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T.B.C. : B-GTD-O-DDB

Test Booklet Series

Serial No.	

TEST BOOKLET

CIVIL ENGINEERING

Paper II

A

Time Allowed : Two Hours

Maximum Marks : 200

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. **PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER AND TEST BOOKLET SERIES CODE A, B, C OR D CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPROPRIATE PLACES IN THE *OMR* ANSWER SHEET. ANY OMISSION/DISCREPANCY WILL RENDER THE ANSWER SHEET LIABLE FOR REJECTION.**
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). 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 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.

    (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 **wrong answer** even if one of the given answers happens 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.

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1. A ship has a metacentric height of 0·90 m and its period of rolling is 20 seconds. The relevant radius of gyration is nearly

   (a) 5·5 m

   (b) 7·5 m

   (c) 9·5 m

   (d) 11·5 m

2. A square gate, 1·5 m × 1·5 m, on one of the vertical sides of a fully filled water tank, has one side on the free water surface. It is hinged on the lower horizontal side and is held in position by a force applied on the vertical central line at a depth of 0·75 m below the free surface. The right magnitude of this force is

   (a) 500 × 9·81 N

   (b) 600 × 9·81 N

   (c) 750 × 9·81 N

   (d) 1000 × 9·81 N

3. A certain water needs alum treatment to the extent of 10 p.p.m. How much alum, in quintals per day, would be needed to treat 10 MLD of water?

   (a) 10

   (b) 1·0

   (c) 100

   (d) 1000

4. The surface tension in a soap bubble of 50 mm diameter with its inside pressure being 2·5 N/m^2 above the atmospheric pressure is

   (a) 0·0125 N/m

   (b) 0·0156 N/m

   (c) 0·2 N/m

   (d) 0·0312 N/m

5. A mercury water manometer has a gauge difference of 0·8 m. The difference in pressure measured in metres of water is

   (a) 0·8

   (b) 1·06

   (c) 10·05

   (d) 8·02

6. A sphere is moving in water with a velocity of 1·6 m/s. Another sphere of twice the diameter is placed in a wind tunnel and tested with air which is 750 times less dense and 60 times less viscous (dynamically) than water. The velocity of air that will model dynamically similar conditions is

   (a) 5 m/s

   (b) 20 m/s

   (c) 10 m/s

   (d) 40 m/s

7. The flow in a river is 1500 cumecs. A distorted model is built with horizontal scale of $\frac{1}{150}$ and vertical scale of $\frac{1}{25}$. The flow rate in the model should be

   (a) 0·04 $m^3 s^{-1}$

   (b) 0·06 $m^3 s^{-1}$

   (c) 0·08 $m^3 s^{-1}$

   (d) 0·10 $m^3 s^{-1}$

8. 10 MLD water is to be chlorinated in a clear water reservoir (CWR) with 0·8 mg/*l* chlorine dose with providing contact time of 40 minutes. The required CWR capacity is nearly

(a) 220 m^3

(b) 280 m^3

(c) 28 m^3

(d) 22 m^3

9. The head over a V-notch at the end of a channel is 75 cm. If an error of 0·15 cm is possible in the measurement of the head, then the percentage error in computing the discharge is

(a) 0·25

(b) 0·5

(c) 0·75

(d) 1·0

10. At a hydraulic jump, the depths at its two sides are 0·3 m and 1·2 m. The head loss in the jump is

(a) 1·0 m

(b) 0·8 m

(c) 0·5 m

(d) 0·45 m

11. Field observations are carried out to assess the discharge of a river. Measurements are taken in a 2000 m straight reach. Slope is approximately 1 in 4000. Bed slope is determinable to a possible accuracy of 0·4 cm; wetted perimeter is determinable within 4% of possible error; and sectional area within 6% of possible error. Using Chezy's equation, the assessed discharge will be accurate to within

(a) 9·6%

(b) 10·8%

(c) 11·4%

(d) 12·7%

12. Consider the following statements in respect of cast iron pipes employed for water supply :

1. Easy to make joints
2. Strong and durable
3. Corrosion resistant
4. Long life

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1, 3 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2, 3 and 4

13. In turbulent flows through rough pipes, the ratio of the maximum velocity to the mean velocity is

(a) 2

(b) $\frac{4}{3}$

(c) 1·1

(d) Dependent on the friction factor

14. Two reservoirs are connected by two pipes P and Q. The pipes have the same diameter and length and are placed in parallel. If the friction factor of P is 9 times that of Q, then the discharge in P to that in Q is

(a) 0·5

(b) 0·45

(c) 0·33

(d) 0·27

15. A sludge had 100 m^3 volume when its moisture content was 95%. What would be its volume if its moisture content changed to 90% ?

