ISRO CIVIL ENGINEERING PAPER

1. A cohesive soil yields a maximum dry density of 18kN/m^3 during a standard proctor compaction test. If the specific gravity is 2.65, what would be its void ratio? (Adopt unit of water as 10kN/m^3)

(a) 0.5523	(b) 0.4722	(c) 0.7121	(d) 0.5835

2. A footing 2m x 1m exerts a uniform pressure of 150kN/m^2 on the soil. Assuming a load dispersion of 2 vertical to 1 horizontal, the average vertical stress in (kN/m^2) at 1.0m below the footing is

(a) 50	(b) 75	(c) 80	(d) 100

3. Match List-I with List-II and select the correct answer using the code given below the lists :

List - I	List - II
A. Axel Bendixen	1. The mathematical theory of elasticity
B. Hardy Cross	2. Theory of curved bars
C. Winkler	3. Slope-deflection method
D. St. Venant	4. Moment distribution

(a) A B C D 1 2 3 4	(b) A B C D 3 4 2 1	(c) A B C D 1 2 4 3	(d) A B C D 3 2 4 1

4. The standard size of brick is

(a) 20cm x 10cm x 10cm	(b) 19cm x 9cm x 9cm
(c) 18cm x 9cm x 9cm	(d) 18cm x 10cm x 10cm

5. The velocity of flow of water in a pipe of 150 mm dia is 0.3m/sec, a diaphragm with a central hole 80mm in diameter is placed in the pipe obstructing the flow. With coefficient of contraction C_C=0.60, the loss of head from Vena Contracta to a point downstream will be

(a) 0.1083m	(b) 0.2250m	(c) 1.2054m	(d) 0.8250m

6. If the depletion of oxygen is found to be 5 ppm after incubating a 2.5% solution of sewage sample for 5 days at 20^0C, B.O.D of the sewage is

(a) 50 ppm	(b) 100 ppm	(c) 150 ppm	(d) 200 ppm

7. A trapezoidal section of an open channel has side slope 2H:1V. If bottom width is `b' and depth `d', the relation between b & d for most economical trapezoidal section of the channel is:

(a) $b = 0.472\ d$	(b) $b/d = 0.5$	(c) $b^2 = 0.3\ d^2$	(d) $d = \sqrt{b}$

8. If the difference in elevation of an edge of the pavement 9m wide and its crown is 15 cm, the camber of the pavement is

