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EXAMINATION-2014

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T.B.C. : B-DMHH-N-DFB

Test Booklet Series

A

Serial

4209

TEST BOOKLET

CIVIL ENGINEERING

PAPER II

Time Allowed : Two Hours ***Maximum Marks : 200***

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1. The standard atmospheric pressure is 101·32 kPa. The local atmospheric pressure is 91·52 kPa. If a pressure at a flow path is recorded as 22·48 kPa (gauge), it is equivalent to

(a) 69·04 kPa (abs)

(b) 88·84 kPa (abs)

(c) 114·0 kPa (abs)

(d) 123·0 kPa (abs)

2. A rectangular pontoon has a width of 6 m, a length of 12 m, and a draught of 1·5 m in fresh water (density = 1000 kg/m^3). Its draught in sea water having density of 1025 kg/m^3 is

(a) 1·04 m

(b) 1·24 m

(c) 1·46 m

(d) 1·50 m

3. The velocity distribution in a laminar flow adjacent to a solid wall is given by u = 3·0 sin (5πy). The viscosity of the fluid is 5 poise. What is the shear stress at a section (i) y = 0·05 m; (ii) y = 0·12 m ?

(a) 16·7 N/m^2 and 6·1 N/m^2

(b) 33·4 N/m^2 and Zero

(c) 16·7 N/m^2 and 12·3 N/m^2

(d) 16·7 N/m^2 and Zero

4. A horizontal venturimeter with inlet diameter of 30 cm and throat diameter of 15 cm is used to measure the flow of water. The reading on a differential manometer connected to the inlet and the throat is 20 cm of mercury. If C_d = 0·98, the rate of flow is nearly

(a) 12·5 *l*/s

(b) 25 *l*/s

(c) 125 *l*/s

(d) 250 *l*/s

5. In order to estimate the energy loss in a pipeline of 1 m diameter through which kerosene of specific gravity 0·80 and dynamic viscosity 0·02 poise is to be transported at the rate of 2 m^3/s, model tests were conducted on a 0·1 m diameter pipe using water at 20°C. If the absolute viscosity of water at 20°C is 1·00 × 10^{-2} poise, then the discharge required for the model pipe would be

(a) 60 *l*/s

(b) 80 *l*/s

(c) 120 *l*/s

(d) 160 *l*/s

6. For a hydraulically efficient rectangular channel of bed width 5 m, the hydraulic radius is equal to

(a) 2·5 m

(b) 1·25 m

(c) 5 m

(d) 2 m

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7. A two-dimensional water jet strikes a fixed two-dimensional plate at 30° to the normal to the plate. This causes the jet to split into two streams in which the ratio of larger discharge to smaller discharge is

(a) 14·0

(b) 3·0

(c) 2·0

(d) 1·0

8. A triangular open channel has a vortex angle of 90° and carries flow at a critical depth of 0·3 m. The discharge in the channel is

(a) 0·41 m^3/s

(b) 0·11 m^3/s

(c) 0·21 m^3/s

(d) 0·31 m^3/s

9. At a hydraulic jump, the depths at the two sides are 0·3 m and 1·4 m. The head loss in the jump is nearly

(a) 1·0 m

(b) 0·95 m

(c) 0·79 m

(d) 0·45 m

10. It is expected that due to extreme cold weather, the entire top surface of canal carrying water will be covered with ice sheet for some days. If the discharge in the canal were to remain unaltered, this condition would lead to

(a) No change in the depth of flow

(b) Decrease in the depth of flow

(c) Gradually decreasing flow

(d) Increase in the depth of flow

11. Consider the following statements regarding a gradually varied flow in a prismatic open channel :

1. Total energy line remains parallel to the water surface.

2. The rate of energy loss at the section is inversely proportional to d^x where d is flow depth with index x.

3. In analyzing the flow, the energy equation of flow is not applicable.

4. Pressure distribution at every section can be assumed to be hydrostatic.

Which of the above statements are correct ?