(a) 200 m^3

(b) 50 m^3

(c) 94·7 m^3

(d) 105·5 m^3

16. The Sludge Volume Index for mixed liquor having suspended solids concentration of 2000 mg/*l* and showing a settled volume of 200 ml from a one litre sample would be

(a) 0·1

(b) 1000

(c) 100

(d) 10

17. The number of impellers required for a multistage pump to lift 4500 litres/minute against a total head 190 m at a speed of 750 rpm with specific speed not to exceed 700 is

(a) 6

(b) 8

(c) 10

(d) 12

18. A hydraulic turbine has an output of 6000 kW when it works under a head of 25 m and runs at 100 rpm. Then the type of turbine used is

(a) Pelton wheel

(b) Francis

(c) Kaplan

(d) Propeller

19. The velocity heads of water at the inlet and outlet sections of a draft tube are 3·0 m and 0·20 m, respectively. The frictional and other losses in the draft tube are 0·4 m. What is the efficiency of the draft tube ?

(a) 15%

(b) 67%

(c) 86%

(d) 92%

20. Consider the following statements regarding valves in a pipe line :

1. In long pipe lines, air will accumulate in the low point of the line and will interfere with the flow.
2. Pressure relief valves are used in pipe lines where pressure may increase beyond the maximum permissible pressure.
3. Non-return valves prevent water flowing back, i.e. in the opposite direction.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

21. A 4-hour rainfall in a catchment of 250 km^2 produces rainfall depths of 6·2 cm and 5 cm in successive 2-hour unit periods. Assuming the φ index of the soil to be 1·2 cm/hour, the runoff volume is

(a) 1·6 ha-m

(b) 16 ha-m

(c) 160 ha-m

(d) 1600 ha-m

22. Return Period Refers to

(a) The Probability of Exceedance of an event

(b) The Probability of Non-Exceedance of an event

(c) The Inverse of the Probability of Exceedance of an event

(d) The Inverse of the Probability of Non-Exceedance of an event

23. Orographic rain occurs when the air is cooled sufficiently as a result of

(a) lifting due to flow over a mountain barrier

(b) relative movement of two large air masses

(c) violent upthrow of air arising from localized heating

(d) cyclonic conditions

24. A Double-Mass-Curve Analysis is useful in

(a) Consistency Analysis

(b) Frequency Analysis

(c) Storage Computation Analysis

(d) Guessing missing data in cases of non-homogeneous terrain

25. Consider the following steps which are involved in arriving at a unit hydrograph :

1. Separation of base flow
2. Estimating the surface runoff in volume
3. Estimating the surface runoff in depth
4. Dividing surface runoff ordinate by depth of runoff

Which is the correct sequence of these steps ?

(a) 4, 3, 2 and 1

(b) 1, 2, 3 and 4

(c) 4, 2, 3 and 1

(d) 1, 3, 2 and 4

26. Probability of a 10-year flood to occur at least once in the next 5 years is

(a) 35%

(b) 40%

(c) 50%

(d) 65%

27. S-curve Hydrograph is the hydrograph

(a) producing 1 cm of runoff over the basin

(b) of flow from a 1 cm intensity rain of infinite duration

(c) having a volume of 1 cm^3

(d) of the total storm duration in any single storm rainfall

28. Surface Runoff represents the total water

(a) flowing in surface channels after the rainfall

(b) obtained after deducting from rainfall water what has infiltrated and/or evaporated, from the total rainfall

(c) excluding the base flow in surface channels after the rainfall

(d) flown (or flowing) through all channels over a specified period of time

29. Consumptive Use refers to the loss of water as a result of

(a) Evaporation and Transpiration

(b) Crop Water Requirement

(c) Evaporation and Infiltration

(d) Evaporation and Transpiration from the cropped area

30. In a uniform semi-infinite aquifer, the dependable discharge of a lone circular open well is increased most easily by

