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

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

Test Booklet Series

A

Serial

TEST BOOKLET

CIVIL ENGINEERING

Paper I

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.

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1. One bag of Portland cement, 50 kg in weight, would normally have a bulk volume of

(a) 30 l

(b) 35 l

(c) 40 l

(d) 45 l

2. AsCu, a preservative for wood, developed by the Forest Research Institute, Dehradun, comprises of chemicals :

$As_2O_5 . 2H_2O$, $CuSO_4 . 5H_2O$ and $K_2Cr_2C_7$ in the proportion of

(a) 1 : 1 : 1

(b) 1 : 2 : 3

(c) 1 : 2 : 4

(d) 1 : 3 : 4

3. The minimum number of annular rings to be seen in every 2·54 cm in the radial direction from the core for timber to be classified as 'Dense' is

(a) 10

(b) 20

(c) 25

(d) 30

4. Consider the following statements related to autoclave bricks :

1. Less water absorption compared to other bricks.
2. Noise reduction.
3. It is cheap compared to other types of bricks.
4. Requirement of bulk volume of mortar in joints being relatively less compared to other types of brick masonry.
5. Not recommended for outer walls.

Which of the above statements are relevant to the use of 'autoclave' bricks ?

(a) 1, 2 and 4

(b) 1, 3 and 5

(c) 2, 3 and 4

(d) 2, 4 and 5

5. If the actual thickness of a brick masonry wall is 19 cm, its effective length is 2·70 m, its effective height is 2·82 m and its code-specified stiffening coefficient is 1·2, then, for design considerations, the slenderness ratio of the wall will be taken as

(a) 11·8

(b) 12·4

(c) 14·2

(d) 14·8

6. Consider the following forms of water in a hydrated cement paste :

1. Capillary water
2. Chemically combined water
3. Interlayer water
4. Adsorbed water

Which of the above forms of water will, on its/their removal, cause shrinkage of the paste ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 2, 3 and 4

(d) 1, 3 and 4

7. A specimen is subjected to a pure shear stress regime of intensity τ. The resulting tensile and compressive stresses σ, which occur on planes inclined at 45° to the direction of the shear stresses, would be

(a) τ

(b) $\frac{\tau}{2}$

(c) $\sqrt{2}\,\tau$

(d) $\frac{\tau}{\sqrt{2}}$

8. Consider the following statements :
High early strength of cement is obtained as a result of

1. Fine grinding.
2. Decreasing the lime content.
3. Burning at higher temperature.
4. Increasing the quantity of gypsum.

Which of the above statements are correct ?

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

9. Consider the following statements related to 'composite mortar' :

1. Addition of lime to cement mortar improves its workability.
2. Composite mortar is obtained by adding 10% by weight of cement and mixing with water.
3. Composite mortar is not preferred in tall buildings.
4. Mechanical grinding is essential for developing composite mortar.

Which of the above statements are true in this case ?

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

10. Consider the following statements related to 'non-destructive testing' of concrete :

1. Indentation test is used to assess the quality of concrete.
2. Resonant Frequency Method is based on a laboratory test.
3. Compressive strength of concrete is estimated through Pulse Velocity Measurement.
4. Dynamic Modulus of Elasticity is determined by a Schometer Test.
5. Thickness of concrete can be estimated by in-situ Rebound Hammer Test.

Which of the above statements are correct ?

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

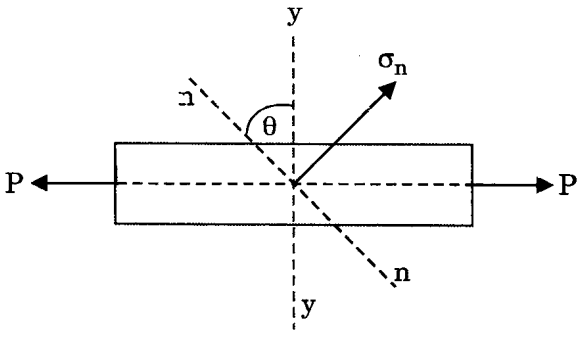
11. What is the amount of water required for a workable RC of mix 1 : 2 : 4 by weight, when W/C is 0·60 and unit weight of concrete is 2400 kg/m^3 ?

(a) 165 l
(b) 205 l
(c) 245 l
(d) 285 l

12. For a given elastic material, the Elastic Modulus **E** is 210 GPa and its Poisson's Ratio is 0·27. What is the approximate value of its Modulus of Rigidity ?

(a) 105 GPa
(b) 83 GPa
(c) 159 GPa
(d) 165 GPa

13. A mild steel bar is subjected to an axial force P, resulting in an axial stress $\sigma_x = 100$ N/mm^2. What would be the normal stress σ_n on a plane n-n making an angle $\theta = 45°$ with its axis ?



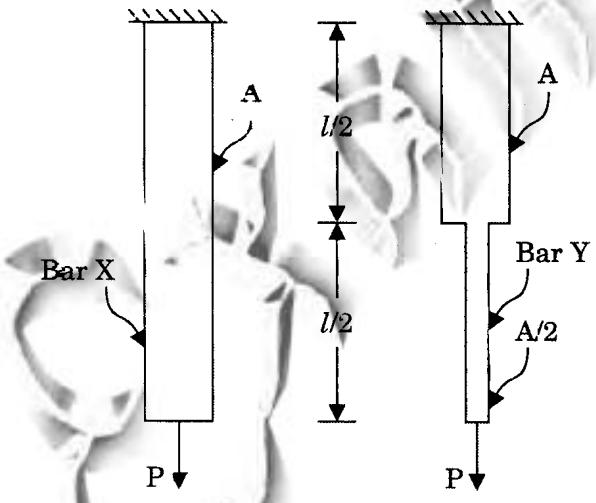
(a) 25 N/mm^2

(b) 40 N/mm^2

(c) 50 N/mm^2

(d) 100 N/mm^2

14. What is the ratio of the strain energy in bar X to that in bar Y when the material of the two bars is the same ? The cross-sectional areas are as indicated over the indicated lengths.



(a) 1/3

(b) 2/3

(c) 4/3

(d) 1/6

15. Which of the following stresses is measured on inclined surface in Mohr's Circle Method ?

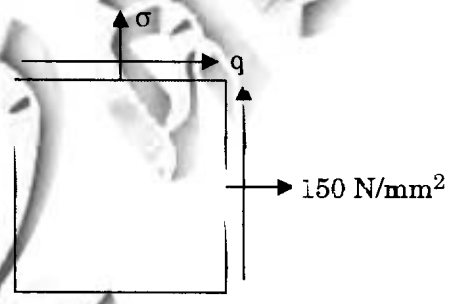
(a) Principal stress

(b) Normal stress

(c) Tangential stress

(d) Maximum stress

16. The state of stress on an element in plane stress is shown as in the figure.



What is the value of σ if the values of the principal stresses are 164 N/mm^2 and 36 N/mm^2, both tensile ?

(a) 100 N/mm^2

(b) 75 N/mm^2

(c) 62·5 N/mm^2

(d) 50 N/mm^2

17. Lead, as a material used in construction, has E = 15 GPa and K = 50 GPa. What is its Poisson's Ratio ?

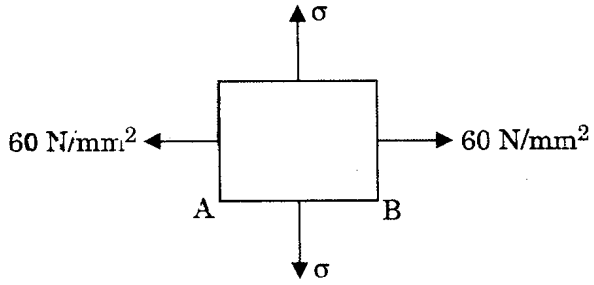
(a) 0·225

(b) 0·30

(c) 0·40

(d) 0·45

18. For a block with Young's Modulus of its material being 210 GPa and its Poisson's Ratio being 0·25, when subjected to a stress system as shown in the figure, what is the magnitude of the stress σ for no strain along AB ?