(a) 1 and 4

(b) 2 and 4

(c) 1 and 2

(d) 2 and 3

12. In a laminar flow through a circular pipe of diameter 200 mm, the maximum velocity is found to be 1 m/s. The velocity at a radial distance of 50 mm from the axis of the pipe will be

(a) 0·50 m/s

(b) 0·25 m/s

(c) 0·75 m/s

(d) 1·25 m/s

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13. A liquid of density ρ and bulk modulus K flows with a mean velocity V in a long rigid pipe of diameter D. A sudden closure of a valve at the downstream end of the pipe will produce a maximum water hammer head of

(a) $\frac{V\sqrt{\rho}}{g\sqrt{K}}$

(b) $\frac{V\sqrt{g}}{\rho\sqrt{K}}$

(c) $\frac{V\sqrt{K}}{g\sqrt{\rho}}$

(d) $\frac{V\rho}{\sqrt{gK}}$

14. A centrifugal pump lifts 100 *l*/s of a liquid against a net head of 150 kPa. The brake power required is 18·0 kW when the liquid is water with a specific weight of 9·8 kN/m^3. What would be the brake power if the liquid is a solvent having a relative density of 0·8 instead of water, with all other factors remaining the same as before ?

(a) 14·4 kW

(b) 18·0 kW

(c) 22·5 kW

(d) 17·2 kW

15. For circular cylinders, with Reynolds number greater than 1000, how would the Strouhal number behave ?

(a) Varies as $Re^{\frac{1}{6}}$

(b) Varies as $Re^{\frac{1}{4}}$

(c) Almost $\approx$ 0·16

(d) Constant at 0·21

16. A centrifugal pump has its impeller of 50 cm diameter at inlet, and it rotates at 1200 rpm. The tangential velocity of the impeller at the inlet is

(a) 16π m/s

(b) 10π m/s

(c) 12π m/s

(d) 100π m/s

17. The following data were noted from an irrigation field :

1. Field capacity = 20%
2. Permanent wilting point = 10%
3. Permissible depletion of available soil moisture = 50%
4. Dry unit weight of soil = 15 kN/m^3
5. Effective rainfall = 50 mm

The net irrigation requirement per metre depth of soil will be

(a) 75 mm

(b) 125 mm

(c) 50 mm

(d) 25 mm

18. In a Francis turbine, the runner blades are radial at the inlet and the discharge leaves the runner radially at the exit. For this turbine

(a) The relative velocity is radial at the outlet

(b) The absolute velocity is radial at the outlet

(c) The guide vane angle is 90°

(d) The velocity of flow is constant

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19. Consider the following statements :

1. The normal annual rainfall of a station is obtained as the arithmetic average of the successive annual rainfall in the last 30 years.
2. The "normal rainfalls" are updated by deleting the needful number of oldest years' data from the record and adding the needful number of most recent years' data to the record.
3. The standard deviation computed for the rainfall of the same 30 years of rainfall data is taken as a measure of the variability of the rainfall during the self-same set of years.
4. If the observed rainfall in any year is less than the current normal annual rainfall, then that year is called a dry year.

Which of the above statements are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 2 and 4 only

(d) 1, 3 and 4 only

20. The double mass analysis is adopted to

(a) Estimate the missing rainfall data

(b) Obtain intensities of rainfall at various durations

(c) Check the consistency of data

(d) Obtain the amount of storage needed to maintain a demand pattern

21. The successive annual rainfall magnitudes at a place for a period of 10 years from 2001 to 2010, both inclusive, are 30·3, 41·0, 33·5, 34·0, 33·3, 36·2, 33·6, 30·2, 35·5 and 36·3 cm. The mean and median values of this annual rainfall series are, respectively

(a) 33·8 cm and 34·39 cm

(b) 34·39 cm and 33·8 cm

(c) 34·39 cm and 40·2 cm

(d) 33·8 cm and 40·2 cm

22. The peak magnitude of a flood hydrograph during 4-hr study duration over a catchment is 300 m^3/s. The total depth of rainfall is 6 cm; and the infiltration loss during the said 4-hr period is 2 cm. A constant uniform base flow of 20 m^3/s is premised throughout. The peak value of the corresponding 4-hr unit hydrograph is

(a) 75 m^3/s

(b) 70 m^3/s

(c) 50 m^3/s

(d) 40 m^3/s

23. The rainfall on 5 successive days in a catchment was 2, 7, 8, 4 and 3 cm. If the φ index for the storm is 3 cm/day, the total direct runoff volume generated from a 195 km^2 catchment is

(a) 19·5 M m^3

(b) 23·4 M m^3

(c) 15·6 M m^3

(d) 32·5 M m^3

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24. The best estimate of runoff represented by 57 mm of runoff depth from a basin area 3300 km^2 is nearly

(a) 2300 cumec-days

(b) 2225 cumec-days

(c) 2175 cumec-days

(d) 2020 cumec-days

25. The probability of a 10-year flood to occur at least once in the next 5 years is

(a) 35%

(b) 41%

(c) 60%

(d) 65%

26. That extreme flood that is physically possible in a region from a severe-most combination, including rare combination of meteorological and hydrological factors, is designated as the