(a) increasing the diameter

(b) making it into one with a square kerb

(c) deepening the well

(d) providing coarser screening filter

31. In a ski-jump bucket provided in an overflow spillway, the lip angle is 30°, and the actual velocity of flow entering the bucket is 30 m/s. The maximum vertical height attained by the trajectory of the jet, measured above the lip of the bucket, is nearly

(a) 45 m

(b) 35 m

(c) 22 m

(d) 11 m

32. The discharge capacity required at the outlet to irrigate 3000 ha of sugarcane having a *kor* depth of 173 mm and a *kor* period of 30 days is

(a) 2·0 m^3/s

(b) 1·0 m^3/s

(c) 20 m^3/s

(d) 0·20 m^3/s

33. By considering the channel index as $\frac{5}{3}$, the setting of an orifice type irrigation outlet to have proportionality is

(a) 0·90

(b) 0·67

(c) 0·30

(d) 0·15

34. What is the strainer length required for a deep tube well giving a discharge of 8 litres per second ? Assume permissible entrance velocity of 2 cm/second. It is desired to have the strainer of slot sizes 20 mm × 0·2 mm with number of slots per cm length of the strainer as 100.

(a) 8 m

(b) 1 m

(c) 12 m

(d) 10 m

35. The population of a city in the year 2000 was 82,300. If average per cent increase in population per decade is 35%, the population of the city in the year 2020 estimated geometrical increase will nearly be

(a) 1,00,000

(b) 1,25,000

(c) 1,50,000

(d) 1,75,000

36. The different actions that take place in anaerobic decomposition process are

1. Alkaline fermentation
2. Acid fermentation
3. Acid regression
4. Methane formation

What is the correct sequence of these actions (from earlier to later) ?

(a) 4, 3, 1 and 2

(b) 2, 3, 1 and 4

(c) 4, 1, 3 and 2

(d) 2, 1, 3 and 4

37. What is the rapid sand filter surface area required for filtering of 10 MLD water assuming a filtration rate of 100,000 $l/m^2/day$?

(a) 100 m^2

(b) 10 m^2

(c) 1 m^2

(d) 1000 m^2

38. Consider the following statements in respect of slow sand filter and rapid sand filter :

1. The two filters differ in respect of the standards regarding non-uniformity of the sand used in their filtering media.
2. The two filters do not differ in respect of the effective size of the sand used in them.
3. The two filters differ in respect of their respective under-drainage system.
4. The two filters differ in respect of their respective rate of filtration.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 2, 3 and 4

(d) 1, 3 and 4

39. How many kg of bleaching powder is needed per day to chlorinate 4 MLD of water so that, after 40 minutes of contact, there remains residual chlorine of 0·25 mg/*l*. The input water has a chlorine demand of 1·25 mg/*l*, and that the bleaching powder has only 25% available chlorine.

(a) 8 kg

(b) 20 kg

(c) 24 kg

(d) 6·6 kg

40. Which of the following help to prevent water pollution due to land-disposal of waste ?

1. Proper consolidation of waste to reduce pore space and permeability
2. Disposal over impervious strata
3. Layer of impervious soil on the top and the sides of the deposited solid waste

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

41. Consider the following statements in respect of electrostatic precipitators :

1. Power requirement is very small compared to other air pollution control devices and so they are cheaper to perform than other devices.

2. Can handle both gases and mists for high volume flow.

3. Very small particles can be collected, either wet or dry.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

42. Consider the following statements :

1. Ammonia nitrogen is a measure of nitrogen present as ammonium hydroxide and ammonium salts. It will progressively decrease as sewage gets treated.

2. Organic nitrogen is the total nitrogenous matter in sewage excepting that present as ammonia nitrogen, nitrites and nitrates. It becomes ammonia in anaerobic decomposition and nitrites or nitrates in aerobic decomposition.

Which of the above statements is/are correct ?

