

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

**T.B.C. : B-DMHH-N-DFA**

**Test Booklet Series**

**Serial No. 43869**

**A**

**TEST BOOKLET  
CIVIL ENGINEERING  
Paper—I**

**Time Allowed : Two Hours**

**Maximum Marks : 200**

**I N S T R U C T I O N S**

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** 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. Which IS code is used for classification of timber for seasoning purposes?

(a) IS : 4970-1973

(b) IS : 1708-1969

(c) IS : 1141-1958

(d) IS : 399-1963

2. Consider the following with regard to 'the application of preservation of timber' :

1. Increase in the life span of the member

2. Increase in the strength of the timber

3. Removal of moisture

4. Prevention of growth of fungi by killing them

Which of the above are correct?

(a) 1, 2, 3 and 4

(b) 2 and 4 only

(c) 1 and 4 only

(d) 2 and 3 only

3. The plies in plywood are so placed that the grains of each ply are

(a) parallel to each other

(b) at right angle to one another

(c) 45° oblique to adjacent grain

(d) not constrained by any consideration

4. Which of the following is an ODD one as regards 'requirements of good brick-earth'?

(a) It must be free from lumps of lime

(b) It should not be mixed with salty water

(c) It must be non-homogeneous

(d) It should not contain vegetable and organic matter

5. The compressive strength of heavy-duty bricks, as per IS : 2980-1962, should be not less than

(a) 440 kg/cm<sup>2</sup>

(b) 175 kg/cm<sup>2</sup>

(c) 100 kg/cm<sup>2</sup>

(d) 75 kg/cm<sup>2</sup>

6. Consider the following statements :

1. Brickwork will have high water tightness.

2. Brickwork is preferred for monument structures.

3. Bricks resist fire better than stones.

4. Bricks of good quality shall have thin mortar bonds.

Which of the above statements are correct?

(a) 1 and 2

(b) 3 and 4

(c) 2 and 3

(d) 1 and 4

7. Consider the following statements :

A good soil for making bricks should contain

1. 30% alumina
2. 10% lime nodules
3. only small quantity of iron oxides
4. 15% magnesia

Which of the above statements are correct?

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

8. Which compound of cement is responsible for strength of cement?

- (a) Magnesium oxide
- (b) Silica
- (c) Alumina
- (d) Calcium sulphate

9. Which type of cement is recommended in large mass concrete works such as a dam?

- (a) Ordinary Portland
- (b) High Alumina
- (c) Low-heat Portland
- (d) Portland Pozzollona

10. Consider the following statements regarding 'setting of cement' :

1. Low-heat cement sets faster than OPC.
2. Final setting time decides the strength of cement.

3. Initial setting time of Portland Pozzollona is 30 minutes.

4. Air-induced setting is observed when stored under damp conditions.

5. Addition of gypsum retards the setting time.

Which of the above statements are correct?

- (a) 1, 2 and 3
- (b) 2, 3 and 4
- (c) 3, 4 and 5
- (d) 2, 3 and 5

11. Consider the following statements regarding 'strength of cement' :

1. Strength test on cement is made on cubes of cement-sand mix.

2. Water to be used for the paste is  $0.25P$ , where  $P$  is the water needed for normal consistency.

3. The normal consistency is determined on Le Chatelier's apparatus.

4. Cubes are cast in two layers in leak-proof moulds further compacted in each layer by vibration on a machine.

Which of the above statements are correct?

- (a) 1 and 2
- (b) 2 and 3
- (c) 1 and 4
- (d) 3 and 4

12. Which of the following ingredients refer to binding materials of mortar?

1. Cement
2. Lime
3. Sand
4. Ashes

Select the correct answer using the code given below.

- (a) 1 and 4
- (b) 3 and 4
- (c) 1 and 2
- (d) 2 and 3

13. Consider the following statements :

1. Bricks in masonry are bound by mortar.
2. Mortars make bricks damp-proof.
3. Strength of brick in masonry is improved by plastering.
4. Addition of lime improves workability.
5. Marine constructions need sulphate-resistant cement mortar.

Which of the above statements are relevant for 'cement mortar'?

- (a) 1, 2 and 3
- (b) 2, 3 and 4
- (c) 1, 4 and 5
- (d) 3, 4 and 5

14. Consider the following parameters of concrete :

1. Impermeability
2. Compactness
3. Durability
4. Desired consistency
5. Workability

Which of the above parameters are relevant for 'water-cement ratio'?

- (a) 4 and 5
- (b) 1 and 2
- (c) 2 and 4
- (d) 3 and 5

15. Consider the following statements :

Presence of  $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$  in concrete leads to

1. expansive reaction in concrete
2. cracking of concrete
3. disruption of concrete
4. shrinkage of concrete

Which of the above statements are correct?

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

16. The maximum total quantity of dry aggregate by mass per 50 kg of cement, to be taken as the sum of the individual masses of fine and coarse aggregates (kg), for M 20 grade of concrete, is

- (a) 625
- (b) 480
- (c) 330
- (d) 250

17. If aggregate size of 50–40 mm is to be tested for determining the proportion of elongated aggregates, the slot length of the gauge should be

- (a) 45 mm
- (b) 53 mm
- (c) 81 mm
- (d) 90 mm

18. Absorption capacity of an aggregate refers to the difference expressed in appropriate proportion in water content between

- (a) a wet aggregate and a dry aggregate
- (b) a dry aggregate and an oven-dry aggregate
- (c) a saturated surface-dry aggregate and a dry aggregate
- (d) a saturated surface-dry aggregate and an oven-dry aggregate

19. Consider the following statements concerning 'elasticity of concrete' :

1. Stress-strain behaviour of concrete is a straight line up to 10% of ultimate stress.
2. Strain determination is obtained from tangent modulus.
3. Modulus of elasticity of concrete is also called as secant modulus.

Which of the above statements are correct?

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

20. Consider the following statements :

The addition of  $\text{CaCl}_2$  in concrete results in

1. increased shrinkage
2. decreased setting time
3. decreased shrinkage
4. increased setting time

Which of the above statements is/ are correct?