(a) 1 in 60	(b) 1 in 45	(c) 1 in 30	(d) 1 in 15

<table>
<tr><td>9.</td><td colspan="4">The scour depth <i>D</i> of a river during flood, may be calculated from the Lacey's equation</td></tr>
<tr><td></td><td colspan="2">(a) $D = 0.47 (Q/f)^{1/2}$</td><td colspan="2">(b) $D = 0.47 (Q/f)$</td></tr>
<tr><td></td><td colspan="2">(c) $D = 0.47 (Q/f)^{1/4}$</td><td colspan="2">(d) $D = 0.47 (Q/f)^{1/3}$</td></tr>
<tr><td>10.</td><td colspan="4">The Glycerine is flowing at 25^0 C in a pipe of diameter 150mm with a velocity of 3.6m/s. The flow is</td></tr>
<tr><td></td><td>(a) Laminar</td><td>(b) Turbulent</td><td>(c) Critical</td><td>(d) Rectilinear</td></tr>
<tr><td>11.</td><td colspan="4">A concrete column 200 x 200 mm in cross-section is reinforced with steel bars of 1200 mm^2, total cross-sectional area. Calculate the safe load for the column if permissible stress in concrete is 5 N/mm^2 and E_s is 15 E_c</td></tr>
<tr><td></td><td>(a) 264 kN</td><td>(b) 274 kN</td><td>(c) 284 kN</td><td>(d) 294 kN</td></tr>
<tr><td>12.</td><td colspan="4">For design of Flexure members, the strain in the reinforcing bars under tension at ultimate state as per IS 456-2000 shall not be less than</td></tr>
<tr><td></td><td colspan="2">(a) $f_y/1.15E$</td><td colspan="2">(b) $f_y/1.15E_S+0.002$</td></tr>
<tr><td></td><td colspan="2">(c) f_y/E_S</td><td colspan="2">(d) $f_y/E_S+0.002$</td></tr>
<tr><td>13.</td><td colspan="4">A soil has liquid limit of 35, plastic limit of 20 and moisture content 25%. What will be its liquidity index and plasticity index</td></tr>
<tr><td></td><td>(a) 0.67, 15</td><td>(b) 0.33, 15</td><td>(c) 0.67, 25</td><td>(d) 0.33, 20</td></tr>
<tr><td>14.</td><td colspan="4">If the moment of inertia of a section about its axis is <i>I</i> and its effective sectional area is <i>A</i>, its radius of gyration <i>r</i> about the axis is</td></tr>
<tr><td></td><td>(a) $r = \frac{I}{A}$</td><td>(b) $r = \sqrt{I/A}$</td><td>(c) $r = {}^3\sqrt{I/A}$</td><td>(d) $r = \sqrt{A/I}$</td></tr>
<tr><td>15.</td><td colspan="4">A uniform cantilever beam has a span of 2m and carries a point load of 6kN at free end. The magnitude of moment to be applied at free end for zero vertical deflection at that point is (neglect self-wt. of the beam)</td></tr>
<tr><td></td><td>(a) 5 kN.m</td><td>(b) 10 kN.m</td><td>(c) 11 kN.m</td><td>(d) 8 kN.m</td></tr>
<tr><td>16.</td><td colspan="4">A bar 40mm in diameter and subjected to a tensile force of 40,000 kgs. Undergoes elongation resulting in decrease in diameter considering the properties of the material as E = 2x10^5 N/mm^2 and Poisson's ratio ν as 0.3, the modulus of rigidity will be:</td></tr>
<tr><td></td><td colspan="2">(a) 76923.07 N/mm^2</td><td colspan="2">(b) 20x10^4 kg/cm^2</td></tr>
<tr><td></td><td colspan="2">(c) 56898.50 N/mm^2</td><td colspan="2">(d) 3x10^5 Kg/cm^2</td></tr>
</table>

17.	**If the volume of a liquid weighing 3000 kg is 4 cubic metres, 0.75 is its**			
	(a)Specific weight		(b)Specific mass	
	(c)Specific gravity		(d)Specific volume	
18.	**The height of water level in a tank above the centre of a circular hole 2.5 cm in diameter is 50m. The velocity of water flowing through the hole is (neglect friction between jet and wall)**			
	(a) 20.53 m/sec	(b) 25.85 m/sec	(c) 31.32 m/sec	(d) 40.40 m/sec
19.	**A simply supported beam is considered as a deep beam if the ratio of effective span to overall depth is less than**			
	(a) 1	(b) 2	(c) 3	(d) 4
20.	**In two dimensional stress system, the radius of the Mohr's circles represents**			
	(a) Maximum normal stress		(b) Minimum normal stress	
	(c) Minimum shear stress		(d) Maximum shear stress	
21.	**If 5x+3y+7z = 5, 3x+2by+2z = 9, 7x+2y+10z = 5, be a system of equations, then**			
	(a) It has only trivial solution, x=0, y=0, z=0		(b) System is consistent and has infinite solution	
	(c) System is consistent and has unique solution		(d) System is inconsistent	
22.	**What is the angle between the tangents to the curve $x=t$, $y=t^2$, $z=t^3$ at $t= \pm1$**			
	(a) Cos^{-1} (-3/7)	(b) Cos^{-1}(1/7)	(c) Cos^{-1}(3/7)	(d) Cos^{-1}(-1/7)
23.	**What is the Laplace transform of $e^{-3t}(2\ cos\ 5t - 3\ sin\ 5t)$**			
	(a) $2s + 9/ s^2 + 6s + 34$		(b) $3s - 9/ s^2 + 6s + 34$	
	(c) $2s - 9/ s^2 + 6s + 34$		(d) $S + 9/ s^2 + 6s + 34$	
24.	**x is a uniformly distributed random variable that takes values between 0 & 1. The value of $E\{x^2\}$ will be**			
	(a) 0	(b) 1/8	(c) 1/4	(d) 1/2
25.	**The earth pressure of a soil at rest, is proportional to**			
	(a) tan (45^0 - ø)	(b) tan (45^0 + ø)	(c) (1 – sin ø)	(d) (1 + sin ø)
26.	**The slope of the e-log *p* curve for a soil mass gives:**			
	(a) Coefficient of permeability, *k*		(b) Coefficient of consolidation C_V	
	(c) Compression index, C_C		(d) Coefficient of volume compressibility, m_v	
27.	**Stress produced in a bar by a suddenly applied load is ——X—— the one produced by the same load when applied gradually. The value of `X' is**			
	(a)Twice	(b)Thrice	(c)Same as	(d)Half of