(a) 1 only

(b) Both 1 and 2

(c) 2 only

(d) Neither 1 nor 2

43. What is the required plan size of a square sedimentation tank (as the primary sedimentation tank in sewage treatment), given that its effective depth is 3 m, and the flow rate is 40 MLD with admissible surface loading of 100,000 $l/m^2/day$?

(a) 23·5 m × 23·5 m

(b) 30 m × 30 m

(c) 20 m × 20 m

(d) 15 m × 15 m

44. Consider the following statements related to ozone :

1. Tropospheric ozone is harmful

2. Stratospheric ozone is beneficial

3. During prevalence of photochemical smog, O_3 is formed

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

45. Consider the following statements related to noise :

1. The range of sound power and sound pressures produced is from 0·0002 μ bars to 10000 μ bars.

2. Human ears do not respond linearly to increase in sound pressures.

3. Regular exposure to moderate noise makes the human ear more resistant to occasional exposures of high-intensity noise.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

46. Consider the following statements in respect of effect of air pollutants on vegetation :

1. Necrosis refers to killing of tissue

2. Chlorosis refers to loss or reduction of green plant pigment

3. Leaf abscission refers to the dropping of leaves

4. Leaf epinasty refers to a downward curvature of a leaf due to a higher rate of growth on the upper surface

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1, 2, 3 and 4

(c) 2, 3 and 4 only

(d) 1, 2 and 4 only

47. A soil deposit has a void ratio of 1·0. If the void ratio is reduced to 0·60 by compaction, the percentage volume loss is

(a) 10%

(b) 20%

(c) 30%

(d) 40%

48. The specific gravity of a soil sample is 2·7 and its void ratio is 0·945. When it is fully saturated, the moisture content of the soil will be

(a) 25%

(b) 30%

(c) 35%

(d) 40%

49. If the co-efficient of permeability is doubled and the co-efficient of volume compressibility is simultaneously halved, the co-efficient of consolidation

(a) increases by 2 times

(b) decreases by 2 times

(c) increases by 4 times

(d) decreases by 4 times

50. Consider the following statements :

Lime stabilization of soil leads to

1. Decrease in shrinkage limit
2. Increase in plastic limit
3. Decrease in liquid limit
4. Flocculation of clay particles

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 1, 3 and 4

(d) 2, 3 and 4

51. Arrange the following soils with respect to increasing order of realizable friction ratio :

1. Loose gravel fill
2. Sands or gravels
3. Clay sand mixtures and silts
4. Clays and peats

(a) 1, 2, 3 and 4

(b) 4, 2, 3 and 1

(c) 1, 3, 2 and 4

(d) 4, 3, 2 and 1

52. In a 7 m thick soil stratum, with its initial void ratio of 0·40, the void ratio decreases to 0·30 when the effective pressure on the stratum is increased by 1·0 kg/cm^2. The consolidation settlement of the stratum will be

(a) 5 cm

(b) 50 cm

(c) 100 cm

(d) 150 cm

53. A footing 1 m × 1 m in size rests on the surface of an infinite layer of soil. It is subjected to a load of 600 kN. What is the immediate settlement of the soil by considering Eu = 2·0 MPa, N = 0·5 and influence factor = 0·95 ?

(a) 22·5 mm

(b) 25·5 mm

(c) 27·5 mm

(d) 30·0 mm

54. A stratum of soil consists of three layers of equal thickness. The permeability of both the top and the bottom layers is 10^{-4} cm/s; and that of the middle layer is 10^{-3} cm/s; then the value of the horizontal coefficient of permeability for the entire composite of the soil layers is

(a) 2×10^{-4} cm/s

(b) 3×10^{-4} cm/s

(c) 4×10^{-4} cm/s

(d) 5×10^{-4} cm/s

55. Consider the following statements regarding the overflow rate of a sedimentation tank :

1. Temperature of water affects the overflow rate
2. Size of particle intended to be removed does not affect the overflow rate
3. Density of particle intended to be removed affects the overflow rate

Which of the above statements are correct ?

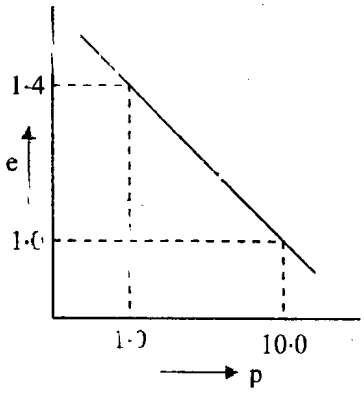
(a) 1 and 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

56.