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

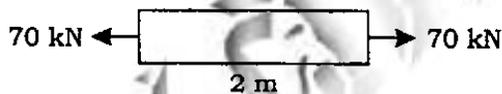
21. If the Poisson's ratio for a material is 0.5, then the elastic modulus for the material is

- (a) three times its shear modulus
- (b) four times its shear modulus
- (c) equal to its shear modulus
- (d) not determinable

22. A metal bar of 10 mm diameter when subjected to a pull of 23.5 kN gave an elongation of 0.3 mm on a gauge length of 200 mm. The Young's modulus of elasticity of the metal will nearly be

- (a) 200 kN/mm<sup>2</sup>
- (b) 300 kN/mm<sup>2</sup>
- (c) 360 kN/mm<sup>2</sup>
- (d) 400 kN/mm<sup>2</sup>

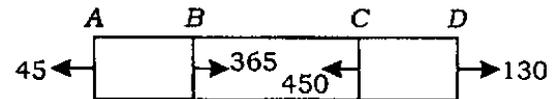
23. A steel rod, 2 m in length, 40 mm in diameter, is subjected to a pull of 70 kN as shown in the figure



To what length should the bar be bored centrally from one end so that total extension will increase by 20% under the same force (the bore diameter is 25 mm and  $E$  is  $2 \times 10^5 \text{ N/mm}^2$ )?

- (a) 0.46 m
- (b) 0.55 m
- (c) 0.87 m
- (d) 0.62 m

24. A member ABCD is subjected to a force system as shown in the figure



The resistive force in the part BC is

- (a) 365 (compressive)
- (b) 450 (tensile)
- (c) 85 (compressive)
- (d) 320 (compressive)

25. Consider the following statements :

If the planes at right angles carry only shear stress of magnitude  $q$  in a certain instance, then the

1. diameter of Mohr's circle would be equal to  $2q$
2. centre of Mohr's circle would lie at the origin
3. principal stresses are unlike and are of magnitude  $q$  each
4. angle between the principal plane and the plane of maximum shear would be  $45^\circ$

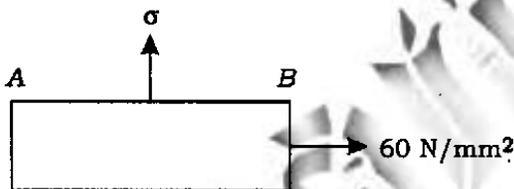
Which of the above statements are correct?

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

26. The state of two-dimensional stresses acting on a concrete lamina consists of a direct tensile stress  $\sigma_x = 1.5 \text{ N/mm}^2$  and shear stress  $\tau = 1.20 \text{ N/mm}^2$ , when cracking of concrete is just impending. The permissible tensile strength of the concrete is

- (a)  $1.50 \text{ N/mm}^2$
- (b)  $2.17 \text{ N/mm}^2$
- (c)  $2.08 \text{ N/mm}^2$
- (d)  $2.29 \text{ N/mm}^2$

27. Two-dimensional stress system on a block made of a material with Poisson's ratio of 0.3 is shown in the figure



The limiting magnitude of the stress  $\sigma$  so as to result in no change in length  $AB$  of the block is

- (a)  $60 \text{ N/mm}^2$
- (b)  $120 \text{ N/mm}^2$
- (c)  $200 \text{ N/mm}^2$
- (d)  $240 \text{ N/mm}^2$

28. The principal stresses at a point in a bar are  $160 \text{ N/mm}^2$  (tensile) and  $80 \text{ N/mm}^2$  (compressive). The accompanying maximum shear stress intensity is

- (a)  $100 \text{ N/mm}^2$
- (b)  $110 \text{ N/mm}^2$
- (c)  $120 \text{ N/mm}^2$
- (d)  $140 \text{ N/mm}^2$

29. An element of a certain material in plane strain has

$$\epsilon_x = 800 \times 10^{-6}$$

$$\epsilon_y = 400 \times 10^{-6}$$

$$\gamma_{xy} = 300 \times 10^{-6}$$

What is the maximum shearing strain?

- (a)  $150 \times 10^{-6}$
- (b)  $355 \times 10^{-6}$
- (c)  $250 \times 10^{-6}$
- (d)  $500 \times 10^{-6}$

30. Consider a circular member of diameter  $D$  subjected to a compressive load  $P$ . For a condition of no tensile stress in the cross-section, the maximum radial distance of the load from the centre of the circle is

(a)  $\frac{D}{6}$

(b)  $\frac{D}{8}$

(c)  $\frac{D}{12}$

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

31. At a point in the web of a girder, the bending and the shearing stresses are  $90 \text{ N/mm}^2$  (tensile) and  $45 \text{ N/mm}^2$  respectively. The principal stresses are

(a)  $108.64 \text{ N/mm}^2$  (tensile) and  $18.64 \text{ N/mm}^2$  (compressive)

(b)  $107.60 \text{ N/mm}^2$  (compressive) and  $18.64 \text{ N/mm}^2$  (tensile)

(c)  $108.64 \text{ N/mm}^2$  (compressive) and  $18.64 \text{ N/mm}^2$  (tensile)

(d)  $0.64 \text{ N/mm}^2$  (tensile) and  $0.78 \text{ N/mm}^2$  (compressive)

32. In a two-dimensional stress system, the principal stresses are  $\sigma_1 = 200 \text{ N/mm}^2$  (tensile) and  $\sigma_2$  (compressive). The yield stress in both simple tension and compression is  $250 \text{ N/mm}^2$ , with  $\mu = 0.25$ . What will be the value of  $\sigma_2$  according to the maximum normal strain theory?

(a)  $160 \text{ N/mm}^2$

(b)  $100 \text{ N/mm}^2$

(c)  $200 \text{ N/mm}^2$

(d)  $250 \text{ N/mm}^2$

33. A simply supported beam has uniform cross-section,  $b = 100 \text{ mm}$ ,  $d = 200 \text{ mm}$ , throughout its length. The beam is subjected to a maximum bending moment of  $6 \times 10^7 \text{ N-mm}$ . The corresponding bending stress developed in the beam is

(a)  $30 \text{ N/mm}^2$

(b)  $60 \text{ N/mm}^2$

(c)  $90 \text{ N/mm}^2$

(d)  $120 \text{ N/mm}^2$

34. A steel plate is bent into a circular arc of radius 10 m. If the plate section be 120 mm wide and 20 mm thick, with  $E = 2 \times 10^5 \text{ N/mm}^2$ , then the maximum bending stress induced is

- (a)  $210 \text{ N/mm}^2$
- (b)  $205 \text{ N/mm}^2$
- (c)  $200 \text{ N/mm}^2$
- (d)  $195 \text{ N/mm}^2$

35. A fletched beam composed of two different pieces, each having breadth  $b$  and depth  $d$ , supports an external load. This statement implies that

1. the two different materials are rigidly connected
2. there will be relative movement between the two materials
3. for transforming into an equivalent single-material section under 'strength' considerations, the depth is kept constant and only the breadth is varied

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

36. A solid shaft of 80 mm diameter is transmitting 100 kW of power at 200 r.p.m. The maximum shear stress induced in the shaft will nearly be

- (a)  $60 \text{ N/mm}^2$
- (b)  $56 \text{ N/mm}^2$
- (c)  $52 \text{ N/mm}^2$
- (d)  $48 \text{ N/mm}^2$