(a) 30 N/mm²

(b) 60 N/mm²

(c) 120 N/mm²

(d) 240 N/mm²

19. Two planks each of 50 mm × 50 mm section are glued together along the length to form a section 50 mm × 100 mm; and used as a beam. If the shear force at a section is 1000 N, what is the maximum shear stress on the glue ?

(a) 0·15 MPa

(b) 0·3 MPa

(c) 0·6 MPa

(d) 2·4 MPa

20. The state of stress at a point in 2-D stress system is characterized by direct stresses of 40 MPa compressive and 80 MPa tensile, on mutually perpendicular planes. Shear stress is absent on these planes. The maximum shear stress at this point (along a duly identified plane) is

(a) 20 MPa

(b) 40 MPa

(c) 60 MPa

(d) 80 MPa

21. An electrical resistance strain rosette indicates strains of − 400, + 800 and + 500 along the x, y and 45° axes. What is the shearing strain γ_{xy} ?

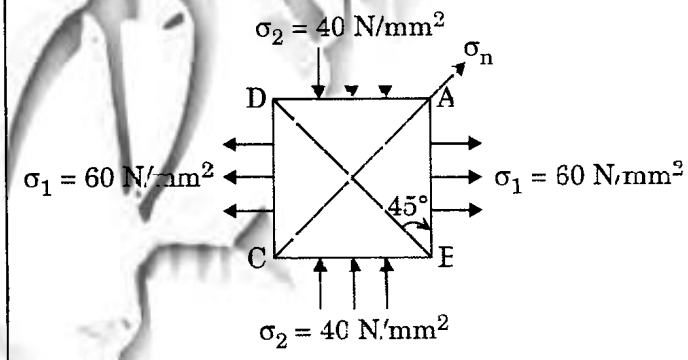
(a) 100

(b) 800

(c) 600

(d) − 200

22. The biaxial stress system in an element is shown in the figure. Which of the following will give the normal stress in N/mm² in the plane BD making an angle of 45° with the plane BA ?



(a) 25

(b) 20

(c) 15

(d) 10

23. A cylindrical pressure vessel is 1200 mm in diameter. It is made of rolled mild steel plate. The vessel is subjected to an internal pressure of 2 N/mm². If the material yields at 200 N/mm², what should be the minimum safe thickness of the plate, based on Maximum Principal Stress Theory ?

(a) 18 mm

(b) 15 mm

(c) 12 mm

(d) 9 mm

24. A machine element develops principal stresses of magnitudes 2P and P. What is the maximum magnitude of P before the material reaches the yield stress f_y as per Distortion Shear Energy Theory ?

(a) f_y

(b) $\frac{f_y}{2}$

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

(d) $\frac{f_y}{\sqrt{3}}$

25. A structural element is subjected to a two-dimensional stress system, wherein σ_1 = 225 N/mm^2 (tensile) with σ_2 being compressive. The yield stress in both simple tension $(\sigma_y)_t$ and simple compression $(\sigma_y)_c$ is 250 N/mm^2 and μ = 0·25. What is the value of σ_2, according to Maximum Strain Theory ?

(a) 200 N/mm^2

(b) 150 N/mm^2

(c) 125 N/mm^2

(d) 100 N/mm^2

26. A simply supported beam of length 4 m is subjected to a uniformly distributed load of 2 kN/m. What is the maximum shear stress if the cross-section is rectangular, 100 mm wide and 200 mm deep ?

(a) 0·2 N/mm^2

(b) 0·1 N/mm^2

(c) 0·4 N/mm^2

(d) 0·3 N/mm^2

27. A mild steel structural section is an unsymmetrical I-section, with the greater width at the top and the smaller width at the bottom. The overall depth of the beam is 300 mm, and the flange stresses at the top and the bottom of the beam are 150 N/mm^2 and 50 N/mm^2 respectively. What is the height of the neutral axis of the beam from its bottom ?

(a) 125 mm

(b) 100 mm

(c) 75 mm

(d) 50 mm

28. A circular shaft of diameter 'D' is made of a material for which Young's Modulus of Elasticity is 'E' and Poisson's Ratio is 'ν'. The ratio of flexural rigidity to torsional rigidity for the shaft is

(a) 4 (1 + ν)

(b) 1·5 (1 − 2ν)

(c) (1 + ν)

(d) 0·25 (1 + ν)

29. A closely coiled helical spring of round steel wire 5 mm in diameter having 12 complete coils of 50 mm mean diameter is subjected to an axial load of 100 N. Modulus of Rigidity of the spring is 80 kN/mm^2. What is the deflection of the spring ?

(a) 12 mm

(b) 24 mm

(c) 36 mm

(d) 48 mm

30. What is the shear stress at the neutral axis in a beam of isosceles triangular section with a base of 40 mm and height 20 mm subjected to a shear force of 3 kN ?

(a) 3 MPa

(b) 6 MPa

(c) 10 MPa

(d) 20 MPa

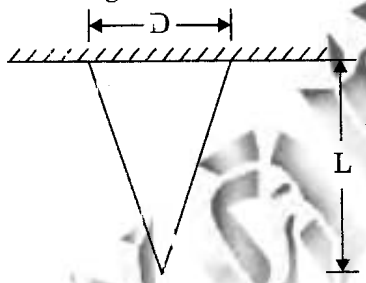
31. A beam of square cross-section is placed such that its neutral axis coincides with its diagonal, and it is subjected to a shear force F. What is the ratio of the maximum shear stress to the shear stress at the neutral axis ?

(a) 9/8
(b) 8/9
(c) 7/8
(d) 8/7

32. The intensity of u.d.l. which, when it acts over the entire span of 1 m of a cantilever beam of rectangular cross-section of width 100 mm and depth 200 mm, would produce a maximum shear stress of 1·5 N/mm^2, is

(a) 20 kN/m
(b) 30 kN/m
(c) 26·3 kN/m
(d) 36·6 kN/m

33. A solid conical bar of circular cross-section is suspended vertically as shown in the figure. The diameter of the bar at the base, D, equals 100 mm and its length, L, is 0·5 m. If E = 200 GN/m^2 and its weight per unit volume is 80 kN/m^3, the elongation of the bar under self-weight is



(a) $1{\cdot}50 \times 10^{-6}$ mm
(b) $1{\cdot}37 \times 10^{-5}$ mm
(c) $1{\cdot}71 \times 10^{-6}$ mm
(d) $1{\cdot}87 \times 10^{-5}$ mm

34. Two closely coiled helical springs A and B are equal in all respects but for the number of turns, with A having just half the number of turns of that of B What is the ratio of deflections in terms of spring A to spring B ?

(a) 1/8
(b) 1/4
(c) 1/2
(d) 2/1

35. What is the diameter d of a solid circular shaft when subjected to a torque T with a corresponding maximum shear stress of magnitude f_s ?

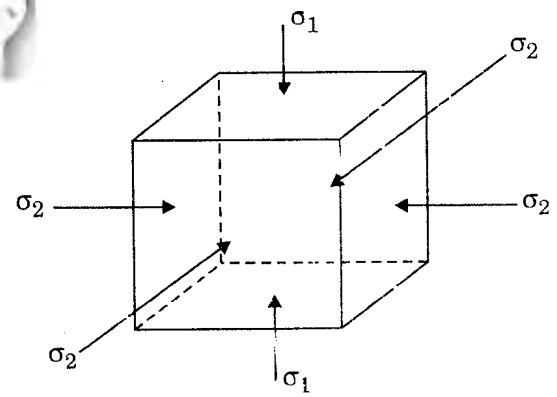
(a) $\dfrac{16T}{\pi f_s}$

(b) $\dfrac{\pi f_s}{16T}$

(c) $\sqrt{\dfrac{16T}{\pi f_s}}$

(d) $\sqrt[3]{\dfrac{16T}{\pi f_s}}$

36. A cubical element of a structural part made of mild steel is subjected to a tri-axial compressive stress as shown in the figure. The vertical compressive stress is σ_1. The Modulus of Elasticity and Poisson's Ratio are E and μ, respectively. What should be the uniform lateral pressure σ_2 in terms of σ_1 and μ, so that lateral strain is prevented ?