(a) Design flood

(b) Standard project flood

(c) Probable maximum flood

(d) Flash flood

27. When 3·5 million m^3 of water was pumped out from an unconfined aquifer of 6·3 km^2 areal extent, the water table was observed to go down by 2·5 m. The specific yield of the aquifer is best approximated as

(a) 32%

(b) 28%

(c) 25%

(d) 22%

28. For an irrigated field having : Field capacity = 30%, Permanent wilting point = 10%, Permissible depletion of available moisture = 40%, Dry weight of soil = 14·70 kN/m^3, Unit weight of water = 9·8 kN/m^3 and Effective rainfall = 30 mm, what is the net irrigation requirement per meter depth of soil ?

(a) 300 mm

(b) 150 mm

(c) 120 mm

(d) 90 mm

29. A lift irrigation scheme using a discharge of 96 m^3/hr is planned to raise a crop with an average Δ of 0·375 m. Intensity of irrigation is 60%. Assuming 3600 hours of working of the tubewell for a year, the culturable command area is

(a) 96 Ha

(b) 48 Ha

(c) 144 Ha

(d) 120 Ha

30. A field measures 40 hectares. When 8 cumecs of water was supplied for 6 hours, 30 cm of water was stored in the root zone. The field application efficiency is nearly

(a) 70%

(b) 80%

(c) 85%

(d) 90%

31. A direct runoff hydrograph due to a storm idealized into a triangular shape has a peak flow rate of 60 m^3/s occurring at 25 hours from its start. If the base width of this hydrograph is 72 hours, and the catchment area is 777·6 km^2, the runoff from the storm is

(a) 1 cm

(b) 2 cm

(c) 5 cm

(d) 10 cm

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32. A tubewell of 30 cm diameter penetrates fully into an artesian aquifer. The strainer length is 15 m. The yield from the well under a drawdown of 3 m through the aquifer consisting of sand of effective size of 0·2 mm and coefficient of permeability of 50 m/day, with radius of drawdown of 150 m, is nearly

(a) 240 *l*/s
(b) 120 *l*/s
(c) 24 *l*/s
(d) 12 *l*/s

33. An unconfined aquifer of porosity 35%, permeability 40 m/day, and specific yield of 0·15 has an area of 100 km^2. If the water table falls uniformly throughout the aquifer area by 0·2 m during a drought, the volume of water lost from storage is

(a) 1·5 Mm^3
(b) 3·0 Mm^3
(c) 7·0 Mm^3
(d) 8·0 Mm^3

34. Ground water flows through an aquifer with a cross-sectional area of $1{\cdot}0 \times 10^4$ m^2 and a length of 1500 m. Hydraulic heads are 300 m and 250 m at the ground water entry and exit points in the aquifer respectively. Ground water discharge into stream is at the rate of 1500 m^3/day. The corresponding hydraulic conductivity of this aquifer will be

(a) 3·5 m/day
(b) 4·5 m/day
(c) 5·0 m/day
(d) 5·5 m/day

35. Consider a wide rigid-boundary canal with bed slope of 0·004, Manning's n = 0·18, and depth of flow = 0·88 m. The average boundary shear stress will be

(a) 17·2 N/mm^2
(b) 18·2 N/mm^2
(c) 19·2 N/mm^2
(d) 16·2 N/mm^2

36. If the direction of advance of a storm is the same as the direction of the resulting runoff in the drainage basin, such runoff will generally

(a) Be more than the 'rational' runoff through a short time
(b) Result in increased infiltration through a short time
(c) Be less than the 'rational' runoff through a short time
(d) Result in increased evaporation, as also transpiration, loss

37. In a Lacey regime channel :

1. The bed load is zero.
2. The suspended load is zero.
3. The bed slope is a function of the full supply discharge and the silt size.

Which of the above statements is/are correct ?

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

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38. A regime canal carries silt of median size 0·25 mm. The Lacey's silt factor of this silt is

(a) 0·66

(b) 0·88

(c) 0·44

(d) 0·22

39. A channel designed by Lacey's theory has a velocity of 0·88 m/sec. The silt factor is 1·1. Then hydraulic mean depth will be

(a) 1·95 m

(b) 1·76 m

(c) 1·63 m

(d) 1·50 m

40. At the base of a gravity dam section, the vertical stress at the toe was found to be 2·4 MPa. If the downstream face of the dam has a slope of 0·707 horizontal : 1 vertical, and if there is no tail water, the maximum principal stress at the toe of the dam is