37. The power transmitted by a 75 mm diameter shaft at 140 r.p.m., subjected to a maximum shear stress of  $60 \text{ N/mm}^2$ , is nearly

- (a) 68 kW
- (b) 70 kW
- (c) 73 kW
- (d) 76 kW

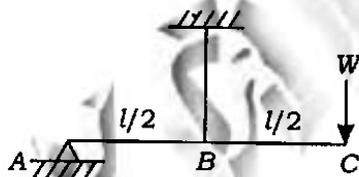
38. A circular shaft of diameter  $D$  is subjected to a torque  $T$ . The maximum shear stress of the shaft will be

- (a) proportional to  $D^3$
- (b) proportional to  $D^4$
- (c) inversely proportional to  $D^3$
- (d) inversely proportional to  $D^4$

39. A hollow shaft of 16 mm outside diameter and 12 mm inside diameter is subjected to a torque of 40 N-m. The shear stresses at the outside and inside of the material of the shaft are respectively

- (a)  $62.75 \text{ N/mm}^2$  and  $50.00 \text{ N/mm}^2$
- (b)  $72.75 \text{ N/mm}^2$  and  $54.54 \text{ N/mm}^2$
- (c)  $79.75 \text{ N/mm}^2$  and  $59.54 \text{ N/mm}^2$
- (d)  $80.00 \text{ N/mm}^2$  and  $40.00 \text{ N/mm}^2$

40. A rigid bar shown in the figure is hinged at A, is supported by a rod at B, and carries a load W at C.



The resistive force in the rod is

- (a)  $0.5W$
- (b)  $1.0W$
- (c)  $1.5W$
- (d)  $2.0W$

41. The symmetry of the stress tensor at a point in a body when at equilibrium is obtained from

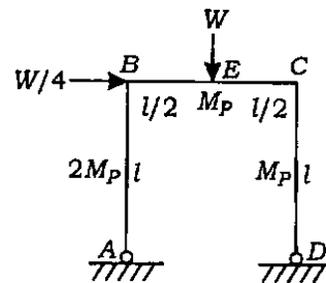
- (a) conservation of mass
- (b) force equilibrium equations
- (c) moment equilibrium equations
- (d) conservation of energy

42. A hinged support in a real beam

- (a) becomes an internal hinge in a conjugate beam
- (b) changes to a free support in a conjugate beam
- (c) changes to a fixed support in a conjugate beam
- (d) remains as a hinged support in a conjugate beam

43. For portal frame shown in the figure, collapse load W has been calculated as per combined mechanism as

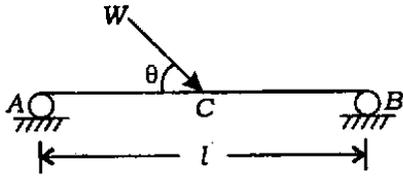
$$W = \frac{16 M_p}{3l}$$



What is the bending moment at B at collapse conditions?

- (a)  $\frac{Wl}{16}$
- (b)  $\frac{Wl}{8}$
- (c)  $\frac{3Wl}{16}$
- (d)  $\frac{3Wl}{8}$

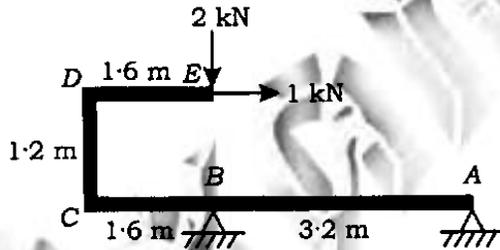
44. The simply supported beam shown in the figure



is

- (a) determinate and stable
- (b) determinate and unstable
- (c) indeterminate and stable
- (d) indeterminate and unstable

45. The bending moment at C for the beam shown in the figure



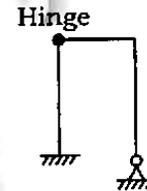
is

- (a)  $-3.2 \text{ kN-m}$
- (b)  $-4.4 \text{ kN-m}$
- (c)  $-6.2 \text{ kN-m}$
- (d)  $-7.2 \text{ kN-m}$

46. A close helical spring of 100 mm mean diameter is made of 10 mm diameter rod, and has 20 turns. The spring carries an axial load of 200 kN with  $G = 84 \times 10^4 \text{ N/mm}^2$ . The stiffness of the spring is nearly

- (a) 5.25 N/mm
- (b) 6.50 N/mm
- (c) 7.25 N/mm
- (d) 8.50 N/mm

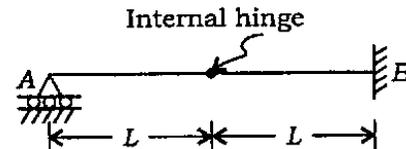
47. For the plane frame as shown in the figure



the degree of kinematic indeterminacy, neglecting axial deformation, is

- (a) 3
- (b) 5
- (c) 7
- (d) 9

48. The carry-over factor  $C_{AB}$  for the beam as shown in the figure



is

- (a) 0.25
- (b) 0.50
- (c) 0.75
- (d) 1.00

49. The ratio of (i) the moment required for unit rotation of the near end of a prismatic member with its far end fixed to (ii) that of a different moment required for the same effect when the far end is hinged, is

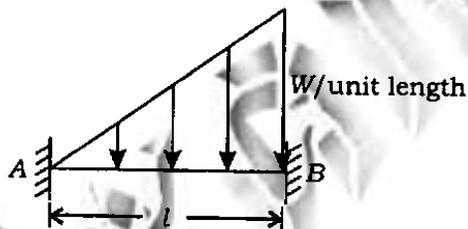
(a) 1                      (b)  $\frac{3}{4}$

(c)  $\frac{4}{3}$                       (d)  $\frac{1}{2}$

50. Force method in structural analysis always ensures

- (a) compatibility of deformation
- (b) equilibrium of forces
- (c) kinematically admissible strains
- (d) overall safety

51. Fixed end moments at A and B for the fixed beam shown in the figure, subjected to the indicated uniformly varying load, are respectively



(a)  $\frac{Wl^2}{30}$  and  $\frac{Wl^2}{20}$

(b)  $\frac{Wl^2}{20}$  and  $\frac{Wl^2}{30}$

(c)  $\frac{Wl^2}{12}$  and  $\frac{Wl^2}{8}$

(d)  $\frac{Wl^2}{8}$  and  $\frac{Wl^2}{12}$

52. Fixed end moments developed at both the ends in a fixed beam of span  $L$  and flexural rigidity  $EI$ , when its right-side support settles down by  $\Delta$ , is

(a)  $\frac{6EI\Delta}{L^2}$  (sagging)