(a) $\dfrac{\mu}{1-\mu}\sigma_1$

(b) $\dfrac{\mu}{(1+\mu)(1-\mu)}\sigma_1$

(c) $\dfrac{\mu}{1+\mu}\sigma_1$

(d) $\dfrac{1+\mu}{1-\mu}\sigma_1$

37. A metal shaft of solid circular section rotates at 160 rpm and is subjected to a torque of 1500 Nm. What is the power, in kW, transmitted by the shaft ?

(a) 32π

(b) 16π

(c) 12π

(d) 8π

38. What is the power transmitted by a 100 mm diameter solid shaft at 150 rpm without exceeding a maximum stress of 60 N/mm^2 ? Take $\pi^2 = 10$.

(a) 187·5 kW

(b) 18·75 kW

(c) 1·875 kW

(d) 1875 kW

39. What is the Polar Modulus of a solid circular metal shaft of diameter 8 cm ?

(a) 64π cm^3

(b) 32π cm^3

(c) 16π cm^3

(d) 8π cm^3

40. A hollow circular shaft has the diameters 50 cm and 30 cm and is subjected to a torque. If the realized maximum shear stress is 30 N/mm^2, what is the applied torque to nearest units ?

(a) 160 Nm

(b) 320 Nm

(c) 80 Nm

(d) 32 Nm

41. Two simply supported beams are made up of the same material and are of the same cross-section. Both beams carry uniformly distributed loads of equal intensities. One beam is 2 m long and the other is 4 m long. The 2 m long beam shows a central deflection of 1 mm. What is the central deflection of the 4 m long beam ?

(a) 13 mm

(b) 2 mm

(c) 8 mm

(d) 1 mm

42. A simply supported beam is subjected to a couple at a section within its span. It will produce

1. SF diagram of zero magnitude.
2. Uniformly varying triangular BM diagram.
3. Sudden change in sign of BM at the point of application of the couple.
4. Equal and opposite reactions at supports.

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

43. If the deflection at the free end of a uniformly loaded cantilever beam is 15 mm and the slope of the deflection curve at the free end is 0·02 radian, then the length of the beam is

(a) 0·8 m

(b) 1·0 m

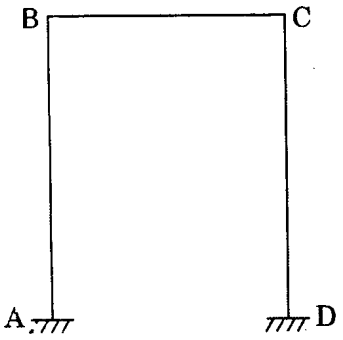
(c) 1·2 m

(d) 1·5 m

44. A beam of overall length l, with equal overhangs on both sides, carries a uniformly distributed load over the entire length. To have numerically equal bending moments at the centre of the beam and at its supports, the distance between the supports should be

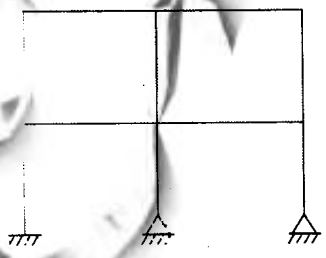
(a) $0{\cdot}277\,l$
(b) $0{\cdot}403\,l$
(c) $0{\cdot}586\,l$
(d) $0{\cdot}707\,l$

45. A single-bay single-storeyed portal frame ABCD is fixed at A and D as shown in the figure. If axial deformation is neglected, the kinematic indeterminacy is



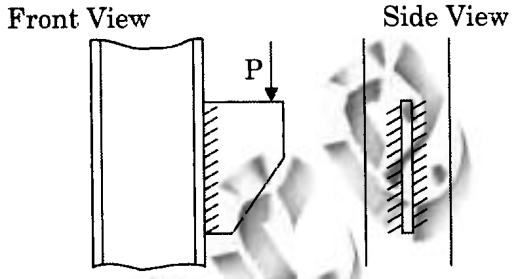
(a) 3
(b) 2
(c) 6
(d) 4

46. What is the number of kinematic indeterminacy for the building frame as shown in the figure when members are inextensible ?



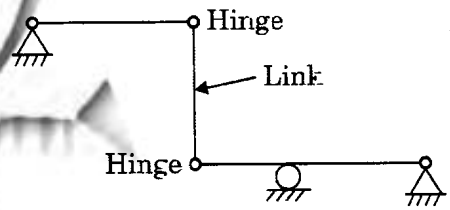
(a) 8
(b) 10
(c) 12
(d) 16

47. For the welded joint shown in the figure, the direct vertical shear stress on the weld is 40 MPa and the bending stress is 120 MPa. For what strength should the weld be designed ?



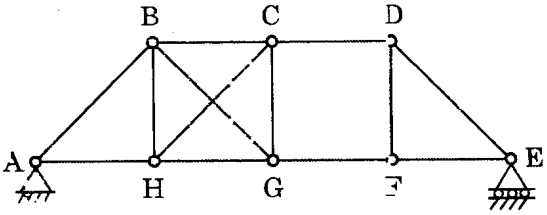
(a) 80 MPa
(b) 120 MPa
(c) 132 MPa
(d) 160 MPa

48. Degree of static indeterminacy of the structure as shown in the figure is



(a) 0
(b) 1
(c) 2
(d) 3

49. Which one of the following statements is correct for the pin-jointed truss shown in the figure ?



(a) The truss is externally determinate but internally indeterminate
(b) The truss is both externally and internally determinate
(c) The truss is externally determinate and internally indeterminate and is unstable
(d) The truss is externally determinate and internally indeterminate and is stable

50. Which one of the following methods is *not* classifiable as a Force Method ?

(a) The Theorem of Three Moments

(b) The Moment Distribution Method

(c) The Method of Consistent Deformation

(d) Castigliano's Theorem

51. A cable of negligible weight is suspended between two points spaced 300 m apart horizontally, with the right support being 12 m higher than the left support. Four vertical loads of magnitudes 400, 200, 400 and 1200 kN are applied at points A, B, C and D which are 60, 120, 180 and 240 m horizontally respectively from the left support. The largest sag of the cable will be at

(a) A

(b) B

(c) C

(d) D

52. A single-bay portal frame of height h, fixed at the base, is subjected to a horizontal displacement δ at the top. The base moments developed are each proportional to