(a) 1·7 MPa

(b) 2·4 MPa

(c) 3·6 MPa

(d) 4·8 MPa

41. The top width and the bottom width at river thalweg level of a concrete gravity dam are 6 m and 24 m respectively. The vertical section of the dam at the thalweg alignment is 38 m above the thalweg. The upstream face is vertical and the depth of water on the upstream side is 36 m. The moment of hydrostatic force about the toe at that level is

(a) 77760 kN-m

(b) 25292 kN-m

(c) 6480 kN-m

(d) 51840 kN-m

42. Which of the following outlets are of semi-modular type ?

1. Khanna's module
2. Adjustable proportional module
3. Submerged pipe outlet
4. Open flume outlet
5. Kennedy's gauge outlet

(a) 2, 4 and 5

(b) 1, 2 and 4

(c) 2, 3 and 5

(d) 3, 4 and 5

43. If the channel index at an irrigation outlet is 5/3, "setting" of an orifice type outlet in order to have proportionality is

(a) 0·90

(b) 0·67

(c) 0·30

(d) 0·15

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44. The total hardness value obtained from the complete analysis of a water sample was found to be 120 mg/*l*. If the value of carbonate hardness is 50 mg/*l*, the non-carbonate hardness and alkalinity are, respectively

(a) 170 mg/*l* and 70 mg/*l*

(b) 170 mg/*l* and 50 mg/*l*

(c) 70 mg/*l* and 50 mg/*l*

(d) 50 mg/*l* and 70 mg/*l*

45. Population levels over 5 decades of a small town are given below.

Year	Population
1960	2,50,000
1970	2,80,000
1980	3,40,000
1990	4,20,000
2000	4,90,000

The population of the town in the year 2020 estimated by Arithmetic Increase method will be

(a) 5,10,000

(b) 5,90,000

(c) 6,10,000

(d) 6,90,000

46. The dissolved oxygen in a water sample is generally estimated by modified Winkler method. Accordingly, approximately 200 ml volume of dissolved-oxygen-fixed solution shall be titrated with

(a) Sodium thiosulphate reagent using soluble starch as an indicator

(b) Sodium thiosulphate reagent using ferroin as an indicator

(c) Ferrous ammonium sulphate reagent using soluble starch as an indicator

(d) Ferrous ammonium sulphate reagent using ferroin as an indicator

47. A water treatment plant treats 6000 m^3 of water per day. If it consumes 20 kg chlorine per day, then the chlorine dosage would be

(a) 3·00 mg/*l*

(b) 3·75 mg/*l*

(c) 4·25 mg/*l*

(d) 3·33 mg/*l*

48. When a turbid stream flows into the ocean, the ionic content of the water increases drastically. This causes coagulation and settling which leads to formation of deposits (deltas). Such coagulation mechanism is called

(a) Adsorption and charge neutralization

(b) Interparticle bridging

(c) Ionic layer compression

(d) Sweep coagulation

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49. A rapid sand filter for a town with water requirement of 1 MLD is to be provided with rate of filtration at 4000 $l/hr/m^2$, with backwash system. What would be the size of the filter and its underdrainage system to the nearest approximation ?

(a) 10 and 0·032 sq. m

(b) 11 and 0·022 sq. m

(c) 12 and 0·045 sq. m

(d) 15 and 0·062 sq. m

50. Consider the following statements in respect of injecting chlorine between rapid sand filter and storage tank :

1. More contact time is available.
2. Chlorine demand is reduced.
3. $NHCl_2$ is formed which is more effective than residual chlorine.
4. Break point chlorination takes place.

Which of the above statements are correct ?

(a) 1, 2, 3 and 4

(b) 1, 2 and 3 only

(c) 1 and 2 only

(d) 3 and 4 only

51. What is the settling velocity of a discrete particle in a wide body of water when the relevant Reynolds number is less than 0·5 ? The diameter and specific gravity of the particle are 2×10^{-3} cm and 2·65, respectively. Water temperature is 20°C. (Kinematic viscosity = 2×10^{-2} cm^2/sec.)