28. **Two circular mild steel bars A and B of equal lengths have diameters 2 cm and 3 cm respectively. Each is subjected to a tensile load of magnitude T. The ratio of elongations of the bars l_A/l_B is**

(a) 2/3	(b) 5/8	(c) 4/9	(d) 2/5

29. **A pipe of 0.1 m^2 cross sectional area suddenly enlarges to 0.3 m^2 cross sectional area. If the discharge of the pipe is 0.3 m^3/sec, the head loss is,**

(a) $2/g$ m of water	(b) $g/2$ m of water
(c) $1g$ m of water	(d) $\sqrt{g}$ m of water

30. **The length of hydraulic jump in rectangular channel is roughly**

(a) 2 to 3 times its height	(b) 3 to 5 times its height
(c) 5 to 7 times its height	(d) 10 to 12 times its height

31. **The absolute minimum radius of horizontal curve for a design speed of 60 Kmph is nearly**

(a) 151 m	(b) 210 m	(c) 360 m	(d) 129 m

32. **If whole circle bearing of a line is 120^0, its reduced bearing is**

(a) S 20^0 E	(b) S 60^0 E	(c) N 120^0 E	(d) N 60^0 E

33. **If,**

A = Cross sectional area

E = Young's modulus of elasticity

G = Modulus of rigidity

J = Polar moment of inertia

Then Torsional rigidity is given by,

(a)AE	(b)GE	(c)EI	(d)GJ

34. **The Muller-Breslau principle in structural analysis is used for,**

(a) Drawing influence line diagram for any force function	(b) Superimposition of load effects
(c) Writing virtual work equation	(d) Calculating strain energy

35. **Minimum stopping distance as per IRC for moving vehicles on road with a design speed of 80 km/hour is**

(a) 80 m	(b) 100 m	(c) 120 m	(d) 150 m

36. **The bearing of *C* from *A* is N 30^0 E and from *B*, 50 metres east of *A*, is N 60^0 W. The departure of *C* from *A* is**

(a) 50 m	(b) 50 √3 m	(c) 25 √3 m	(d) 25 m

37. **Which one of the following conditions is valid in case of unconfined compression test in comparison to triaxial test?**

(a) Minor principal stress = 0	(b) Minor principal stress = 0.5 x major principal stress
(c) Minor principal stress = major principal stress	(d) Major principal stress = 3 x minor principal stress

38.	A rod of uniform cross-section A and length L is deformed by δ, when subjected to a normal force P. The Young's Modulus E of the material is,			
	(a) $E = \frac{P.\delta}{A.L}$	(b) $E = \frac{A.\delta}{P.L}$	(c) $E = \frac{P.L}{A.\delta}$	(d) $E = \frac{A.L}{P.\delta}$