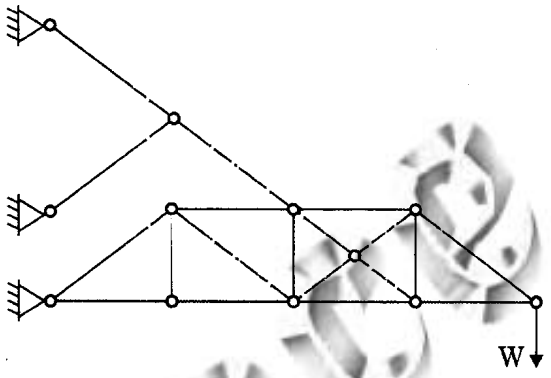
(a) $\frac{1}{h}$

(b) $\frac{1}{h^2}$

(c) $\frac{1}{h^3}$

(d) $\frac{1}{h^4}$

53. The total (both external and internal) degrees of indeterminacy of the pin-jointed structure shown in the figure is



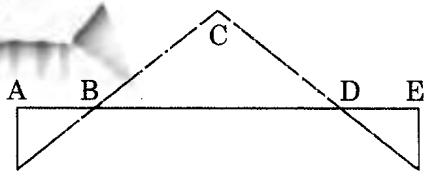
(a) 4

(b) 3

(c) 2

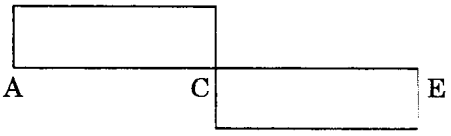
(d) 1

54. The bending moment diagram of a beam is shown in the figure.

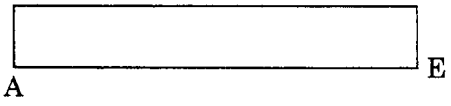


The shear force diagram of the beam is represented by

(a)



(b)



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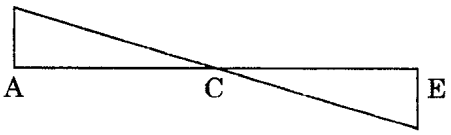
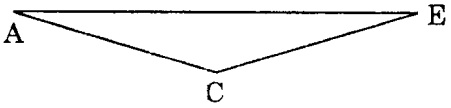
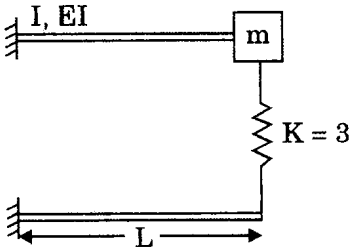


(d)



55. For the structure shown in the figure, all of I, EI and L are of respective unit values. The equivalent stiffness constant for the structure is

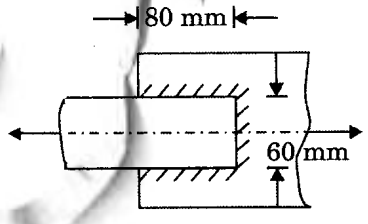


(a) 1
(b) 1·5
(c) 4·5
(d) 9

56. In considering Plastic Analysis, which of the following is a valid comprehensive statement ?

(a) Shape factor is the ratio of Plastic Section Modulus to the Elastic Section Modulus
(b) Shape factor is the ratio of Elastic Section Modulus to the Plastic Section Modulus
(c) Shape factor is the ratio of Plastic Section Modulus to the Elastic Section Modulus and its value is always greater than 1·0
(d) Shape factor is the ratio of Elastic Section Modulus to the Plastic Section Modulus and its value is always less than 1·0

57. A fillet-welded joint is shown in the figure. The size of the weld is 8 mm. Safe stress in the weld is 110 N/mm^2. What is the safe force (to the nearest magnitude) to which the weld can be subjected ?

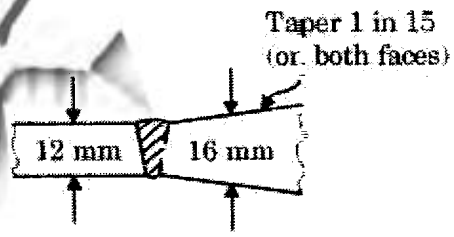


(a) 125 kN
(b) 130 kN
(c) 140 kN
(d) 135 kN

58. A circular shaft of diameter 120 mm is welded to a rigid plate by a fillet weld of size 6 mm. If a torque of 8 kNm is applied to the shaft, what is the maximum stress in the weld (to the nearest unit) ?

(a) 34 N/mm^2
(b) 37 N/mm^2
(c) 90 N/mm^2
(d) 95 N/mm^2

59. Two plates of dimensions 150 mm × 16 mm and 150 mm × 12 mm at their welding edges are joined by butt welding as shown in the figure. What is the maximum tension that this single V-butt weld joint can transmit ? The permissible tensile stress in the plates is 150 MPa.



(a) 168·75 kN
(b) 270 kN
(c) 218 kN
(d) 1350 kN

60. A solid shaft transmits 150 kW at a shear stress of 70 MPa running at a frequency of 3 Hz. What will be the shear stress when the frequency is 1·5 Hz ?

(a) 35 MPa
(b) 50 MPa
(c) 57 MPa
(d) 140 MPa

61. What is the maximum number of 20 mm diameter bolts that can be accommodated in a single row on a 140 mm wide flat strip used as one of the structural elements involved in the process ?

(a) 4

(b) 3

(c) 2

(d) 5

62. What is the nearest magnitude of strength of a 8 mm fillet weld of 100 mm length made between two flats each 10 mm thick ? The allowable shear stress on the weld is 110 MPa.

(a) 23 kN

(b) 33 kN

(c) 46 kN

(d) 66 kN

63. Consider the following statements :

1. The thickness of the gusset plate should not be more than the thickness of the structural members being connected.
2. A plate girder is essentially a beam and its moment of resistance depends upon its section modulus.
3. The function of the flanges in a plate girder is to resist the bending moment and hence their respective areas can be reduced near the supports of a simply supported beam.

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

64. Consider the following statements :

In a plate girder

1. Bearing stiffeners are designed for bearing forces and they must also be checked for safety against compressive forces.
2. The length of any staggered intermittent fillet weld should not be less than 10 times the thickness of the stiffener.
3. Bearing stiffeners must be provided at the point of maximum bending moment.

Which of the above statements are correct ?

(a) 1 and 3 only

(b) 2 and 3 only

(c) 1 and 2 only

(d) 1, 2 and 3

65. Consider the following statements :

Secondary stresses are induced in a roof truss due to

1. Purlins placed at intermediate points on panel lengths.
2. Rigidity of joints.
3. Eccentricity of the bolt line relative to the centroid of the member.

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

66. In the case of an axially loaded column, machined for full bearing, the fastenings connecting the column to the base plates through gussets are to be designed for

(a) 100% of the load on the column

(b) 50% of the load on the column

(c) 25% of the load on the column

(d) Respective erection conditions only

67. Consider the following statements :

1. When analyzing by the Ultimate Load Method, the eccentrically loaded fastener group rotates about an instantaneous centre.
2. The rivet which is the farthest from the centre of gravity of the rivet group and may also be the nearest to the applied load line is the most 'critical' one.
3. The deformation at each rivet is not proportional to its distance from the centre of rotation.

Which of the above statements are correct ?

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

68. For a reinforced concrete beam with M 20 concrete with Fe 415 steel, the working moment corresponding to 'balanced failure' by the Limit State Method of Design is A times of the relatable magnitude of the working moment computed by the Working Stress Method. This value of A is nearly

(a) 1·0
(b) 1·5
(c) 2·0
(d) 2·5

69. A singly reinforced rectangular concrete beam has a width of 150 mm and an effective depth of 330 mm. The characteristic compressive strength of concrete is 20 MPa and the tensile strength of steel is 415 MPa. Adopt the stress block for concrete as per IS 456 – 2000 and take the limiting value of depth of neutral axis as 0·48 times the effective depth of the beam for considering as a balanced section. What is the likely approximation for the limiting value of the moment of resistance of the beam ?

(a) 15 kNm
(b) 25 kNm
(c) 45 kNm
(d) 75 kNm

70. If the stirrup spacing is equal to 0·75 times the effective depth of an RC beam, then the shear capacity of stirrup steel is equal to

(a) $1{\cdot}25\ (f_y\ A_{sv})$
(b) $1{\cdot}16\ (f_y\ A_{sv})$
(c) $1{\cdot}00\ (f_y\ A_{sv})$
(d) $0{\cdot}80\ (f_y\ A_{sv})$

where f_y is yield strength and A_{sv} is cross-sectional area of the stirrup steel.