(a) 0·018 cm/sec

(b) 0·025 cm/sec

(c) 0·18 cm/sec

(d) 0·25 cm/sec

52. If the length dimension of a square filter bed increases to two times (while the rate of filtration remains unchanged), the amount of water filtered would become

(a) 4 times

(b) 2 times

(c) 1 time

(d) 16 times

53. If the average sewage from a city is 95×10^6 l/day and the average 5-day BOD is 300 mg/l against a standard of 75 mg/day per capita at 20°C, then the population equivalent of the city will be

(a) 28,500

(b) 285×10^6

(c) 3,80,000

(d) 380×10^6

54. As per Manual on Sewerage and Sewage Treatment, Central Public Health and Environmental Engineering Organization, Ministry of Urban Development, Government of India, when a sewer connects with another sewer having a difference of 600 mm in level between the water lines (peak flow levels) of main line and the invert level of branch line, the connection may be provided using a

(a) Side entrance manhole

(b) Junction manhole

(c) Flushing manhole

(d) Drop manhole

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

(a) Aerobic and endogenous metabolism
(b) Anaerobic and exogenous metabolism
(c) Anaerobic and endogenous metabolism
(d) Aerobic and exogenous metabolism

56. A sewage sludge has a water content of 99%. What will be the concentration of suspended solids in the sludge ?

(a) 10 mg/*l*
(b) 100 mg/*l*
(c) 1000 mg/*l*
(d) 10,000 mg/*l*

57. Consider the following statements :

1. The quality of waste water is determined on the basis of DO.
2. The BOD test is based on DO.
3. Determination of DO helps in controlling corrosion.

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

58. The major source of 'Carbon monoxide' in the urban atmosphere is due to

(a) Decomposition of organics
(b) Chemical reaction between VOC and NO_X
(c) Incomplete combustion of fuel
(d) Incomplete combustion in the presence of sunlight

59. Consider the following statements relating zones of atmosphere to altitude :

1. Temperature decreases with altitude in troposphere.
2. Speed of sound decreases with altitude in troposphere.
3. Temperature increases with altitude in stratosphere.
4. Ozone is present in stratosphere which protects people from harmful effects of solar radiation.

Which of the above statements are correct ?

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

60. The principle involved in collection and sampling of particulate matter in which the particles are drawn through a device by deflecting them from their original paths is called

(a) Filtration
(b) Electrostatic precipitation
(c) Impaction
(d) Gravitational settling

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61. A soil sample has a void ratio of 0·5; its porosity will be

(a) 50%

(b) 66%

(c) 100%

(d) 33%

62. A sample of sand has a volume of 1000 ml in its natural state. Its minimum volume when compacted is 750 ml. When gently poured into a measuring cylinder, its possible maximum volume is 1320 ml. What is the relative density ?

(a) 56

(b) 52

(c) 58

(d) 60

63. Consider the following statements :

1. Knowledge about moisture content is necessary to determine permeability.
2. Some typical marine clay may have moisture content as high as 400%.
3. Sand-bath method of moisture content determination is not suitable for soils containing organic matter.

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

64. A saturated specimen of clay was immersed in mercury and displaced volume was 21·8 cc. The weight of the sample was 32·2 gm. After oven drying for 48 hours, weight reduced to 20·2 gm while volume came down to 11·6 cc. The shrinkage limit of the soil is

(a) 7·9%

(b) 8·0%

(c) 8·9%

(d) 9·8%

65. A sand sample has a bulk density of 20 kN/m^3 and a degree of saturation of 70%. If the specific gravity of soil grains is 2·65, the value of critical hydraulic gradient for the soil will be

(a) 1·02

(b) 1·05

(c) 1·10

(d) 1·15

66. The void ratio of a given soil A is twice that of another soil B, while the effective size of particles of soil A is one-third of that of soil B. The ratio of height of capillary rise of water in soil A to that in soil B will be

(a) 0·67

(b) 1·0

(c) 1·5

(d) 2·0

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67. Compression index developed by Casagrande is

(a) $C_v = 0{\cdot}009\ (LL + 10\%)$

(b) $C_v = 0{\cdot}009\ (LL - 10\%)$

(c) $C_v = 0{\cdot}0009\ (LL + 10\%)$

(d) $C_v = 0{\cdot}0009\ (LL - 10\%)$

68. When a structural load is applied on a soil stratum, which of the following soil types will have the minimum settlement ?

(a) Over-consolidated clay stratum

(b) Clayey silt stratum

(c) Normally consolidated clay stratum

(d) Sandy clay stratum

69. Consider the following statements :

1. The water content of a soil remains unchanged during the entire duration of a 'quick' test.
2. Effective stress cum shear parameters of clay can be obtained from drained triaxial shear test.
3. Strain-controlled shear test is a good option since this test procedure maintains better control on the rate of loading than other tests.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 only

(c) 1 and 3 only

(d) 2 and 3 only

70. Consider the following statements :

1. The static cone penetration test is unsuitable for layered deposits of sands, silts and clays.
2. The results of groundwater investigation are recorded as water-table contours over the site.
3. Closed piezometers are used to measure pore water pressure in soils having low permeability.