(b)  $\frac{12EI\Delta}{L^2}$  (sagging)

(c)  $\frac{6EI\Delta}{L^2}$  (hogging)

(d)  $\frac{12EI\Delta}{L^2}$  (hogging)

53. The Muller-Breslau principle for influence line is applicable for

- (a) simple beams
- (b) continuous beams
- (c) redundant trusses
- (d) All of the above

54. For a fixed beam with a concentrated load  $W$  at  $\frac{1}{4}$  of span from one end, the ultimate load is

(a)  $\frac{16M_P}{3L}$                       (b)  $\frac{4M_P}{L}$

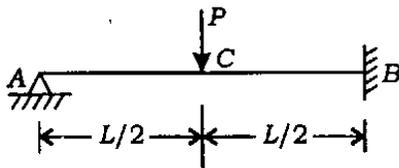
(c)  $\frac{32M_P}{3L}$                       (d)  $\frac{6M_P}{L}$

[adopting standard notations]

55. The plastic modulus of a section is  $4.8 \times 10^{-4} \text{ m}^3$ . The shape factor is 1.2. The plastic moment capacity of the section is 120 kN-m. The yield stress of the material is

- (a) 100 MPa
- (b) 240 MPa
- (c) 250 MPa
- (d) 300 MPa

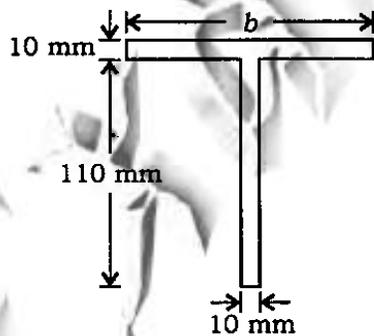
56. A propped cantilever beam shown in the figure has a plastic moment capacity of  $M_0$ .



The collapse load is

- (a)  $\frac{4M_0}{L}$
- (b)  $\frac{6M_0}{L}$
- (c)  $\frac{8M_0}{L}$
- (d)  $\frac{12M_0}{L}$

57. The dimensions of a T-section are shown in the figure



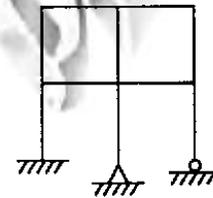
For the depth of plastic neutral axis from the top of the T-section to be 9.583 mm, the flange width  $b$  must be

- (a) 100 mm
- (b) 110 mm
- (c) 120 mm
- (d) 130 mm

58. The shape factors of a triangle section and a diamond section are respectively

- (a) 2.343 and 2.0
- (b) 2.0 and 2.343
- (c) 1.343 and 2.0
- (d) 2.0 and 1.343

59. For a skeletal frame shown in the figure



static and kinematic indeterminacies are

- (a) 3 and 11
- (b) 3 and 9
- (c) 3 and 6
- (d) 6 and 3

60. The effective length of a fillet weld is taken as the actual length

- (a) plus twice the size of the weld
- (b) minus twice the size of the weld
- (c) plus the size of the weld
- (d) minus the size of the weld

61. An angle ISA  $50 \times 50 \times 6$  is connected to a gusset plate 5 mm thick, with 16 mm bolts. What is the bearing strength of the bolt when the hole diameter is 16 mm and the allowable bearing stress is 250 MPa?
- (a) 8 kN  
 (b) 20 kN  
 (c) 22.5 kN  
 (d) 24 kN
62. The effective length of a battened strut of actual length  $L$ , effectively held in position at both ends but not restrained in direction, is taken as
- (a)  $L$                       (b)  $1.1L$   
 (c)  $1.5L$                     (d)  $1.8L$
63. The slenderness ratio (as per IS : 800) of a member, carrying compressive loads arising from combined dead loads and imposed loads, should not exceed
- (a) 180                      (b) 250  
 (c) 350                      (d) 380
64. A mild steel tube of mean diameter 20 mm and thickness 2 mm is used as an axially loaded tension member. If  $f_y = 300$  MPa, what is the maximum load that the member can carry?
- (a) 11.25 kN  
 (b) 22.5 kN  
 (c) 30.0 kN  
 (d) 37.5 kN
65. Localized bearing stress caused by the transmission of compression from the wide flange to the narrow web causes a failure called
- (a) web buckling  
 (b) web shear flow  
 (c) web bearing  
 (d) web crippling
66. The best-suited rolled steel section for a tension member is
- (a) angle section  
 (b) T-section  
 (c) channel section  
 (d) flat section
67. In a plate girder, the web is primarily designed to resist
- (a) torsional moment  
 (b) shear force  
 (c) bending moment  
 (d) diagonal buckling
68. Lacing of compound steel columns
- (a) increases the load-carrying capacity  
 (b) decreases the chances of local buckling  
 (c) decreases overall buckling of the column  
 (d) assures unified behaviour

69. A welded plate girder, consisting of two flange plates of 350 mm × 16 mm each and a web plate of 1000 mm × 6 mm, requires

- (a) no stiffeners
- (b) horizontal stiffeners
- (c) intermediate vertical stiffeners
- (d) vertical and horizontal stiffeners

70. When designing steel structures, one must ensure that local buckling in webs does not take place. This check may not be critical when using rolled steel sections because

- (a) quality control at the time of manufacture of rolled sections is very good
- (b) web depths available are small
- (c) web stiffness is built-in in rolled sections
- (d) depth to thickness ratio of the web is always appropriately adjusted

71. Horizontal stiffener in a plate girder is provided to safeguard against web buckling due to

- (a) shear
- (b) compressive force in bending
- (c) tensile force in bending
- (d) heavy concentrated load

72. In an industrial steel building, which of the following elements of a pitched roof primarily resist loads parallel to the ridge?

- (a) Bracings
- (b) Purlins
- (c) Columns
- (d) Trusses

73. For a compression member with double angle section, which of the following sections will give larger value of minimum radius of gyration?

- (a) Equal angles back-to-back
- (b) Unequal angles with long legs back-to-back
- (c) Unequal angles with short legs back-to-back
- (d) None of the above

74. According to IS : 875 Part 3, design wind speed is obtained by multiplying the basic wind speed by factors  $k_1$ ,  $k_2$  and  $k_3$ , where  $k_3$  is

- (a) terrain height factor
- (b) structure size factor
- (c) topography factor
- (d) risk coefficient

75. The length of beam over which the moment is greater than the yield moment is called as the plastic hinge length. What is the plastic hinge length for a simply supported beam of circular cross-section loaded at mid-span (shape factor for the section =  $\frac{5}{3}$ )?