71. A concrete column carries an axial load of 450 kN and a bending moment of 60 kNm at its base. An isolated footing of size 2 m × 3 m with the 3 m side along the plane of the bending moment is provided under the column. Centres of gravity of the column and the footing coincide. The net maximum and minimum pressures, in kPa, on the soil under the footing are, respectively

(a) 95 and 75
(b) 75 and 55
(c) 95 and 55
(d) 75 and 75

72. Carry-over factor at a support/end is defined as

(a) Modulus of Elasticity EI
(b) The ratio of moment produced at the far end to the applied moment at that support end
(c) The value of the moment to be applied to that end to cause a local slope of one radian
(d) 2 EK

73. What is the pH value of potable water, as specified by IS 456 – 2000 ?

(a) Equal to 7
(b) Between 6 and 9
(c) Less than 6
(d) Not less than 6

74. A certain RC structure has to be constructed along a sea coast. The minimum grade of concrete to be used as per IS 456 – 2000 is

(a) More than M 20

(b) More than M 20 and less than M 30

(c) Not less than M 30

(d) Less than M 45 and more than M 30

75. What is the minimum area of tension reinforcement in beams when Fe 415 is used ?

(a) 0·8%

(b) 0·12%

(c) 0·15%

(d) 0·2%

76. If a 2-legged 8 mm diameter HYSD bar is used as shear reinforcement for a beam of width 230 mm and effective depth 300 mm, what is the nearest magnitude of the spacing of minimum shear reinforcement ?

(a) 420 mm

(b) 390 mm

(c) 350 mm

(d) 320 mm

77. Web buckling occurs in a beam due to excessive

(a) Direct tensile stress in the web

(b) Bending tensile stress in the web

(c) Torsional shear stress in the web

(d) Compressive stress in the web

78. Which of the following statements are correct in respect of welded connections ?

1. Strength of Butt weld is equal to the strength of components joined.
2. Fillet welds carry the loads computed based on the tensile strength characteristics of fusion material.
3. For effective transmission of load by fillet weld, the fusion faces shall subtend an angle between 60° and 120°.

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

79. A post-tensioned beam of span 25 m is prestressed with 20 numbers of 40 mm diameter cables, each stressed to 1500 MPa, with eccentricity $e = 0$ at supports and $e = 500$ mm at midspan, varying parabolically. If the shear force at the support section due to externally applied load is 4500 kN, what is the nearest magnitude of the shear force resisted by the stirrups ?

(a) 3060 kN

(b) 4540 kN

(c) 250 kN

(d) 1480 kN

80. For a pre-tensioned beam, Young's Modulus of steel and concrete are 200 GPa and 35·35 GPa, respectively. If the ultimate shrinkage strain and Ultimate Creep Coefficient are 200 microns and 1·6, respectively, what is the level of sustained stress in concrete at the level of 'steel' if the loss due to creep is three times the loss due to shrinkage ?

(a) 9 MPa

(b) 13 MPa

(c) 11 MPa

(d) 15 MPa

81. Consider the following statements :

Correct estimation of loss of prestress is required for assessing

1. The serviceability behaviour of a PSC beam.
2. The ultimate shear resistance of a PSC beam.
3. The ultimate moment of resistance of a PSC beam.

Which of the above statements is/are correct ?

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

82. Which of the following statements are correct in case of vertical intermediate stiffeners ?

1. These are required only when the ratio of web depth to thickness is greater than 150.
2. They should be provided throughout the length of beam at spacing less than 1·5 times web depth.
3. These can be fitted between flanges with clear gaps at top and bottom.

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

83. The relation between the strength of brick masonry f_w, the strength of bricks f_b, and the strength of mortar f_m is given by (where K_w is a coefficient based on the layout of the bricks and the joints)

(a) $f_w = \sqrt{K_w \frac{f_b}{f_m}}$

(b) $f_w = K_w \sqrt{\frac{f_b}{f_m}}$

(c) $f_w = \sqrt{K_w f_b f_m}$

(d) $f_w = K_w \sqrt{f_b f_m}$

84. As per IS 3102 – 1962, for F1 class bricks, the percentage water absorption after 24 hrs of immersion in cold water shall ***not*** exceed

(a) 20%
(b) 12%
(c) 25%
(d) 5%

85. The effective height of a masonry wall of height H restrained fully at its top and partially at its bottom is

(a) 0·75 H
(b) 0·85 H
(c) 1·00 H
(d) 1·50 H

86. The effective length of a masonry wall stiffened by buttresses on both ends and continuing beyond these buttresses at both ends is

(a) 1·0 L
(b) 2·0 L
(c) 0·9 L
(d) 0·8 L

where L is the c/c length of the wall between successive buttresses.

87. A wall carries an axial load, 12 kN/m and also an eccentric load of 27 kN/m at 72 mm from the central axis of the wall. The equivalent eccentricity e is nearly

(a) 65 mm
(b) 60 mm
(c) 55 mm
(d) 50 mm

88. A shear wall of length 5 m, height 3 m and thickness 250 mm has to resist the forces due to horizontal earthquake in its plane. The relevant Section Modulus of the wall section is

(a) $3{\cdot}75 \times 10^8$ mm^3
(b) $10{\cdot}41 \times 10^8$ mm^3
(c) $31{\cdot}25 \times 10^6$ mm^3
(d) 75×10^8 mm^3

89. In reinforced brickwork slabs, the diameter of main reinforcement shall, preferably ***not*** exceed

(a) 8 mm

(b) 10 mm

(c) 12 mm

(d) 16 mm

90. Consider two RCC beams, P and Q, each of width 400 mm and effective depth 750 mm, made with concrete having a $\tau_{c\,max}$ = 2·0 MPa. For the reinforcement provided and the grade of concrete used, it may be assumed that $\tau_{c\,max}$ = 0·75 MPa. If the design shear for the beams P and Q is 400 kN and 750 kN, respectively, which of the following statements is true considering the provisions of IS 456 – 2000 ?

(a) Shear reinforcement should be designed for 175 kN for beam P and the section for beam Q should be revised

(b) Nominal shear reinforcement is required for beam P and the shear reinforcement should be designed for 120 kN for beam Q

(c) Shear reinforcement should be designed for 175 kN for beam P and the section for beam Q should be designed for 525 kN for beam Q

(d) The sections for both beams, P and Q, need to be revised

91. The minimum strain at failure in tension steel having yield stress f_y = 415 MPa and Young's Modulus E_s = 200 GPa, as per Limit State Method of Design, is

(a) 0·0025

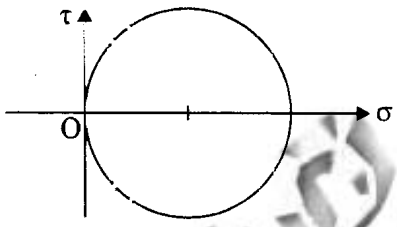
(b) 0·0038

(c) 0·0045

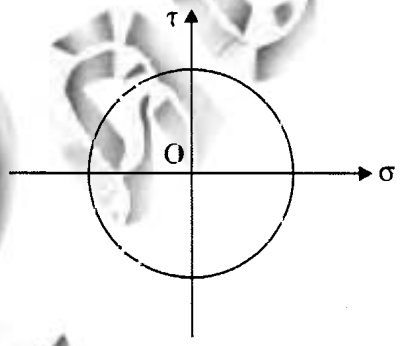
(d) 0·0050

92. Which one of the following Mohr's Circles represents the state of pure shear ?

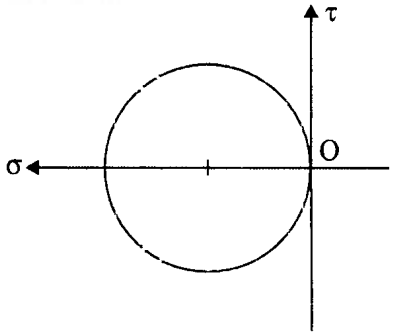
(a)