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

71. Consider the following statements :

1. According to Terzaghi, the average angle of wall friction may be taken equal to two-thirds of the respective angle of internal friction.
2. Wall friction increases the active earth pressure and also decreases the passive earth resistance of the soil.
3. Wall friction decreases the active earth pressure and increases the passive earth resistance of the soil.

Which of the above statements is/are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 3 only

(d) 1 and 3 only

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72. Consider the following statements :

1. Uniform surcharge increases active earth pressure even as it decreases passive resistance.
2. For analyzing the conditions at a masonry gravity wall, application of Coulomb's theory of earth pressure is preferred.
3. Culmann's method is applicable to a stratified backfill; whereas Poncelet's method is not.

Which of the above statements are correct ?

(a) 1 and 2
(b) 1 and 3
(c) 2 and 3
(d) 1, 2 and 3

73. Consider the following statements :

1. In the case of footings on purely cohesive soils, the benefit due to surcharge or depth of foundation is only marginal.
2. The bearing capacity of a footing in pure clay may be increased by increasing its size.
3. Factor of safety should be applied only to the net ultimate bearing capacity.

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

74. The gross bearing capacity of a footing is 450 kN/m^2. If the footing is 1·5 m wide and is at a depth of 1 m in a clayey soil which has a unit weight of 20 kN/m^3, then the net bearing capacity is

(a) 410 kN/m^2
(b) 420 kN/m^2
(c) 430 kN/m^2
(d) 440 kN/m^2

75. A drop hammer is used to drive a wooden pile. The hammer weight is 25 kN and its free falling height is 0·8 m. The penetration in the last blow is 12 mm. What is the nearest approximation to the load carrying capacity of the pile according to the Engineering News Formula ?

(a) 125 kN
(b) 110 kN
(c) 3000 kN
(d) 90 kN

76. Consider the following statements :

1. Initial load tests and routine load tests are carried out on test piles and working piles, respectively.
2. In a pile load test, the allowable load can be taken equal to half the ultimate load at which the total settlement amounts to one-tenth of the pile diameter.
3. In a pile load test, the allowable load can be taken equal to two-thirds of the total load which causes a plastic settlement of 6 mm.

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

77. A theodolite was set up at P and the angle of elevation to the top of a mobile tower ST was 30°. The staff reading held at a station of RL 110 m was 2·555 m, the telescope being horizontal. The horizontal distance between the foot of the tower and the instrument station is 810 m. The RL of the top of the tower is

(a) 578·25 m
(b) 579·50 m
(c) 580·25 m
(d) 582·40 m

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78. The measured radius of a circle is 80 m with a possible error of 0·05 m in its diameter. The error in the computed area will nearly be

(a) $+6{\cdot}5\ m^2$

(b) $-0{\cdot}65\ m^2$

(c) $\pm 12{\cdot}6\ m^2$

(d) $\pm 8{\cdot}2\ m^2$

79. The length of a survey line when measured with a chain of 20 m nominal length was found to be 841·5 m. If the chain used is 0·1 m too long, the correct length of the measured line is

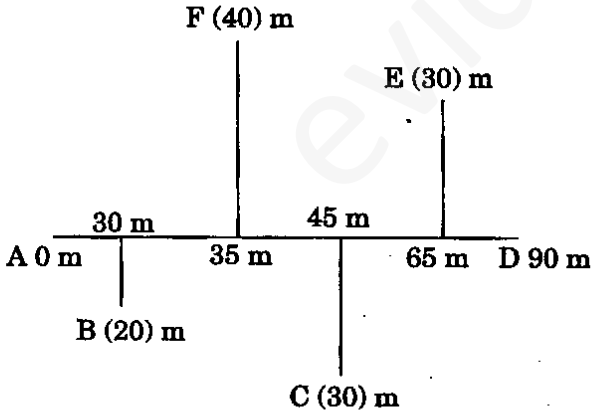
(a) 845·7 m

(b) 837·39 m

(c) 843·6 m

(d) 839·4 m

80. In a cross staff survey, the perpendicular offsets are taken on right and left of the chain line AD as shown in figure – all values are in 'metres'. The area enclosed by ABCDEFA, computed by trapezoidal method is



(a) $3650\ m^2$

(b) $3200\ m^2$

(c) $3475\ m^2$

(d) $3500\ m^2$

81. In levelling between two points A and B on the opposite sides of a river, the level was first set up near A and the staff readings on A and B were 2·645 m and 2·30 m respectively. The level was then moved near B and set up; the respective staff readings then were 1·085 m and 1·665 m on A and B respectively. What is the true difference of level between A and B ?