- (a)  $0.15l$
- (b)  $0.33l$
- (c)  $0.4l$
- (d)  $0.5l$

[adopting standard notations]

76. Battens provided for a compression member shall be designed to carry a transverse shear equal to

- (a) 2.5% of axial force in the member
- (b) 5% of axial force in the member
- (c) 10% of axial force in the member
- (d) 20% of axial force in the member

77. In which of the following cases is the compression flange most susceptible to buckle laterally?

- (a) An I-section supporting a roof slab with shear connection
- (b) Purlin of a roof supporting dead and live loads
- (c) Encased beam
- (d) A steel I-section supporting a point load when acting as a cantilever

78. The serviceability criterion for a plate girder design is based upon

- (a) width of flange
- (b) depth of web
- (c) minimum thickness of web
- (d) stiffness of web

79. If any tension reinforcement in an RC beam attains its yield stress during loading before the concrete in the compression zone fails due to crushing, the beam is said to be

- (a) under-reinforced
- (b) over-reinforced
- (c) balanced
- (d) non-homogeneous

80. The distance between the centroid of the area of tension reinforcement and the maximum compressive fibre in a reinforced concrete beam design is known as

- (a) overall depth
- (b) effective depth
- (c) lever arm
- (d) depth of neutral axis

81. In a reinforced concrete section, the shape of the nominal shear stress diagram is

- (a) parabolic over the full depth
- (b) parabolic above the neutral axis and rectangular below the neutral axis
- (c) rectangular over the full depth
- (d) rectangular above the neutral axis and parabolic below the neutral axis

82. Assuming the concrete below the neutral axis to be cracked, the shear stress across the depth of a singly reinforced rectangular beam section

- (a) increases parabolically to the neutral axis and then drops abruptly to zero value
- (b) increases parabolically to the neutral axis and then remains constant over the remaining depth
- (c) increases linearly to the neutral axis and then remains constant up to the tension steel
- (d) increases parabolically to the neutral axis and then remains constant up to the tension steel

83. Critical section for shear in case of flat slabs is

- (a) at a distance of effective depth of slab from the periphery of the column/the drop panel
  - (b) at a distance of  $\frac{d}{2}$  from the periphery of the column/the capital/the drop panel
  - (c) at the drop panel of the slab
  - (d) at the periphery of the column
- [adopting standard notations]

84. The enlarged head of the supporting column of a flat slab is called

- (a) capital
- (b) drop
- (c) panel
- (d) block

85. The critical section for maximum bending moment in the footing under masonry wall is located at

- (a) the middle of the wall
- (b) the face of the wall
- (c) mid-way between the face and the middle of the wall
- (d) a distance equal to the effective depth of footing from the face of the wall

86. The problems of lateral buckling can arise only in those steel beams which have

- (a) moment of inertia about the bending axis larger than the other
- (b) moment of inertia about the bending axis smaller than the other
- (c) fully supported compression flange
- (d) None of the above

87. Consider the following statements :

The design depth of the footing for an isolated column is governed by

1. maximum bending moment
2. maximum shear force
3. punching shear

Which of the above statements are correct?

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

88. Spalling stresses are produced in post-tensioned pre-stressed concrete members at

- (a) locations of maximum bending moment only
- (b) locations of maximum shear zone
- (c) anchorage zone
- (d) bond-developing zone

89. In a pre-stressed member, it is advisable to use

- (a) low-strength concrete
- (b) high-strength concrete
- (c) high-strength concrete and high-tension steel
- (d) high-strength concrete and low-tension steel

90. The percentage loss of pre-stress due to anchorage slip of 3 mm in a concrete beam of length of 30 m which is post-tensioned by a tendon subjected to an initial stress of  $1200 \text{ N/mm}^2$  and modulus of elasticity equal to  $2.1 \times 10^5 \text{ N/mm}^2$ , is

- (a) 0.0175%
- (b) 0.175%
- (c) 1.75%
- (d) 17.5%

91. Engines are rated at specified conditions. Then which of the following statements are correct?

1. Power developed increases as local temperature increases.
2. Power developed increases as local temperature decreases.
3. Power developed is not dependent on local temperature.
4. Power developed increases as local atmospheric pressure increases.
5. Power developed increases as local atmospheric pressure decreases.

Select the correct answer using the code given below.

- (a) 1 and 4
- (b) 3 and 4
- (c) 3 and 5
- (d) 2 and 4

92. Consider the following statements in respect of 'mixers' :

1. Mass batch mixing of ingredients is the most desirable method.
2. Charging all materials into a drum mixer is done 'at once'.
3. The quantity of material fed into a mixer should be not more than the quantity that can be used in less than 30 minutes after completion of mixing.
4. Reversing mixers have less capacity than tilting mixers.
5. In large mixers, additional time of mixing is allowed.

Which of the above statements are correct?

- (a) 1, 2 and 3
- (b) 1, 3 and 5
- (c) 2, 3 and 4
- (d) 2, 4 and 5

93. Consider the following statements about 'cranes' :

1. Mobile cranes are suitable in small operations.
2. Whirley crane is a stationary crane with a long boom.
3. Tower crane is used in lifting heavy machinery.
4. A guy-derrick can operate in a limited area only.

Which of the above statements are correct?

- (a) 1 and 4
- (b) 2 and 4
- (c) 1 and 3
- (d) 2 and 3

94. Extracts from the head-discharge characteristics of two centrifugal pumps are tabulated with respective subscripts 1 and 2; manometric head  $h_m$  is given in metres; and discharge  $Q$  is given in lps :

$Q$	12	14	16	18	20
$h_{m_1}$	50.2	50.8	51.3	50.0	30.0
$h_{m_2}$	42.4	38.8	35.7	32.0	25.0

The pumps are connected in series against a static head of 80 m; the estimate of the total of head losses is  $\frac{Q^2}{120}$  m. What is the delivered discharge?

- (a) 15.80 lps
- (b) 16.35 lps
- (c) 17.35 lps
- (d) 17.75 lps

95. Which system of network given below completely eliminates the use of dummy activities?

- (a) A-O-A (Activity-on-Arrow)
- (b) A-O-N (Activity-on-Node)
- (c) PERT
- (d) CPM

96. Free float can be associated with which of the following?

1. In one of two sub-paths between any two adjacent nodes
2. In the last activity in the sub-paths, less by at least one of the sub-paths, between any two nodes
3. Following all sub-activities in a laddered network
4. Whenever mandatory calendar dates are prescribed for major milestone events

Select the correct answer using the code given below.