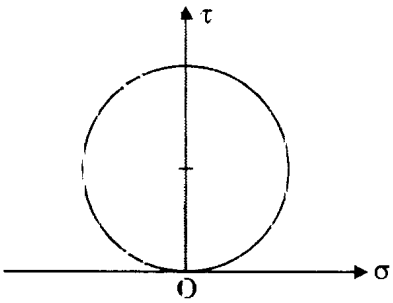
(b)



(c)



(d)



93. Activity A, Activity B and Activity C are cast into a ladder diagrammatic CPM network, with splitting each into three equal parts as A_1, A_2, A_3; and B_1, B_2, B_3; and C_1, C_2, C_3. Typical sequencing as in a ladder diagram is adopted (like B_2 following A_2 and B_1). The optimum number of dummy arrows needed for a satisfactory and correct ladder diagram will be

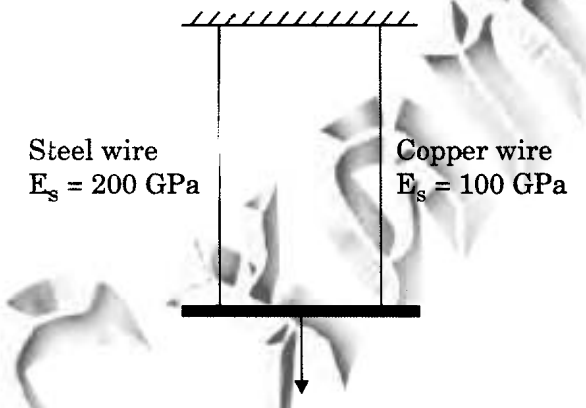
(a) 1

(b) 2

(c) 3

(d) 4

94. A mechanism shown in the figure consists of equally long steel and copper wires which carry the applied load in equal shares. What shall be the ratio of the diameter of the copper wire to that of the steel wire, when both the wires undergo equal strains ?



(a) $\sqrt{2}$

(b) 1·0

(c) $\frac{1}{\sqrt{2}}$

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

95. Consider the following related to sand in mortars :

1. It increases the volume of the mortar mix.
2. It increases the strength of masonry.
3. The cost of the mortar is reduced.
4. Shrinkage of the mortar is almost prevented.
5. Surkhi can replace sand in cement mortar used in plastering and this modified mortar is more durable.

Which of the above are relevant to 'sand' in mortar ?

(a) 1, 2, 4 and 5

(b) 1, 3 and 4 only

(c) 3, 4 and 5 only

(d) 2, 3 and 4 only

96. In a concrete mix, if the maximum size of coarse aggregate is increased, the proportion of fine to coarse aggregate should be

(a) Increased

(b) Decreased

(c) Kept the same

(d) Not dependent on size of aggregates

97. It is estimated that an activity can be assigned an optimistic duration of 16 days, a pessimistic duration of 28 days and a most likely duration of 19 days. What is the expected duration for this activity ?

(a) 20 days

(b) 19 days

(c) 22 days

(d) 18 days

98. Consider the following statements :

1. Modulus of Elasticity of concrete increases with increase in compressive strength of concrete.
2. Brittleness of concrete increases with decrease in compressive strength of concrete.
3. Shear strength of concrete increases with increase in compressive strength of concrete.

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1, 2 and 3

(c) 1 and 3 only

(d) 2 and 3 only

99. A three-hinged parabolic arch of span 'l' and rise 'h' is subjected to a u.d.l. of intensity 'ω'; then the horizontal thrust at the supports is

(a) $\frac{\omega l^2}{8 h}$

(b) $\frac{\omega l}{h}$

(c) $\frac{\omega l}{8 h^2}$

(d) $\frac{\omega h l}{8}$

100. A rectangular beam of width 230 mm and effective depth 300 mm is proposed to carry a BM and SF of 120 kNm and 270 kN, respectively. If M 30 grade of concrete and Fe 415 steel are used for which $\tau_{c\ max}$ = 3·5 MPa, which one of the following statements is correct ?

(a) It can be designed as a singly reinforced, under-reinforced section

(b) It can be designed as a doubly reinforced section

(c) The section is unsafe from shear considerations

(d) It can be designed as a doubly reinforced section but it is unsafe from shear considerations

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) :*

Timber suitable for furniture is obtained from conifers only.

Statement (II) :

Woods with distinct annual rings are conifers.

102. *Statement (I) :*

Seasoning of timber gives dimensional stability, safety against attack by fungi and improved workability.

Statement (II) :

Seasoning of timber removes moisture in the form of sap from timber.

103. *Statement (I) :*

Strength of brick wall is dependent on the type of bricks and the mortar used.

Statement (II) :

Slenderness ratio of masonry decides the strength of the wall, and also mortar type to be used.

104. *Statement (I) :*

Fly ash bricks are used in construction as alternatives to burnt clay bricks.

Statement (II) :

Fly ash bricks are lighter in weight and are stronger than burnt clay bricks.

105. *Statement (I) :*

Air-entraining cement has a higher initial setting time than o.p.c. and resists frost action better.

Statement (II) :

Air-entraining cement has a longer final setting time compared to o.p.c.

106. *Statement (I) :*

A merging node will have a uniquely determinable Late Event Time.

Statement (II) :

A merging node is defined as a node where more than one incoming activity arrow leads in.

107. *Statement (I) :*

Deadweight of a structure can be reduced by using light weight concrete in construction.

Statement (II) :

Aerated concrete, being of light weight, is used in R.C.C. multi-storied construction.

108. *Statement (I) :*

Admixture in concrete is an essential constituent of concrete.

Statement (II) :

Admixture helps in improving or modifying specific qualities in concrete.

109. *Statement (I) :*

The failure surface of an axially loaded mild steel tension specimen of circular cross-section is along a plane at 45° to the axis of the specimen.

Statement (II) :

The failure occurs on a plane of the specimen subjected to maximum shear stress and mild steel is relatively weak in shear.

110. *Statement (I) :*

In pin-jointed roof trusses, purlins are kept above nodes in the top chord.

Statement (II) :

The top chord is continuous through the nodes of the truss.

111. *Statement (I) :*

Repeated passes are needed with sheep-foot rollers for optimum compaction.

Statement (II) :

Even if optimum moisture content is ensured, repeated passes are needed to ensure right and even distribution of moisture within the soil volume.

112. *Statement (I) :*

Dewatering pumps for use in shallow pits are often of nearly straight-blade centrifugal types.

Statement (II) :

Centrifugal pumps can lift water to high lifts.

113. *Statement (I) :*

Crawler-mounted excavator is more suitable for excavation in soft ground.

Statement (II) :

Crawler-mounted excavator can be moved at low speeds.

114. *Statement (I) :*

In a project involving construction of several self-similar multi-storey houses, the Scheduled Bar Chart is best converted into Lines of Balance Diagram — which yet remains a 'Stacked' Bar Chart.

Statement (II) :

It is necessary to ensure that no set of Lines of Balance slope forward in time, from last block to first block, or top to bottom.

115. *Statement (I) :*

At positions of curtailment of flange plates in a built-up structure, web stiffeners are also necessarily to be provided.

Statement (II) :

This improves the architectural beauty of the structure

116. *Statement (I) :*

AON networks do not generally have any dummy links.

Statement (II) :

Links express activity dependencies exhaustively and completely.

117. *Statement (I) :*

'Lift' and 'lead', even if wherever relevant, do not affect any activity duration during the course of implementation of a project.

Statement (II) :

Procurement of materials, particularly, is normally from assigned, or designated, quarry sites, which are already fixed while starting the project.

118. *Statement (I) :*

Time-Cost Study for a project must be adopted only when project duration is to be crashed.