The virgin compression curve for a particular soil is as shown in the above figure on the standard graphical format. The compression index of the soil is

(a) 0·3

(b) 0·4

(c) 0·5

(d) 0·6

57. In a triaxial compression test, the major principal stress was 90 kPa and the minor principal stress was 30 kPa, at failure. The pore pressure at failure was observed to be 10 kPa. The tangent of the angle of shearing resistance of the sandy soil that was tested was

(a) $\frac{1}{2}$

(b) $\frac{1}{3}$

(c) $\frac{2}{3}$

(d) $\frac{3}{4}$

58. A cylindrical soil specimen of saturated clay, 3·50 cm diameter and 8 cm length, is tested in an unconfined compression testing machine. The specimen failed under a vertical load of 50 kg together with an accompanying additional deformation of 8 mm. What is the unconfined compressive strength of this clay ?

(a) 4·67 kg/cm^2

(b) 5·0 kg/cm^2

(c) 5·5 kg/cm^2

(d) 6·0 kg/cm^2

59. Consider the following statements related to the properties of a good quality soil sample :

1. Area ratio should be low
2. Cutting edge should be thick
3. Inside clearance should be high
4. Outside clearance should be low

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

60. Consider the following statements regarding biochemical oxygen demand (BOD) of river water :

1. The BOD rate constant varies with river water temperature
2. The BOD rate constant does not depend on the BOD of the river water
3. The BOD rate constant is often different for different river waters
4. The BOD rate constant cannot be determined in a laboratory

Which of the above statements are correct ?

(a) 1 and 4

(b) 1 and 3

(c) 2 and 3

(d) 2 and 4

61. The time taken to construct a building was from April 1992 to September 1993. In September 1996, the average settlement was found to be 5·16 cm. If the ultimate settlement is estimated to be 25 cm, then the settlement in January 1997 would have been

(a) 6 cm

(b) 7 cm

(c) 8 cm

(d) 9 cm

62. Consider the following statements :

1. The proportioning of footing in sand is more often governed by settlement rather than by bearing capacity.
2. The pressure bulb profiles under a strip footing form as co-axially imaginable bulbs under its length.
3. Friction piles are also called 'floating piles'

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

63. Which of the following factors affect the bearing capacity of cohesive soils ?

1. Density of the soil
2. Angle of shearing resistance of the soil
3. Depth of the footing
4. Width of the footing

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2, 3 and 4

64. Consider the following statements :

1. The required yield of a retaining wall to reach equilibrium in the active case is less than for the passive case.

2. The active pressure caused by a cohesionless backfill on a smooth vertical retaining wall may be reduced by compacting the backfill.

3. Given a choice, one should prefer a cohesive soil for a backfill vis-a-vis a non-cohesive soil.

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

65. Consider the following statements :

Problems regarding foundations to be constructed in expansive soils are solved by

1. Resorting to light foundation pressure

2. Using under-reamed piles for light loads

3. Making the structure rigid enough so that settlement and uplift would not affect them

4. Providing a well-designed basement with the foundation below the neutral point

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 4

(c) 1 and 3

(d) 2 and 3

66. Which of the following tests are essential for designing a foundation on expansive soils ?

1. Swelling pressure test

2. Free swell test

3. Estimation of differential free swell

4. Shrinkage limit test

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 1, 2, 3 and 4

(d) 2, 3 and 4 only

67. Consider the following statements :

The general principles of surveying are

1. To work from part to whole

2. To locate a new station by measurements from at least two fixed reference points already established and/or identifiable

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

68. Consider the following statements :

1. Dynamic resistance of a soil is not much different from its static resistance
2. The most comprehensive pile driving formula is Hiley's formula
3. Pile driving formulae are more useful if the subsoil consists of coarse grained soils

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

69. The Whole Circle Bearing of line *AB* is 50° and of line *BC* is 120°. The deflection angle at *B* from *AB* to *BC* is