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

97. In PERT analysis, the time estimates of activities follow

- (a) normal distribution curve
- (b)  $\beta$ -distribution curve
- (c) Poisson's distribution curve
- (d) binomial distribution curve

98. Three consecutive activities A, B and E (in that order) have their T—Duration (in days) vs. C—Direct Cost (in monetary units) relationship expressed in the following table :

A		B		E	
T	C	T	C	T	C
8	15	6	7	4	11
9	14	7	6	5	12
10	16	8	7	6	13

What is the optimum duration for the corresponding minimum total direct cost for all the three activities when taken up consecutively without pause or disruption?

- (a) 22 days
- (b) 21 days
- (c) 20 days
- (d) 19 days

99. In an Activity-on-Arrow network, which of the following rules of network logic are mandatory?

1. Any two events can be directly connected by not more than one activity.
2. Event numbers should not be duplicated in a network.
3. Before an activity may begin, all the activities preceding it must be completed.

Select the correct answer using the code given below.

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

100. List the following processes in their correct sequence, from earliest to latest, in project implementation planning :

1. Project duration
2. Resource histogram
3. Standardized input/performance for each activity including alternatives
4. WBS
5. Resource optimization considering constraints
6. Activities and their inter-relationships

Select the correct answer using the code given below.

- (a) 2, 1, 3, 5, 6 and 4
- (b) 2, 6, 3, 5, 1 and 4
- (c) 4, 1, 3, 5, 6 and 2
- (d) 4, 6, 3, 5, 1 and 2

Directions :

Each of the 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 and select the answers to these items using the code given below.

Code :

- (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) :

Bricks are soaked in water before using in brick masonry for removing dirt and dust.

Statement (II) :

Bricks are soaked in water before using in brick masonry so that bricks do not absorb moisture from the bonding cement mortar.

**102. Statement (I) :**

Brick masonry in mud mortar is weak in strength.

**Statement (II) :**

Cement mortar enhances the strength of the bricks relative to mud mortar.

**103. Statement (I) :**

Quick-setting cement with initial setting time of 5 minutes is used in underwater constructions.

**Statement (II) :**

Aggregate and cement are mixed dry, and the mixture is then dumped in water.

**104. Statement (I) :**

Water needed for hydration decides the quantity of the water to be used in mortar preparation.

**Statement (II) :**

Excess water in mortar reduces its strength.

**105. Statement (I) :**

Preparing mortar by using masonry cement improves workability as well as the finish during plastering.

**Statement (II) :**

Masonry cement is easy to handle.

**106. Statement (I) :**

Grading of concrete is based on 28-day strength.

**Statement (II) :**

Concrete does not gain any further strength after 28-day curing.

**107. Statement (I) :**

Addition of admixture improves the workability of concrete.

**Statement (II) :**

Addition of admixture increases the strength of concrete.

108. Statement (I) :

There are two independent elastic constants for an isotropic material.

Statement (II) :

All metals at micro-level are isotropic.

109. Statement (I) :

Mohr's theory is based on logical arrangement of experimental results.

Statement (II) :

Mohr's theory generalizes Coulomb's theory.

110. Statement (I) :

The most-suited failure theory for concrete is maximum shear strength theory.

Statement (II) :

Ductile materials are limited by their shear strength.

111. Statement (I) :

In simple bending, strain in the bent beam varies linearly across the beam depth.

Statement (II) :

As per Hooke's law, within elastic limit, the stress is proportional to the strain.

112. Statement (I) :

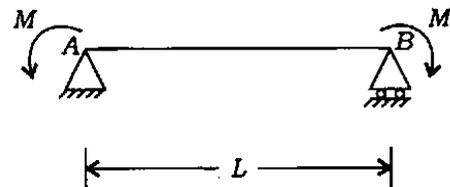
The failure surface of a standard cast iron specimen of circular cross-section subjected to torsion is on a helicoidal surface at  $45^\circ$  to its axis.

Statement (II) :

The failure occurs on a plane of the specimen subjected to maximum tensile stress, and cast iron is weak in tension.

113. Statement (I) :

A simply supported beam  $AB$  of constant  $EI$  throughout, when subjected to pure terminal couples as shown in the figure, will bend into an arc of a circle.



Statement (II) :

Theory of simple bending establishes relationships from among  $M$ ,  $f$ ,  $R$ ,  $y$ ,  $E$  and  $I$ .

**114. Statement (I) :**

Concrete of desired strength can be achieved by weight-batching method.

**Statement (II) :**

Volume-batching method does not take into account bulking of aggregates, hence concrete of desired strength cannot be achieved by volume-batching.

**115. Statement (I) :**

Hoe is not very advantageous in digging trenches and basements.

**Statement (II) :**

In a hoe, the digging action results from the drag of the bucket.

**116. Statement (I) :**

In close-range works of excavation, power shovel is suitable.

**Statement (II) :**

Power shovel has greater rigidity and gives greater output than draglines.

**117. Statement (I) :**

Reciprocating pump is self-priming.

**Statement (II) :**

Reciprocating pump is used to pump dirty water in excavations.

**118. Statement (I) :**

A linked-bar chart is premised on a resource-based scheduled network, and so is unique to the relevant project.

**Statement (II) :**

A squared scheduled network drawn after allocating activity durations, with consideration of floats that have been originally available, may yet have the inputs-scheduling pending.

**119. Statement (I) :**

A dummy job takes zero time to perform.

**Statement (II) :**

It is used solely to illustrate precedence relationship.

**120. Statement (I) :**

In resource levelling, project completion time is not extended provided there is no constraint on availability of resources.

**Statement (II) :**

There is generally a constraint against exceeding the project duration time.

**SPACE FOR ROUGH WORK**



**SPACE FOR ROUGH WORK**



**SPACE FOR ROUGH WORK**



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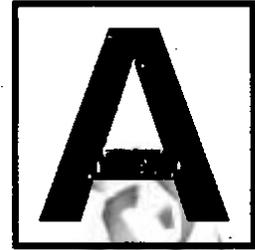
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**Test Booklet Series**

**Serial**

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**TEST BOOKLET  
CIVIL ENGINEERING  
PAPER II**



**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 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.**
  - (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 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.