39.	A simply supported beam has an effective span of 16m. What shall be the limiting ratio of span to effective depth as per IS 456-2000?			
	(a) 26	(b) 20	(c) 12.5	(d) 15
40.	If the depletion of oxygen is found to be 2.5 mg/litre after incubating 2.5 ml of sewage diluted with 250 ml water for 5 days at 20^0C, B.O.D of the sewage is			
	(a) 50 mg/l	(b) 100 mg/l	(c) 200 mg/l	(d) 250 mg/l
41.	The number of bricks per CUM of brickwork in CM is about			
	(a) 200 numbers	(b) 500 numbers	(c) 700 numbers	(d) 800 numbers
42.	The slope correction for a length of 30 m along a gradient of 1 in 20, is			
	(a) 3.75 cm	(b) 0.375 cm	(c) 37.5 cm	(d) 2.75 cm
43.	Both Reynolds and Froude numbers assume significance in one of following examples:			
	(a) Motion of submarine at large depths	(b) Motion of ship in deep seas		
	(c) Cruising of missile in air	(d) Droplet formation		
44.	The flow in open channel is said to be subcritical if the Froude number is			
	(a) Less than 1.0	(b) Equal to 1.0		
	(c) Greater than 1.0	(d) Zero		
45.	An ideal vertical curve to join two gradients is			
	(a) Cubic	(b) Parabolic	(c) Elliptical	(d) Hyperbolic
46.	For the differential equation dy/dx + ay = 0 with y(0) = 1, solution is			
	(a) e^{at}	(b) e^{-at}	(c) ae^{-at}	(d) $e^{\sqrt{-at}}$
47.	$y = cx - c^2$ is a general solution of the differential equation			
	(a) $(dy/dx)^2 - x\ (dy/dx) + y = 0$	(b) $d^2y/dx^2 = 0$		
	(c) $dy/dx = c$	(d) $d^3y/dx^3 = 0$		
48.	The triangle formed by three points A(1, -2, -3), B(2, -3, -1), C(3, -1, -2) is			
	(a) Isosceles right angled Δ	(b) Equilateral Δ		
	(c) Scalene Δ	(d) Acute Δ		

49.	**The partial differential equation** **$5\partial^2 z/\partial x^2 + 6\partial^2 z/\partial y^2 = xy$ is,**			
	(a) Elliptic	(b) Parabolic	(c) Hyperbolic	(d) Sinusoidal
50.	**If A is a 3x3 matrix and $\|A\|=3$, then $\|3A\|$ is**			
	a) 9	b) 27	c) 81	d) 243
51.	**The relationship between void ratio (e) and porosity ratio (n) is:**			
	(a) $n = \frac{1+e}{1-e}$	(b) $e = \frac{1+n}{1-e}$	(c) $n = \frac{e}{1+e}$	(d) e=n(1+e)
52.	**If D1 and D2 are depths of water up-stream and down-stream of a hydraulic jump in rectangular channel, the loss of head at the jump is**			
	(a) $\frac{(D_2-D_1)^3}{D_1D_2}$	(b) $\frac{(D_2-D_1)^3}{2D_1D_2}$	(c) $\frac{(D_2-D_1)^3}{3D_1D_2}$	(d) $\frac{(D_2-D_1)^3}{4D_1D_2}$
53.	**Modular ratio 'm' for M25 grade of concrete is**			
	(a) 18.67	(b) 13.33	(c) 10.98	(d) None
54.	**The minimum reinforcement in slabs should not be less than ----% of the total cross-sectional area when HYSD bars are used in the either direction,**			
	(a) 0.10	(b) 0.12	(c) 0.15	(d) 0.18
55.	**A cantilever beam carries a uniformly distributed total load W over its whole length and a concentrated upward load W at its free end. The net vertical deflection at the free end is**			
	(a) Zero		(b) $\frac{5.WL^3}{24\,EI}$ downwards	
	(c) $\frac{5.WL^3}{24\,EI}$ upwards		(d) $\frac{5.WL^3}{48\,EI}$ downwards	
56.	**As per IS 1893 [Part-I] – 2002, Bangalore falls under which earthquake zone -**			
	(a)Zone-I	(b) Zone-II	(c) Zone-III	(d) Zone-IV
57.	**The maximum shear stress in a rectangular beam is -------- times of average shear stress**			
	(a) 1.15	(b) 1.25	(c) 1.5	(d) 1.75
58.	**Minimum cement content required for M 35 grade of concrete for very severe exposure condition as per IS 456 -2000 is ------ kg/m^3**			
	(a) 300	(b) 320	(c) 340	(d) 360
59.	**Permissible deviation from specified dimensions of cross-section of Column & Beams as per IS Standards is -------mm**			
	(a) +10 mm - 4 mm	(b) +12 mm - 6 mm	(c) +14 mm - 8 mm	(d) None