(a) 50°

(b) 70°

(c) 110°

(d) 120°

70. The levelling staff held at a distance of 200 m is read at 4·54 m with the bubble out of centre by 2 divisions towards the observer. If the sensitiveness of the bubble is 25 secs/division, and 1 division = 2 mm, then actual staff reading must have been

(a) 4·5 m

(b) 4·492 m

(c) 4·54 m

(d) 4·62 m

71. In a levelling survey, the summation of all backsights and the summation of all foresights are 7·475 m and 7·395 m, respectively. The reduced level of the initial benchmark is 100·000 m. The reduced level of the last point where the staff is held will be

(a) 100·000 m

(b) 100·080 m

(c) 107·395 m

(d) 107·475 m

72. Consider the following statements regarding excreta disposal without water carriage system :

1. Pit-Privy is a pit in the ground with the toilet seat located directly over it.
2. Bore-Hole Latrines do not cause nuisance due to flies and odour.
3. Aqua-Privy works on the same principle as a septic tank.
4. In the context of a Bore-Hole Latrine, a pit of about 30 cm to 40 cm diameter is dug to a depth of 4 m to 8 m.

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 2 and 4 only

(c) 1, 3 and 4 only

(d) 1, 2, 3 and 4

73. Which of the following minor instruments are used for setting out right angles in chain surveying ?

1. Cross staff
2. Optical square
3. Prism square
4. Auto level

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 3

(d) 2, 3 and 4 only

74. Regarding a Prismatic Compass, which one of the following statements is correct ?

(a) The object is sighted first. The observer then moves to the side of the object vane to take the reading

(b) Sighting and reading are done simultaneously

(c) The readings are taken from the north end

(d) The compass has an edge bar needle

75. With regard to Trigonometric Levelling, which one of the following statements is correct at its simplest applications ?

(a) Determination of the elevations of stations is based on the observed vertical angles and the horizontal distances

(b) Determination of the horizontal distances is based on the observed vertical angles

(c) Determination of the vertical angles is based on the observed horizontal distances

(d) Determination of the horizontal distances is based on the observed vertical angles and the measured elevations

76. Consider the following statements :

1. The component of the distance between two points measured in the north-south direction is called the latitude of the line, between the points
2. The component of the distance between two points measured in the east-west direction is called the departure of the line, between the points
3. The latitude is considered as positive when reckoned southward
4. The departure is considered as negative when reckoned westward

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 2, 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

77. For minor adjustments of horizontal angles measured using a theodolite, the tangential screw is adjusted after

(a) both the plates are unclamped

(b) the lower plate is clamped and the upper plate is unclamped

(c) the upper plate is clamped and the lower plate is unclamped

(d) both the plates are clamped

78. Consider the following statements regarding ecology :

1. Climax ecosystem is a stage in the evolution of an ecosystem, at which all the species are in dynamic equilibrium among themselves as also with the environment.

2. Ecological niche means all the physical, chemical and biological factors that a species needs in order to live and reproduce exist.

3. Edge effect refers to the presence of rich and unique biological diversity found in an ecotone.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

79. For better accuracy in measuring and plotting the sides of a triangle by triangulation, the angles of the triangle

(a) should not be more than 30°

(b) should not be less than 30° or more than 120°

(c) are not restricted in magnitude

(d) should not be less than 120°

80. To uniquely determine the position of the user using GPS, one needs to receive signals from at least

(a) 1 satellite

(b) 2 satellites

(c) 3 satellites

(d) 4 satellites

81. Which one of the following Remote Sensing Systems employs only one detector ?

(a) Scanning

(b) Framing

(c) Electromagnetic spectrum

(d) All of the above

82. The maximum superelevation to be provided on a road curve is 1 in 15. If the rate of change of superelevation is specified as 1 in 120 and the road width is 10 m, then the minimum length of the transition curve on each end will be

(a) 120 m

(b) 100 m

(c) 80 m

(d) 180 m

83. A four-lane divided highway, with each carriageway being 7·0 m wide, is to be constructed in a zone of high rainfall. In this stretch, the highway has a longitudinal slope of 3% and is provided a camber of 2%. What is the hydraulic gradient on this highway in this stretch ?