Statement (II) :

When there are unmanageable restrictions in realizing a predetermined resource histogram Time-Cost Study may have to consider extension of project duration as well

119. *Statement (I) :*

Activity streams along a component Work-Breakdown Structure along a sub-path can refer also to an auxiliary Work-Breakdown Structure considered vertically in segments of adjacent sub-paths.

Statement (II) :

Work-Breakdown Structures refer to a single sub-path with a progressive duration along the activity arrows.

120. *Statement (I) :*

In a multi-path PERT network, the project duration resulting from the critical path always has a 50% probability of completion by that duration.

Statement (II) :

The expected through-path duration together with 3-times the standard deviation of that expected duration must be considered for all the paths in the network

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

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

Test Booklet Series

Serial No.	

TEST BOOKLET

CIVIL ENGINEERING

Paper II

A

Time Allowed : Two Hours

Maximum Marks : 200

INSTRUCTIONS

1. IMMEDIATELY AFTER THE COMMENCEMENT OF THE EXAMINATION, YOU SHOULD CHECK THAT THIS TEST BOOKLET ***DOES NOT*** HAVE ANY UNPRINTED OR TORN OR MISSING PAGES OR ITEMS, ETC. IF SO, GET IT REPLACED BY A COMPLETE TEST BOOKLET.
2. **PLEASE NOTE THAT IT IS THE CANDIDATE'S RESPONSIBILITY TO ENCODE AND FILL IN THE ROLL NUMBER AND TEST BOOKLET SERIES CODE A, B, C OR D CAREFULLY AND WITHOUT ANY OMISSION OR DISCREPANCY AT THE APPROPRIATE PLACES IN THE *OMR* ANSWER SHEET. ANY OMISSION/DISCREPANCY WILL RENDER THE ANSWER SHEET LIABLE FOR REJECTION.**
3. You have to enter your Roll Number on the Test Booklet in the Box provided alongside. ***DO NOT*** write ***anything else*** on the Test Booklet.
4. This Test Booklet contains **120** items (questions). Each item comprises four responses (answers). You will select the response which you want to mark on the Answer Sheet. In case, you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **ONLY ONE** response for each item.
5. You have to mark your responses **ONLY** on the separate Answer Sheet provided. See directions in the Answer Sheet.
6. All items carry equal marks.
7. Before you proceed to mark in the Answer Sheet the response to various items in the Test Booklet, you have to fill in some particulars in the Answer Sheet as per instructions sent to you with your Admission Certificate.
8. After you have completed filling in all your responses on the Answer Sheet and the examination has concluded, you should hand over to the Invigilator ***only the Answer Sheet***. You are permitted to take away with you the Test Booklet.
9. Sheets for rough work are appended in the Test Booklet at the end.
10. **Penalty for wrong Answers :**

    THERE WILL BE PENALTY FOR WRONG ANSWERS MARKED BY A CANDIDATE.

    (i) There are four alternatives for the answer to every question. For each question for which a wrong answer has been given by the candidate, **one-third (0·33)** of the marks assigned to that question will be deducted as penalty.

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

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

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

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

   (a) 5·5 m

   (b) 7·5 m

   (c) 9·5 m

   (d) 11·5 m

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

   (a) 500 × 9·81 N

   (b) 600 × 9·81 N

   (c) 750 × 9·81 N

   (d) 1000 × 9·81 N

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

   (a) 10

   (b) 1·0

   (c) 100

   (d) 1000

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

   (a) 0·0125 N/m

   (b) 0·0156 N/m

   (c) 0·2 N/m

   (d) 0·0312 N/m

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

   (a) 0·8

   (b) 1·06

   (c) 10·05

   (d) 8·02

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

   (a) 5 m/s

   (b) 20 m/s

   (c) 10 m/s

   (d) 40 m/s

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

   (a) 0·04 m^3 s^{-1}

   (b) 0·06 m^3 s^{-1}

   (c) 0·08 m^3 s^{-1}

   (d) 0·10 m^3 s^{-1}

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

(a) 220 m^3

(b) 280 m^3

(c) 28 m^3

(d) 22 m^3

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

(a) 0·25

(b) 0·5

(c) 0·75

(d) 1·0

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

(a) 1·0 m

(b) 0·8 m

(c) 0·5 m

(d) 0·45 m

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

(a) 9·6%

(b) 10·8%

(c) 11·4%

(d) 12·7%

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

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

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1, 3 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2, 3 and 4

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

(a) 2

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

(c) 1·1

(d) Dependent on the friction factor

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

(a) 0·5

(b) 0·45

(c) 0·33

(d) 0·27

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

(a) 200 m^3

(b) 50 m^3

(c) 94·7 m^3

(d) 105·5 m^3

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

(a) 0·1

(b) 1000

(c) 100

(d) 10

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

(a) 6

(b) 8

(c) 10

(d) 12

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

(a) Pelton wheel

(b) Francis

(c) Kaplan

(d) Propeller

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

(a) 15%

(b) 67%

(c) 86%

(d) 92%

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

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

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

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

(a) 1·6 ha-m

(b) 16 ha-m

(c) 160 ha-m

(d) 1600 ha-m

22. Return Period Refers to

(a) The Probability of Exceedance of an event

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

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

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

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

(a) lifting due to flow over a mountain barrier

(b) relative movement of two large air masses

(c) violent upthrow of air arising from localized heating

(d) cyclonic conditions

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

(a) Consistency Analysis

(b) Frequency Analysis

(c) Storage Computation Analysis

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

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

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

Which is the correct sequence of these steps ?

(a) 4, 3, 2 and 1

(b) 1, 2, 3 and 4

(c) 4, 2, 3 and 1

(d) 1, 3, 2 and 4

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

(a) 35%

(b) 40%

(c) 50%

(d) 65%

27. S-curve Hydrograph is the hydrograph

(a) producing 1 cm of runoff over the basin

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

(c) having a volume of 1 cm^3

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

28. Surface Runoff represents the total water

(a) flowing in surface channels after the rainfall

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

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

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

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

(a) Evaporation and Transpiration

(b) Crop Water Requirement

(c) Evaporation and Infiltration

(d) Evaporation and Transpiration from the cropped area

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

(a) increasing the diameter

(b) making it into one with a square kerb

(c) deepening the well

(d) providing coarser screening filter

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

(a) 45 m

(b) 35 m

(c) 22 m

(d) 11 m

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

(a) 2·0 m^3/s

(b) 1·0 m^3/s

(c) 20 m^3/s

(d) 0·20 m^3/s

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

(a) 0·90

(b) 0·67

(c) 0·30

(d) 0·15

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

(a) 8 m

(b) 1 m

(c) 12 m

(d) 10 m

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

(a) 1,00,000

(b) 1,25,000

(c) 1,50,000

(d) 1,75,000

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

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

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

(a) 4, 3, 1 and 2

(b) 2, 3, 1 and 4

(c) 4, 1, 3 and 2

(d) 2, 1, 3 and 4

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

(a) 100 m^2

(b) 10 m^2

(c) 1 m^2

(d) 1000 m^2

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

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

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 2, 3 and 4

(d) 1, 3 and 4

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

(a) 8 kg

(b) 20 kg

(c) 24 kg

(d) 6·6 kg

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

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

(a) 1 and 2 only

(b) 1 and 3 only

(c) 1, 2 and 3

(d) 2 and 3 only

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

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

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

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

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1 and 3 only

(d) 1, 2 and 3

42. Consider the following statements :

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

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

Which of the above statements is/are correct ?