60. **Soundness of Cement is measured by**

(a) Vicat Apparatus

(b) Le Chatelier Apparatus

(c) Rebound Hammer

(d) Ultra Sonic Pulse Velocity Apparatus

61. **The moment of Inertia of a thin Rod of Mass 'm' & length 'l', about its axis through its center of gravity & Perpendicular to its length is**

(a) $m l^2 / 4$

(b) $m l^2 / 6$

(c) $m l^2 / 8$

(d) $m l^2 / 12$

62. **The ratio of Static Friction to Dynamic friction is always**

(a) Equal to 1

(b) Less than 1

(c) Greater than 1

(d) None

63. **Laterite is Chemically Classified as**

(a) Calcareous Rock

(b) Argillaceous rock

(c) Siliceous rock

(d) Metamorphic rock

64. **The compressive strength of Granite is**

(a) 50to70MN / M^2

(b) 70 to 130MN / M^2

(c) 130 to 170 MN / M^2

(d) 170 to 200 MN / M^2

65. **A first class brick should not absorb water more than ----------of its own dry weight after 24 hours of immersion in cold water**

(a) 10%

(b) 15%

(c) 20%

(d) 25%

66. **For RCC Construction the maximum size of Coarse aggregate is limited to**

(a) 10 mm

(b) 15 mm

(c) 20 mm

(d) 25 mm

67. **The propagation of Shear Crack in prestressed concrete member depends on**

(a) Tensile Reinforcement

(b) Compression Reinforcement

(c) Shear reinforcement

(d) Shape of the Cross-section of beam

68. **A doubly Reinforced section is used ,**

a) When the members are subjected to alternate external loads and bending moment in the section reverses

(b) When the members are subjected to loading eccentric on either side of the axis

(c) When the members are subjected to accidental lateral loads

(d) All the above

69. **The material having particle size varying from 0.007 mm to 0.06 mm is termed as ,**

(a) Silt

(b) Clay

(c) Sand

(d) None of the above

70. **In a manufacture of cement, the dry and wet mixture of Calcareous and argillaceous materials are burnt at a temperature of**

(a) 900°C to 1000° C
(b) 1000°C to 1200° C
(c) 1200°C to 1500° C
(d) 1500°C to 1600° C

71. **A method of differential levelling is used in order to find the differences in elevation between the two points when,**

(a) They are too far apart
(b) There are obstacles between two
(c) The differences between them is too great
(d) All the above

72. **If the depth is kept constant for a beam of uniform strength , then its width will vary in proportion to ----------, where M is the bending moment,**

(a) M
(b) √ M
(c) M^2
(d) M^3

73. **A lead ball with certain velocity is made to strike a wall, it falls down; but a rubber ball of the same mass and with same velocity strikes the same wall, it rebounds. Select the reason from the following :**

(a) Both the balls under go an equal change in the momentum
(b) The change in momentum suffered by rubber ball is more than the lead ball
(c) The change in momentum suffered by rubber ball is less than the lead ball
(d) None of the above