(a) 4·0%

(b) 3·6%

(c) 4·5%

(d) 3·0%

84. In an area of heavy rainfall, a State Highway of high-type bituminous surface with four lanes (14·0 m wide) is to be constructed. What will be the height of the crown of the road relative to the edges for a composite camber (i.e. middle half as parabolic and the rest as straight lines) ?

(a) 14 cm

(b) 21 cm

(c) 28 cm

(d) 7 cm

85. Consider the following statements :

1. Effective stress in a sand layer below a lake with standing water does not alter as the water level fluctuates.

2. Regarding water table below the ground surface, any rise in the water table causes equal changes in both pore pressure and effective stress.

3. Capillary saturation will cause the effective stress to increase.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

86. A descending gradient of 4% meets an ascending grade of 1 in 20 where a valley curve of length 200 m is to be formed. What will be the distance of the lowest point on the valley curve from its first tangent point ?

(a) 100 m

(b) 111 m

(c) 125 m

(d) 118 m

87. What will be the non-passing sight distance on a highway for a design speed of 100 kmph when its ascending gradient is 2% ? Assume coefficient of friction as 0·7 and brake efficiency as 50%.

(a) 176 m

(b) 200 m

(c) 150 m

(d) 185 m

88. Consider the following statements :

1 The ultimate bearing capacity of a footing on sand increases with an increase in its width.

2. The settlement of the footing on sand increases with increase in its width.

Which of the above statements are correct ?

(a) 1 only

(b) Both 1 and 2

(c) 2 only

(d) Neither 1 nor 2

89. The duration of green time in a traffic signal depends on

(a) traffic density

(b) traffic volume

(c) traffic speed

(d) All of the above

90. What will be the theoretical maximum capacity (to nearest 10 units) for a single lane of highway given that the speed of the traffic stream is 40 kmph ?

(a) 3000 veh/h

(b) 2860 veh/h

(c) 2010 veh/h

(d) 2510 veh/h

91. The lowest height above the runway where the pilots make the decision to continue the landing manoeuvre or to cut it short is called the

(a) Runway height

(b) Decision height

(c) Threshold height

(d) Runway visual range

92. What would be the admissible gradient for a BG track when the grade resistance coupled with a 4° curve resistance shall equal the resistance due to a ruling gradient of 1 in 200 ?

(a) 0·30%

(b) 0·40%

(c) 0·24%

(d) 0·34%

93. In the layout of an MG track, the versine of a horizontal circular curve is measured over a 11·8 m chord length. What would be the radius of the curve if the value of the versine was 2 cm ?

(a) 900 m

(b) 800 m

(c) 870 m

(d) 850 m

94. What will be the optimum depth of ballast cushion required for a BG railway track below the sleepers with sleeper density of (M + 5) and bottom width of 22·22 cm ?

(a) 25 cm

(b) 21 cm

(c) 28 cm

(d) 30 cm

95. Which one of the following items of hill road construction does not help in the prevention of landslides during the monsoon season ?

(a) Breast walls

(b) Hair-pin bends

(c) Catch-water drains

(d) Retaining walls

96. The radius of a horizontal circular curve is 480 m and design speed therein 70 kmph. What will be the equilibrium superelevation for the pressures on the inner and the outer wheels to be equal ?

(a) 5%

(b) 6%

(c) 7%

(d) 8%

97. The runway length for an airport located at 450 m above MSL, corrected for elevation, is 3670 m. The monthly means of maximum and mean daily temperatures for the hottest month of the year are 27°C and 18°C, respectively. What will be the final corrected length of the runway with correction incorporated also due to temperature effects ?

(a) 4500 m

(b) 4000 m

(c) 3750 m

(d) 3400 m

98. The magnetic azimuth of one end of a runway is 80° measured clockwise from the magnetic north. The other end of the runway will be numbered as

(a) 16

(b) 24

(c) 26

(d) 8

99. What will be the initial traffic after construction, in commercial vehicles per day (CVD) for the following data ?

Annual average daily traffic at last count = 400 CVD

Rate of traffic growth per annum = 7%

The road is proposed to be completed in 3 years

(a) 500

(b) 421

(c) 490

(d) 449

100. What shall be the radius of an exit taxiway with design exit speed of 90 kmph and coefficient of friction 0·13 ?

(a) 550 m

(b) 500 m

(c) 475 m

(d) 449 m

Directions :

Each of the next **Twenty (20)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes 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) : Open channel flow in a channel is said to be critical when the specific force is maximum for a given discharge.