(a) A and B are at same level

(b) A is 0·5825 m below B

(c) A is 0·4825 m below B

(d) B is 0·5825 m below A

82. A plane, which is perpendicular to the plumb line through a point and is tangential to the level surface at that point is called a

(a) Tangential plane

(b) Vertical plane

(c) Level plane

(d) Horizontal plane

83. The magnetic bearing of a line is 55° 30′ and the magnetic declination is 4° 30′ east. The true bearing of a line will be

(a) 60°

(b) 34° 30′

(c) 49° 30′

(d) 51°

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84. Staff reading on the floor of a verandah of a school building is 1·815 m and staff reading when held with bottom of staff touching the ceiling over the verandah is 2·870 m. R.L. of the floor is 74·500 m. Height of the ceiling above floor is

(a) 4·270 m

(b) 4·685 m

(c) 3·955 m

(d) 4·920 m

85. Consider the following parameters in respect of RADAR principle :

1. It is an active sensing system.
2. Electromagnetic radiation of wavelength is in centimetre range.
3. It operates in visible region.
4. It comprises Radio detection and ranging.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 2, 3 and 4

(c) 1, 2 and 4

(d) 1, 2, 3 and 4

86. The observations made over the same area on different dates to monitor ground features like crop growth is called

(a) Temporal resolution

(b) Radiometric resolution

(c) Spatial resolution

(d) Spectral resolution

87. In a transit theodolite, any incidental error due to eccentricity of verniers is primarily counteracted by

(a) Reading both the verniers

(b) Reading different parts of main scale

(c) Reading right and left faces

(d) Taking both right swing readings

88. In setting up the plane table at a station P, the corresponding point on the plan was not accurately centred above P. If the displacement of P was 50 cm in a direction perpendicular to the ray, how much on the plan would be the consequent displacement of a point from its true position if the scale was 1 cm = 10 m ?

(a) 5 mm

(b) 1 mm

(c) 0·5 mm

(d) 0·05 mm

89. If a vehicle travelling at 40 kmph was stopped within 1·8 sec after the application of the brakes, then the average skid resistance coefficient is

(a) 0·63

(b) 0·73

(c) 0·83

(d) 0·93

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90. While aligning a hill road with a ruling gradient of 6%, a horizontal curve of 75 m radius is encountered. The compensated gradient at the curve will be

(a) 1%

(b) 2%

(c) 3%

(d) 5%

91. What is the deflection at the surface of a flexible pavement due to a wheel load of 40 kN and a tyre pressure of 0·5 MPa ? The value of E for pavement and subgrade is 20 MPa.

(a) 15 mm

(b) 11 mm

(c) 9 mm

(d) 6 mm

92. In a flexible pavement

(a) Vertical compressive stresses decrease with depth of the layer

(b) The vertical compressive stress is the maximum at the lowest layer

(c) Tensile stresses get developed

(d) Maximum stress induced by a given traffic load is dependent on the location of the load on the pavement surface

93. Benkleman beam deflection method is used for design of

(a) Rigid overlays on rigid pavements

(b) Rigid overlays on flexible pavements

(c) Flexible overlays on flexible pavements

(d) Flexible overlays on rigid pavements

94. The design speed of a traffic lane is 70 kmph. What is the theoretical capacity per hour taking the total reaction time to be 2 seconds and average length of vehicles as 8 m ?

(a) 828

(b) 728

(c) 628

(d) 428

95. An electric locomotive running at 60 kmph on a curved track of 1·68 m gauge laid at 800 m radius should be provided with superelevation of the rail by an amount of

(a) 50·5 mm

(b) 55·5 mm

(c) 59·5 mm

(d) 65·5 mm

96. 'Composite Sleeper Index' is employed to determine

(a) Sleeper density requirement

(b) Number of fixtures required for a certain type of sleeper

(c) Durability of sleeper

(d) Mechanical strength of wooden sleeper whereby its suitability for use is assessed

97. Which of the following types of Elastic fastenings can be used on all types of sleepers (like Wooden, Cast-Iron or Concrete) on Indian Railways ?

