, 3 & 4

Ans: (a)

78. If the velocity of flow as well as the diameter of the flowing pipe are respectively doubled through a pipe system in use since long, the head loss will thereafter be
(a) Halved (b) Doubled (c) Increased 4 times (d) No change

Ans: (b)

79. Consider the following statements:
The total head against which a pump has to work must include, besides any other items,
1. the suction lift. 2. the delivery head.
3. the head lost due to friction at entrance in the rising main.
4. the head lost due to friction at exit in the rising main.
Which of these statements are correct?
(a) 1, 2 & 3 only (b) 2 & 3 only (c) 1, 2, 3 & 4 (d) 3 & 4 only

Ans: (c)

80. An urban area is located in plains having "average climatic conditions". The impervious area thereof for which drainage must be provided is 3.6 ha and the design rainfall intensity is 2.0 cm/hr. The drains will be designed for a runoff of
(a) 0.05 m^3/s (b) 0.10 m^3/s (c) 0.20 m^3/s (d) 0.40 m^3/s

Ans: (c)

81. If water table is encountered in the standard pit while conducting plate load test
(a) The load test should be abandoned
(b) The pit is considered unsafe
(c) Test should be conducted with complete dewatering continuously throughout the test duration
(d) The bearing capacity of soil cannot be determined in this condition

Ans: (c)

82. A wall with smooth vertical back and 10 meters height retains cohesionless material with a horizontal surface. The cohesionless material weighs 4.91 kN/m^3 and has an angle of internal friction of 30^0. The total active earth pressure is
(a) 81.585 kN/m length of wall (b) 91.585 kN/m length of wall
(c) 40.743 kN/m^2 (d) 8.158 kN/m^2

Ans: (a)

83. Consider the following statements regarding Coulomb's theory of earth pressure:
1. It is based on wedge theory of earth pressure.
2. It assumes the wall surface to be rough.
3. It may or may not satisfy the static equilibrium condition occurring in nature.
Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (b)

84. An isobar is a line which connects all points below the ground surface at which
(a) The local ground elevation is same (b) The settlement is same
(c) The vertical stress is the same (d) The ground elevation is varying

Ans: (c)

85. For the determination of shear strength parameters, c and ϕ, of soil in the laboratory, the test to be conducted will be
(a) Triaxial compression test (b) Sieve analysis
(c) Compaction test (d) Relative density test

Ans: (a)

86. Consider the following statements:
1. For a saturated soil, Skempton's B-parameter is nearly equal to unity.
2. For an undisturbed sensitive clay, the stress-strain curve shows a peak.
3. Interlocking contributes significantly to the shearing strength in case of dense sand.
Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (a)

87. Consider the following statements:
1. Mathematically speaking, the time taken for 100% consolidation is infinite.
2. The time factor for a particular average degree of consolidation depends upon the distribution of initial excess hydrostatic pressure.
3. Secondary consolidation obeys Terzaghi's one-dimensional theory of consolidation.
Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (b)

88. Consider the following statements:
1. Organic matter decreases the permeability of a soil.
2. Entrapped air decreases the permeability of a soil.
Which of these statements are correct?
(a) 1 only (b) 2 only (c) Both 1 &2 (d) Neither 1 nor 2

Ans: (c)

89. The porosity of a certain soil sample was found to be 80% and its specific gravity was 2:7; the critical hydraulic gradient will be estimated as
(a) 0.34 (b) 0.92 (c) 1.0 (d) 1.5

Ans: (a)

90. The porosity of a soil sample having its void ratio equal unity would be
(a) 33.33% (b) 50.0% (c) 66.66% (d) 75.0%

Ans: (b)

91. The natural water content of the soil sample was found to be 40%, specific gravity is 2.7 and void ratio 1.2; then the degree of saturation of the soil will be
(a) 100% (b) 69% (c) 87% (d) 90%

Ans: (d)

92. Environmental impact assessment includes
(a) Environmental statement
(b) Environmental management plan
(c) Risk and hazard assessment and mitigation
(d) All of the above

Ans: (d)