(a) 1 only

(b) Both 1 and 2

(c) 2 only

(d) Neither 1 nor 2

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

(a) 23·5 m × 23·5 m

(b) 30 m × 30 m

(c) 20 m × 20 m

(d) 15 m × 15 m

44. Consider the following statements related to ozone :

1. Tropospheric ozone is harmful

2. Stratospheric ozone is beneficial

3. During prevalence of photochemical smog, O_3 is formed

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

45. Consider the following statements related to noise :

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

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

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

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

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

1. Necrosis refers to killing of tissue

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

3. Leaf abscission refers to the dropping of leaves

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

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1, 2, 3 and 4

(c) 2, 3 and 4 only

(d) 1, 2 and 4 only

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

(a) 10%

(b) 20%

(c) 30%

(d) 40%

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

(a) 25%

(b) 30%

(c) 35%

(d) 40%

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

(a) increases by 2 times

(b) decreases by 2 times

(c) increases by 4 times

(d) decreases by 4 times

50. Consider the following statements :

Lime stabilization of soil leads to

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

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1, 2 and 4

(c) 1, 3 and 4

(d) 2, 3 and 4

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

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

(a) 1, 2, 3 and 4

(b) 4, 2, 3 and 1

(c) 1, 3, 2 and 4

(d) 4, 3, 2 and 1

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

(a) 5 cm

(b) 50 cm

(c) 100 cm

(d) 150 cm

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

(a) 22·5 mm

(b) 25·5 mm

(c) 27·5 mm

(d) 30·0 mm

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

(a) 2×10^{-4} cm/s

(b) 3×10^{-4} cm/s

(c) 4×10^{-4} cm/s

(d) 5×10^{-4} cm/s

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

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

Which of the above statements are correct ?

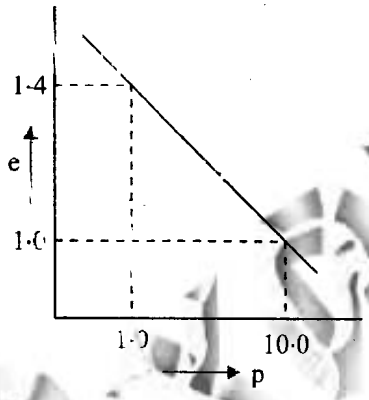
(a) 1 and 3 only

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1, 2 and 3

56.



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

(a) 0·3

(b) 0·4

(c) 0·5

(d) 0·6

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

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

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

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

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

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

(a) 4·67 kg/cm^2

(b) 5·0 kg/cm^2

(c) 5·5 kg/cm^2

(d) 6·0 kg/cm^2

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

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

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 3

(c) 3 and 4

(d) 1 and 4

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

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

Which of the above statements are correct ?

(a) 1 and 4

(b) 1 and 3

(c) 2 and 3

(d) 2 and 4

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

(a) 6 cm

(b) 7 cm

(c) 8 cm

(d) 9 cm

62. Consider the following statements :

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

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

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

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

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 2, 3 and 4 only

(d) 1, 2, 3 and 4

64. Consider the following statements :

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

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

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

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

65. Consider the following statements :

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

1. Resorting to light foundation pressure

2. Using under-reamed piles for light loads

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

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

Which of the above statements are correct ?

(a) 1 and 2

(b) 2 and 4

(c) 1 and 3

(d) 2 and 3

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

1. Swelling pressure test

2. Free swell test

3. Estimation of differential free swell

4. Shrinkage limit test

(a) 1, 2 and 3 only

(b) 1, 2 and 4 only

(c) 1, 2, 3 and 4

(d) 2, 3 and 4 only

67. Consider the following statements :

The general principles of surveying are

1. To work from part to whole

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

Which of the above statements is/are correct ?

(a) 1 only

(b) 2 only

(c) Both 1 and 2

(d) Neither 1 nor 2

68. Consider the following statements :

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

Which of the above statements are correct ?

(a) 1 and 2 only

(b) 1 and 3 only

(c) 2 and 3 only

(d) 1, 2 and 3

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

(a) 50°

(b) 70°

(c) 110°

(d) 120°

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

(a) 4·5 m

(b) 4·492 m

(c) 4·54 m

(d) 4·62 m

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

(a) 100·000 m

(b) 100·080 m

(c) 107·395 m

(d) 107·475 m

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

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

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 2 and 4 only

(c) 1, 3 and 4 only

(d) 1, 2, 3 and 4

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

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

(a) 1 and 2 only

(b) 2 and 3 only

(c) 1, 2 and 3

(d) 2, 3 and 4 only

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

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

(b) Sighting and reading are done simultaneously

(c) The readings are taken from the north end

(d) The compass has an edge bar needle

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

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

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

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

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

76. Consider the following statements :

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

Which of the above statements are correct ?

(a) 1, 2 and 3 only

(b) 2, 3 and 4 only

(c) 1, 2 and 4 only

(d) 1, 2, 3 and 4

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

(a) both the plates are unclamped

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

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

(d) both the plates are clamped

78. Consider the following statements regarding ecology :

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

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

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

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 1 and 3 only

(d) 2 and 3 only

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

(a) should not be more than 30°

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

(c) are not restricted in magnitude

(d) should not be less than 120°

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

(a) 1 satellite

(b) 2 satellites

(c) 3 satellites

(d) 4 satellites

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

(a) Scanning

(b) Framing

(c) Electromagnetic spectrum

(d) All of the above

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

(a) 120 m

(b) 100 m

(c) 80 m

(d) 180 m

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

(a) 4·0%

(b) 3·6%

(c) 4·5%

(d) 3·0%

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

(a) 14 cm

(b) 21 cm

(c) 28 cm

(d) 7 cm

85. Consider the following statements :

1. Effective stress in a sand layer below a lake with standing water does not alter as the water level fluctuates.
2. Regarding water table below the ground surface, any rise in the water table causes equal changes in both pore pressure and effective stress.
3. Capillary saturation will cause the effective stress to increase.

Which of the above statements are correct ?

(a) 1, 2 and 3

(b) 1 and 2 only

(c) 2 and 3 only

(d) 1 and 3 only

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

(a) 100 m

(b) 111 m

(c) 125 m

(d) 118 m

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

(a) 176 m

(b) 200 m

(c) 150 m

(d) 185 m

88. Consider the following statements :

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

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

Which of the above statements are correct ?

(a) 1 only

(b) Both 1 and 2

(c) 2 only

(d) Neither 1 nor 2

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

(a) traffic density

(b) traffic volume

(c) traffic speed

(d) All of the above

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

(a) 3000 veh/h

(b) 2860 veh/h

(c) 2010 veh/h

(d) 2510 veh/h

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

(a) Runway height

(b) Decision height

(c) Threshold height

(d) Runway visual range

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

(a) 0·30%

(b) 0·40%

(c) 0·24%

(d) 0·34%

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

(a) 900 m

(b) 800 m

(c) 870 m

(d) 850 m

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

(a) 25 cm

(b) 21 cm

(c) 28 cm

(d) 30 cm

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

(a) Breast walls

(b) Hair-pin bends

(c) Catch-water drains

(d) Retaining walls

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

(a) 5%

(b) 6%

(c) 7%

(d) 8%

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

(a) 4500 m

(b) 4000 m

(c) 3750 m

(d) 3400 m

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

(a) 16

(b) 24

(c) 26

(c) 8

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

Annual average daily traffic at last count = 400 CVD

Rate of traffic growth per annum = 7%

The road is proposed to be completed in 3 years

(a) 500

(b) 421

(c) 490

(d) 449

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

(a) 550 m

(b) 500 m

(c) 475 m

(d) 449 m

Directions :

Each of the next **Twenty (20)** items consists of two statements, one labelled as the 'Statement (I)' and the other as 'Statement (II)'. Examine these two statements carefully and select the answers to these items using the codes given below :

Codes :

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

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

(c) Statement (I) is true but Statement (II) is false

(d) Statement (I) is false but Statement (II) is true

101. Statement (I) : Open channel flow in a channel is said to be critical when the specific force is maximum for a given discharge.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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