(a) Sigma clip

(b) IRN-202 clip

(c) LG-20 Lock spike

(d) Pandrol clip

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98. According to the wave action theory for creep of rails, the pitch and depth of wave depend upon :

1. Section of rails
2. Track modulus
3. Stiffness of track
4. Stability of foundation
5. Weight of the train

Which of these are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 2, 3 and 4

(d) 3, 4 and 5

99. Two parallel railway tracks are to be connected by a reverse curve, both segments having the same radius. If the centre lines of the tracks are 8 m apart and the maximum adaptable distance between the tangent points is 32 m, the allowable radius for the curves is

(a) 4 m

(b) 8 m

(c) 32 m

(d) 64 m

100. The steepest gradient on a 2° curve on a Broad Gauge line with a stipulated ruling gradient of 1 in 200, given that grade compensation is 0·04% per degree of curve, is

(a) 1 in 200

(b) 1 in 150

(c) 1 in 238

(d) 1 in 283

Directions : *Each of the next* ***twenty (20)*** *items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. You are to 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) :*

Instantaneous unit hydrograph (IUH) is used in theoretical analysis of rainfall excess-runoff characteristics of a catchment.

Statement (II) :

For a given catchment, IUH, being independent of rainfall characteristics, is indicative of the catchment storage characteristics.

102. *Statement (I) :*

Theoretically an infinite number of unit graphs are possible for a given basin.

Statement (II) :

The rainfall duration and its areal distribution affect the hydrograph.

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103. *Statement (I) :*

The sharp corners in the cross-section of a canal are rounded.

Statement (II) :

The corners may not become zones of stagnation.

104. *Statement (I) :*

During an epidemic of infective hepatitis, the supplied water is super chlorinated.

Statement (II) :

Spore-forming bacteria which cause this disease are effectively removed from water by super chlorination.

105. *Statement (I) :*

When waste water is treated at an oxidation ditch, anaerobic sludge digester is not required.

Statement (II) :

Oxidation ditch admits an extended aeration process whereby sludge gets mineralized.

106. *Statement (I) :*

Dilution of the wastewater sample with organic-free, oxygen-saturated water is necessary to measure 5-day 20°C BOD values greater than 7 mg/*l*.

Statement (II) :

The saturation for oxygen in water at 20°C is approximately 9 mg/*l*.

107. *Statement (I) :*

The rate of biomass production will always be lower than the rate of food utilization in a biological system having a mixed culture of micro-organisms.

Statement (II) :

Catabolism converts part of the food into waste products.

108. *Statement (I) :*

Electrostatic precipitators (ESP) can remove particles of sub-micron size.

Statement (II) :

Due to high voltage supply, ESPs attract any charged particle.

109. *Statement (I) :*

A semi-log plot is used to represent the grain size distribution of a soil sample.

Statement (II) :

In a semi-log plot, a wide range of grain sizes can be accommodated.

110. *Statement (I) :*

Clays exhibit more hygroscopicity than sands.

Statement (II) :

Clays are colloidal and consequently their specific surface is very high.

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111. *Statement (I) :*

The zero-air void curve is non-linear.

Statement (II) :

The dry density at 100% saturation is a non-linear function of void ratio.

112. *Statement (I) :*

In a consolidation test, pressure on the soil specimen is doubled at each step.

Statement (II) :

It is intended that the soil always remains in a normally consolidated condition.

113. *Statement (I) :*

For a cantilever retaining wall, Rankine's theory of earth pressure may be used.

Statement (II) :

For a retaining wall with smooth vertical back, Rankine's theory is appropriate.

114. *Statement (I) :*

Microwave bands are composed of radiation with wavelength between 1 mm and 1 m.

Statement (II) :

Microwaves are capable of penetrating through the atmosphere under almost all conditions.

115. *Statement (I) :*

Multistage imaging refers to viewing a given area in several narrow bands.

Statement (II) :

Multistage imaging is also called spatial resolution.

116. *Statement (I) :*

Spectral reflectance curves describe the spectral response of a target.

Statement (II) :

Every object on the Earth has its unique spectral reflectance.

117. *Statement (I) :*

The regions of the electromagnetic spectrum in which the atmosphere is transparent are called atmospheric windows.

Statement (II) :

The atmosphere is practically transparent in the visible region of the electromagnetic spectrum.

118. *Statement (I) :*

Scattering is more in lower wavelengths than in higher wavelengths.

Statement (II) :

Scattering effect decreases the signal value.

119. *Statement (I) :*

The process by which the geometry of an image area is made planimetric is called rectification.

Statement (II) :

It is the most precise geometric correction.

120. *Statement (I) :*

The effective head of a turbo-machine is equal to : Gross head minus the head loss in penstock and the velocity head at the turbine inlet.

Statement (II) :

A turbo-machine becomes susceptible to cavitation if pressure falls below the vapour pressure of the liquid.

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