Statement (II) : Direct integration for steady non-uniform flow by Bresse's method was developed for very wide rectangular channels.

102. Statement (I) : A moving hydraulic jump is called a surge.

Statement (II) : The travel of a wave is faster in the upper portion than in the lower portion in case of positive surges.

103. Statement (I) : Total energy line and the hydraulic gradient line for a pipe flow cannot intersect each other

Statement (II) : The vertical differences between these two lines must equal the velocity head.

104. Statement (I) : In a reciprocating pump, the piston is considered to be moving with simple harmonic motion on the assumption that the connecting rod is very large compared to the crank length.

Statement (II) : There is acceleration at the beginning and retardation at the end of each stroke.

105. Statement (I) : Possibility of cavitation is an important consideration in the selection of a turbine for a given head and a range of corresponding specific speed.

Statement (II) : High-speed turbines are used for high heads.

106. Statement (I) : By providing Air Vessels on the suction and delivery sides of a reciprocating pump, it is possible to increase the delivery head of the pump.

Statement (II) : The Air Vessel terminates the acceleration head and contributes to the outgoing discharge becoming reasonably steady and uniform.

107. Statement (I) : If the soil moisture is only slightly more than the wilting coefficient, the plant must expend extra energy to obtain the water; and hence the plant will not grow healthily.

Statement (II) : Excessive water supply retards plant growth.

108. Statement (I) : Dracontiasis is transmitted by drinking contaminated water.

Statement (II) : Dracontiasis can be controlled by filtration of the drinking water.

109. Statement (I) : Coagulation is the process of charge neutralization on colloids.

Statement (II) : Flocculation is the process to grow the chargeless colloids into settleable flocs.

110. Statement (I) : The flow in water distribution pipes takes place due to gravity.

Statement (II) : The flow in sewers takes place due to gravity.

111. Statement (I) : Anaerobic digestion of sewage is unsuitable in the vicinity of a crowded locality.

Statement (II) : Aerobic digestion of sewage is costly but is suitable at a crowded locality.

112. Statement (I) : Duty of drip irrigation is very high.

Statement (II) : Losses are least in drip irrigation.

113. Statement (I) : An alluvial channel is defined as a channel in which the flow transports sediment of the same physical characteristics as the material in the wetted surface of the channel.

Statement (II) : This ensures that the channel cross-section and the channel slope do not change.

114. Statement (I) : The excavation of side slope of an irrigation canal for clayey type of soil should be made at 1 : 1 (i.e. 1 horizontal to 1 vertical) which is taken as nearly equal to the angle of internal friction of the soil.

Statement (II) : The angle of internal friction represents the stable slope when the excavated soil, or soil in loose conditions, assumes when dumped in situ.

115. Statement (I) : Composting is basically a treatment method for inorganic waste from a community.

Statement (II) : In the incineration method of refuse disposal, the refuse is burnt off and the volume is much reduced.

116. Statement (I) : Gases are normally formless fluids and can be changed to liquid or solid states by change of temperature and pressure.

Statement (II) : Smog refers to the occurrence of a heavy, cloudy, hazy floating layer in the atmosphere formed by a mixture of smoke, dust, fog and mist.

117. Statement (I) : The specific speed (N_S) of a centrifugal pump is defined as the speed (in rpm) at which it works most efficiently.

Statement (II) : The specific speed is a characteristic of pumps that can be used as a basis for comparing the performance of centrifugal pumps.

118. Statement (I) : Permanent lowering of ground water table results in settlement of foundations.

Statement (II) : Increase in effective stress does not result in settlement of strata.

119. Statement (I) : Boussinesq equation is not suitable for sedimentary deposits.

Statement (II) : Sedimentary deposits do not represent an isotropic-cum-homogeneous system.

120. Statement (I) : In cohesive soils, the ultimate bearing capacity is independent of foundation width.

Statement (II) : The ultimate bearing capacity of cohesive soils increases with depth below ground level.

SPACE FOR ROUGH WORK

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