93. For noise measurement, formula for sound pressure level (SPL) is 20 log $\frac{P}{P_{ref}}$. What will be the resultant noise in dB if P is 0.0002 μ bar?
(a) 0 (b) 60 (c) 90 (d) 100

Ans: (a)

94. Consider the following statements:
1. Particulates have irregular shapes.
2. Size can be determined by an equivalent aerodynamic diameter by comparing with a perfect sphere.
3. Particulates larger than 10 μ are said to settle relatively quickly since their settling velocity is not less than 10 cm/min.
4. The particles roughly the size of bacteria have aerodynamic diameter of 0.1 μm to 10 μm.
Which of these statements are correct?
(a) 1, 2, 3 & 4 (b) 1 & 3 only (c) 1, 2 & 4 only (d) 2, 3 & 4 only

Ans: (c)

95. Which of the following factors contribute to formation of photochemical smog?
1. Stable atmosphere
2. NO_x
3. Solar insolation
4. CO
(a) 1, 2, 3, & 4 (b) 2, 3 & 4 only (c) 1 & 4 only (d) 1, 2 and 3 only

Ans: (a)

96. It takes 0.4 hrs to drive from the garage to the head of the route, 0.4 hrs to drive between the route head and disposal site and 0.25 hrs to return from the disposal site. It takes 0.2 hrs to offload a truck at the disposal site. The crew is permitted two 15-minute breaks and a further 30 minutes for miscellaneous delays. It two runs are made to the deposit site each day, how much time is left in an 8-hr nominal duty duration for refuse collection before starting to return to garage from disposal site? Take loading time as 30 minutes.
(a) 4.15 hrs (b) 4.25 hrs (c) 4.75 hrs (d) 4.85 hrs

Ans: (a)

97. Consider the following statements:
The time of BOD assimilation in a stream can be affected by
1. Ratio of stream depth to flow width.
2. Stream BOD value
3. BOD rate constant.
Which of these statements are correct?
(a) 1, 2 & 3 (b) 1 & 2 only (c) 2 & 3 only (d) 1 & 3 only

Ans: (a)

98. The most common constituents of alkalinity in natural water are measured by titrating the water sample with 0.02 N H_2SO_4 using
(a) Eriochrome Black T and Ferroin indicators
(b) Ferroin and Phenolphthalein indicators
(c) Phenolphthalein and Methyl Orange indicators
(d) Methyl Orange and Ericochrome Black T indicators

Ans: (c)

99. A sample of sewage is estimated to have a 5 days 20^0C BOD of 250 mg/*l*. If the test temperature be 30^0C, in how many days will the same value of BOD be obtained?
(a) 1.5 days (b) 2.5 days (c) 3.3 days (d) 7.5 days

Ans: (c)

100. A sewer has a diameter of 300 mm and slop of 1 in 400. While running full it has a mean velocity of 0.7 m/s. If both the diameter and slope are doubled (to respectively be 600 mm and 1 in 200), what will be the changed mean velocity when running half-full? Use Manning's formula.
(a) 1.59 m/s (b) 2.80 m/s (c) 0.90 m/s (d) 1.00 m/s

Ans: (a)

Direction:

Each of the next following **twenty (20)** items consists of two statements, one labelled as 'Statement (I)' and the other as 'Statement (II)'. You are to examine these two statements carefully and select the answers to these items using code given below:

Codes:

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is ***not*** the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

101. Statement (I): In a flownet, each field must be a (curvilinear) square.
Statement (II): Each flow channel in a flownet has the same rate of flow.

Ans: (d)

102. Statement (I): Boundary layer theory is applicable only in the vicinity of the leading edge of a flat plate.
Statement (II): Boundary layer theory is based on the assumption that its thickness is small when compared to other linear dimensions in the flow.

Ans: (d)

103. Statement (I): The best hydraulic section always has the minimum excavation.
Statement (II): The best hydraulic section gives the minimum area for a given discharge.