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

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 =  $1000 \text{ kg/m}^3$ ). Its draught in sea water having density of  $1025 \text{ kg/m}^3$  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  $u = 3.0 \sin(5\pi y)$ . The viscosity of the fluid is 5 poise. What is the shear stress at a section (i)  $y = 0.05 \text{ m}$ ; (ii)  $y = 0.12 \text{ m}$  ?
  - (a)  $16.7 \text{ N/m}^2$  and  $6.1 \text{ N/m}^2$
  - (b)  $33.4 \text{ N/m}^2$  and Zero
  - (c)  $16.7 \text{ N/m}^2$  and  $12.3 \text{ N/m}^2$
  - (d)  $16.7 \text{ N/m}^2$  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  $2 \text{ m}^3/\text{s}$ , model tests were conducted on a 0.1 m diameter pipe using water at  $20^\circ\text{C}$ . If the absolute viscosity of water at  $20^\circ\text{C}$  is  $1.00 \times 10^{-2}$  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

7. A two-dimensional water jet strikes a fixed two-dimensional plate at  $30^\circ$  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
- 14.0
  - 3.0
  - 2.0
  - 1.0
8. A triangular open channel has a vertex angle of  $90^\circ$  and carries flow at a critical depth of 0.3 m. The discharge in the channel is
- $0.41 \text{ m}^3/\text{s}$
  - $0.11 \text{ m}^3/\text{s}$
  - $0.21 \text{ m}^3/\text{s}$
  - $0.31 \text{ m}^3/\text{s}$
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
- 1.0 m
  - 0.95 m
  - 0.79 m
  - 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
- No change in the depth of flow
  - Decrease in the depth of flow
  - Gradually decreasing flow
  - Increase in the depth of flow
11. Consider the following statements regarding a gradually varied flow in a prismatic open channel :
- Total energy line remains parallel to the water surface.
  - The rate of energy loss at the section is inversely proportional to  $d^x$  where  $d$  is flow depth with index  $x$ .
  - In analyzing the flow, the energy equation of flow is not applicable.
  - Pressure distribution at every section can be assumed to be hydrostatic.
- Which of the above statements are correct ?
- 1 and 4
  - 2 and 4
  - 1 and 2
  - 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
- 0.50 m/s
  - 0.25 m/s
  - 0.75 m/s
  - 1.25 m/s

13. A liquid of density  $\rho$  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
- $\frac{V\sqrt{\rho}}{g\sqrt{K}}$
  - $\frac{V\sqrt{g}}{\rho\sqrt{K}}$
  - $\frac{V\sqrt{K}}{g\sqrt{\rho}}$
  - $\frac{V\rho}{\sqrt{gK}}$
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<sup>3</sup>. 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?
- 14.4 kW
  - 18.0 kW
  - 22.5 kW
  - 17.2 kW
15. For circular cylinders, with Reynolds number greater than 1000, how would the Strouhal number behave?
- Varies as  $Re^{\frac{1}{6}}$
  - Varies as  $Re^{\frac{1}{4}}$
  - Almost  $\approx 0.16$
  - 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
- $16\pi$  m/s
  - $10\pi$  m/s
  - $12\pi$  m/s
  - $100\pi$  m/s
17. The following data were noted from an irrigation field:
- Field capacity = 20%
  - Permanent wilting point = 10%
  - Permissible depletion of available soil moisture = 50%
  - Dry unit weight of soil = 15 kN/m<sup>3</sup>
  - Effective rainfall = 50 mm
- The net irrigation requirement per metre depth of soil will be
- 75 mm
  - 125 mm
  - 50 mm
  - 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
- The relative velocity is radial at the outlet
  - The absolute velocity is radial at the outlet
  - The guide vane angle is 90°
  - The velocity of flow is constant

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  $300 \text{ m}^3/\text{s}$ . 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  $20 \text{ m}^3/\text{s}$  is premised throughout. The peak value of the corresponding 4-hr unit hydrograph is

- (a)  $75 \text{ m}^3/\text{s}$
- (b)  $70 \text{ m}^3/\text{s}$
- (c)  $50 \text{ m}^3/\text{s}$
- (d)  $40 \text{ m}^3/\text{s}$

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

- (a)  $19.5 \text{ M m}^3$
- (b)  $23.4 \text{ M m}^3$
- (c)  $15.6 \text{ M m}^3$
- (d)  $32.5 \text{ M m}^3$

24. The best estimate of runoff represented by 57 mm of runoff depth from a basin area 3300 km<sup>2</sup> is nearly
- 2300 cumec-days
  - 2225 cumec-days
  - 2175 cumec-days
  - 2020 cumec-days
25. The probability of a 10-year flood to occur at least once in the next 5 years is
- 35%
  - 41%
  - 60%
  - 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
- Design flood
  - Standard project flood
  - Probable maximum flood
  - Flash flood
27. When 3.5 million m<sup>3</sup> of water was pumped out from an unconfined aquifer of 6.3 km<sup>2</sup> areal extent, the water table was observed to go down by 2.5 m. The specific yield of the aquifer is best approximated as
- 32%
  - 28%
  - 25%
  - 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<sup>3</sup>, Unit weight of water = 9.8 kN/m<sup>3</sup> and Effective rainfall = 30 mm, what is the net irrigation requirement per meter depth of soil ?
- 300 mm
  - 150 mm
  - 120 mm
  - 90 mm
29. A lift irrigation scheme using a discharge of 96 m<sup>3</sup>/hr is planned to raise a crop with an average  $\Delta$  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
- 96 Ha
  - 48 Ha
  - 144 Ha
  - 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
- 70%
  - 80%
  - 85%
  - 90%
31. A direct runoff hydrograph due to a storm idealized into a triangular shape has a peak flow rate of 60 m<sup>3</sup>/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<sup>2</sup>, the runoff from the storm is
- 1 cm
  - 2 cm
  - 5 cm
  - 10 cm

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<sup>2</sup>. 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<sup>3</sup>
- (b) 3.0 Mm<sup>3</sup>
- (c) 7.0 Mm<sup>3</sup>
- (d) 8.0 Mm<sup>3</sup>

34. Ground water flows through an aquifer with a cross-sectional area of  $1.0 \times 10^4 \text{ m}^2$  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<sup>3</sup>/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<sup>2</sup>
- (b) 18.2 N/mm<sup>2</sup>
- (c) 19.2 N/mm<sup>2</sup>
- (d) 16.2 N/mm<sup>2</sup>

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

38. A regime canal carries silt of median size 0.25 mm. The Lacey's silt factor of this silt is
- 0.66
  - 0.88
  - 0.44
  - 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
- 1.95 m
  - 1.76 m
  - 1.63 m
  - 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
- 1.7 MPa
  - 2.4 MPa
  - 3.6 MPa
  - 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
- 77760 kN-m
  - 25292 kN-m
  - 6480 kN-m
  - 51840 kN-m
42. Which of the following outlets are of semi-modular type ?
- Khanna's module
  - Adjustable proportional module
  - Submerged pipe outlet
  - Open flume outlet
  - Kennedy's gauge outlet
- 2, 4 and 5
  - 1, 2 and 4
  - 2, 3 and 5
  - 3, 4 and 5
43. If the channel index at an irrigation outlet is  $\frac{5}{3}$ , "setting" of an orifice type outlet in order to have proportionality is
- 0.90
  - 0.67
  - 0.30
  - 0.15

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<sup>3</sup> 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