Ans: (c)

104. Statement (I): A given channel may be classifiable as mild for one discharge, critical for another discharge, and steep for yet another discharge.
Statement (II): Normal depth and critical depth are independent functions of the discharge along with, or without, other appropriate parameters.

Ans: (a)

105. Statement (I): For a hydraulic ram, D'Aubuisson's efficiency is always more than Rankine's efficiency.
Statement (II): By definition, efficiency is always less than unity in any system of mechanics; and addition of a small value to both numerator and denominator in the ratio of such a case always improves the value.

Ans: (a)

106. Statement (I): Air pollutant concentration and time of retention increase due to inversion.
Statement (II): During winter, the heavy cold layer in the atmosphere retains the hot toxic pollutants for a longer period in the atmosphere.

Ans: (a)

107. Statement (I): Chlorides are added to kill pathogens as a disinfection process in the treatment of water.
Statement (II): It forms hypochlorous acid to oxidize the organic compounds including bacteria.

Ans: (d)

108. Statement (I): When a tube well penetrates into a homogeneous aquifer and is then pumped, there will occur lowering of water surface. The resultant surface is designated as 'Drawdown curve'.
Statement (II): Since the pressure on the surface of the 'Drawdown curve' is always at atmospheric level, it is called by this name.

Ans: (b)

109. Statement (I): Fluoride concentrations of approximately 1.0 mg/*l* in drinking water help to prevent dental cavities in children.
Statement (II): During formation of permanent teeth, fluoride combines chemically with tooth enamel resulting in softer and weaker teeth that are less resistance to decay.

Ans: (c)

110. Statement (I): Virus is living organisms in a natural environment including soil.
Statement (II): Virus comes to life after entering the host tissue through contamination.

Ans: (d)

111. Statement (I): The BOD test is conducted for 5 days at 20^0C.
Statement (II): The amount of oxygen utilized by microorganisms anaerobically is called BOD.

Ans: (c)

112. Statement (I): An epidemic of infection is hepatitis is transmitted by drinking contaminated water.
Statement (II): Since infective hepatitis is transmitted by bacteria, it can be controlled by filtration and disinfection of water.

Ans: (c)

113. Statement (I): The ability of water to conduct electricity, known and measured as the specific conductance, and concentration of total dissolved solids are not relatable on a one-to-one basis.
Statement (II): Many organic molecules and compounds dissolve in water without ionizing and hence are not taken into account while measuring specific conductance.

Ans: (a)

114. Statement (I): Water with heavy algal growth often has pH values as high as 9 to 10.
Statement (II): Non-utilization of the bicarbonate ion as a carbon source by algae can result in substantial accumulation of OH^- ions.

Ans: (c)

115. Statement (I): Municipal Solid Waste is disposed off in the Transport Safe Disposal Facility (TSDF) to convert it into organic compost.
Statement (II): The organic Municipal Solid Waste is converted into compost by worms; and the process is called ‘Vermicomposting’.

Ans: (a)

116. Statement (I): Chlorophyll-bearing plants take water and carbondioxide to synthesize carbohydrates.
Statement (II): Wasted food ultimately leads to production of various natural resources like water and sunlight energy.

Ans: (c)

117. Statement (I): A curved, or straight, line connecting the relevant stress points is called the stress path.
Statement (II): All the total stress paths and the effective stress paths for the drained tests are straight lines at a slope of 45^0.

Ans: (b)

118. Statement (I): Foundations may not be geometrically categorized as shallow, or deep, foundations.
Statement (II): A foundation is shallow if its depth is equal to or less than its width; otherwise it is deep.

Ans: (a)

119. Statement (I): Different types of piles are used in construction work depending on the type of load to be carried, the sub-soil conditions and the ground water table.
Statement (II): The load transfer mechanism from a pile to the soil is selfsame in all cases.

Ans: (c)

120. Statement (I): Present usage of GPS for positioning includes personal navigation, aircraft navigation, offshore survey, vessel navigation, etc.
Statement (II): GPS is a satellite navigation system designed to provide information about instantaneous velocity and time almost anywhere on the globe at any time and in any weather.

Ans: (a)