49. A rapid sand filter for a town with water requirement of 1 MLD is to be provided with rate of filtration at  $4000 \text{ l/hr/m}^2$ , with backwash system. What would be the size of the filter and its underdrainage system to the nearest approximation ?
- 10 and 0.032 sq. m
  - 11 and 0.022 sq. m
  - 12 and 0.045 sq. m
  - 15 and 0.062 sq. m
50. Consider the following statements in respect of injecting chlorine between rapid sand filter and storage tank :
- More contact time is available.
  - Chlorine demand is reduced.
  - $\text{NHCl}_2$  is formed which is more effective than residual chlorine.
  - Break point chlorination takes place.
- Which of the above statements are correct ?
- 1, 2, 3 and 4
  - 1, 2 and 3 only
  - 1 and 2 only
  - 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  $2 \times 10^{-3} \text{ cm}$  and 2.65, respectively. Water temperature is  $20^\circ\text{C}$ . (Kinematic viscosity =  $2 \times 10^{-2} \text{ cm}^2/\text{sec}$ .)
- 0.018 cm/sec
  - 0.025 cm/sec
  - 0.18 cm/sec
  - 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
- 4 times
  - 2 times
  - 1 time
  - 16 times
53. If the average sewage from a city is  $95 \times 10^6 \text{ l/day}$  and the average 5-day BOD is 300 mg/l against a standard of 75 mg/day per capita at  $20^\circ\text{C}$ , then the population equivalent of the city will be
- 28,500
  - $285 \times 10^6$
  - 3,80,000
  - $380 \times 10^6$
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
- Side entrance manhole
  - Junction manhole
  - Flushing manhole
  - Drop manhole

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<sub>x</sub>
- (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

61. A soil sample has a void ratio of 0.5; its porosity will be
- 50%
  - 66%
  - 100%
  - 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?
- 56
  - 52
  - 58
  - 60
63. Consider the following statements :
- Knowledge about moisture content is necessary to determine permeability.
  - Some typical marine clay may have moisture content as high as 400%.
  - Sand-bath method of moisture content determination is not suitable for soils containing organic matter.
- Which of the above statements are correct?
- 1, 2 and 3
  - 1 and 2 only
  - 2 and 3 only
  - 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
- 7.9%
  - 8.0%
  - 8.9%
  - 9.8%
65. A sand sample has a bulk density of  $20 \text{ kN/m}^3$  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
- 1.02
  - 1.05
  - 1.10
  - 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
- 0.67
  - 1.0
  - 1.5
  - 2.0

67. Compression index developed by Casagrande is

- (a)  $C_v = 0.009 (LL + 10\%)$
- (b)  $C_v = 0.009 (LL - 10\%)$
- (c)  $C_v = 0.0009 (LL + 10\%)$
- (d)  $C_v = 0.0009 (LL - 10\%)$

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

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  $450 \text{ kN/m}^2$ . 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  $20 \text{ kN/m}^3$ , then the net bearing capacity is

- (a)  $410 \text{ kN/m}^2$
- (b)  $420 \text{ kN/m}^2$
- (c)  $430 \text{ kN/m}^2$
- (d)  $440 \text{ kN/m}^2$

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  $30^\circ$ . 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

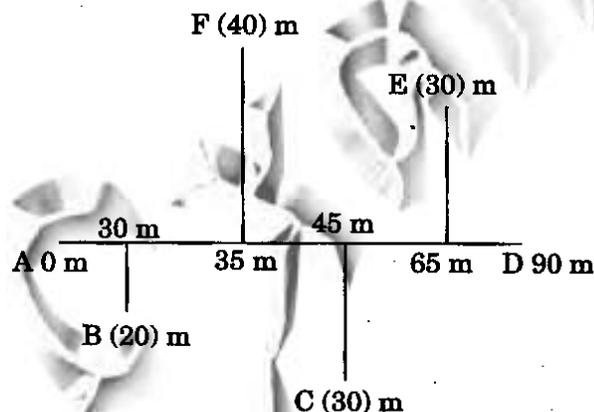
78. The measured radius of a circle is 80 m with a possible error of 0.05 m in its diameter. The error in the computed area will nearly be

- (a)  $+ 6.5 \text{ m}^2$
- (b)  $- 0.65 \text{ m}^2$
- (c)  $\pm 12.6 \text{ m}^2$
- (d)  $\pm 8.2 \text{ m}^2$

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)  $3650 \text{ m}^2$
- (b)  $3200 \text{ m}^2$
- (c)  $3475 \text{ m}^2$
- (d)  $3500 \text{ m}^2$

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  $55^\circ 30'$  and the magnetic declination is  $4^\circ 30'$  east. The true bearing of a line will be

- (a)  $60^\circ$
- (b)  $34^\circ 30'$
- (c)  $49^\circ 30'$
- (d)  $51^\circ$

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
- 4.270 m
  - 4.685 m
  - 3.955 m
  - 4.920 m
85. Consider the following parameters in respect of RADAR principle :
- It is an active sensing system.
  - Electromagnetic radiation of wavelength is in centimetre range.
  - It operates in visible region.
  - It comprises Radio detection and ranging.
- Which of the above statements are correct ?
- 1, 2 and 3
  - 2, 3 and 4
  - 1, 2 and 4
  - 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
- Temporal resolution
  - Radiometric resolution
  - Spatial resolution
  - Spectral resolution
87. In a transit theodolite, any incidental error due to eccentricity of verniers is primarily counteracted by
- Reading both the verniers
  - Reading different parts of main scale
  - Reading right and left faces
  - 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 ?
- 5 mm
  - 1 mm
  - 0.5 mm
  - 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
- 0.63
  - 0.73
  - 0.83
  - 0.93

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
- 1%
  - 2%
  - 3%
  - 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.
- 15 mm
  - 11 mm
  - 9 mm
  - 6 mm
92. In a flexible pavement
- Vertical compressive stresses decrease with depth of the layer
  - The vertical compressive stress is the maximum at the lowest layer
  - Tensile stresses get developed
  - 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
- Rigid overlays on rigid pavements
  - Rigid overlays on flexible pavements
  - Flexible overlays on flexible pavements
  - 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 ?
- 828
  - 728
  - 628
  - 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
- 50.5 mm
  - 55.5 mm
  - 59.5 mm
  - 65.5 mm
96. 'Composite Sleeper Index' is employed to determine
- Sleeper density requirement
  - Number of fixtures required for a certain type of sleeper
  - Durability of sleeper
  - 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 ?
- Sigma clip
  - IRN-202 clip
  - LG-20 Lock spike
  - Pandrol clip

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  $2^\circ$  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.

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.

**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.

**SPACE FOR ROUGH WORK**



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