74. **A large tank open to the Atmosphere is filled with water to a height of 5m from the outlet tap. A tap near the bottom of tank is now opened , and water flows out from the smooth and rounded outlet. Determine the Maximum velocity at the outlet,**

(a) 9.2 m/s
(b) 9.9 m/s
(c) 19.8 m/s
(d) none

75. **The loss of pressure in Venturimeter,**

(a) Reduces with decrease in cone angle in the outlet cone
(b) Reduces with decreasing cone angle in the inlet cone
(c) Increases with decreasing cone angle in the outlet cone
(d) Increase with decreasing cone angle in the inlet cone .

76. **Bending equation is**

(a) M/I=R/E=F/Y
(b) I/M=E/R=Y/R
(c) M/I=E/R=F/Y
(d) M/I=R/E=Y/F

77. **For a prismatic beam of length L & moment of inertia I, the stiffness factor is**

a) IE/L
(b) 2EI/L
(c) 3EI/L
(d) 4EI/L

78. **In case of SHM, the period of oscillation (T) is given by,**

(a) $T=2\omega/\P^2$
(b) $T=2\P/\omega$
(c) $T=\omega/2\P$
(d) $T=\P/2\omega$

79.	**One Newton force is,**			
	(a) 10^3 dynes	(b) 10^4 dynes	(c) 10^5 dynes	(d) 10^6 dynes
80.	**If 2,3,4 are the Eigen values of A , then the Eigen values of 4A will be**			
	(a) 2,3,16	(b) 2,12,4	(c) 8,12,16	(d) 8,3,4

End of questions

1. The minimum and maximum eigen value of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are –2 and 6 respectively. What is the other eigen value?

(a)5 (b)3 (c) 1 (d)-1

2. Evaluate $\lim_{x \to 1} \frac{x^{x} - x}{x-1-\log x}$

(a)2 (b)0 (c) -2 (d)8

3. If the rank of the matrix A is 2, the rank of 2A is
(a)1 (b)2 (c) 4 (d)6

4. The degree of the differential equation $\frac{d^2x}{dt^2} + 2x^3 = 0$ is

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

5. $_0\int^{\pi/2} \text{Sin}^2 x dx$ equal to
(a) π/4 (b) π/3 (c) π/2 (d) π

6. Two coins are simultaneously tossed. The probability of two heads simultaneously appearing is
(a) 1/8 (b) 1/6 (c) 1/4 (d) ½

7. The $\lim_{x \to 0} \frac{\text{Sin}(2/3\, x)}{x}$ is

(a) 2/3 (b) 1 (c) 3/2 (d) ∞

8. Evaluate $_0\int^{\pi/2} \frac{\sqrt{(\text{Sin}\, x)}}{\sqrt{(\text{Sin}\, x)} + \sqrt{(\cos x)}}\, dx$

(a) π/4 (b) π/8 (c) π/2 (d) π/16

9. Evaluate $\lim_{x \to 0} \frac{e^{x} \sin x - x - x^2}{x^2 + x\log(1-x)}$

(a) –2/3 (b) 2/3 (c) –3/2 (d) 3/2

10. The rank of A = $\begin{bmatrix} 0 & 0 & 0 & 0 \\ 4 & 2 & 3 & 0 \\ 1 & 0 & 0 & 0 \\ 4 & 0 & 3 & 0 \end{bmatrix}$ is

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

11. The modulus of Rupture of concrete in terms of its characteristic cube compressive strength (f_{ck}) in Mpa according to IS456 – 2000 is
(a) 5000 f_{ck} (b) 0.7 f_{ck} (c) $5000\sqrt{f_{ck}}$ (d) $0.7\sqrt{f_{ck}}$

12. For limit state of collapses, the partial safety factor recommended by IS456 – 2000 for estimating the design strength of concrete and reinforcement steel are respectively
(a) 1.15 & 1.5 (b) 1.0 & 1.0 (c) 1.5 & 1.15 (d) 1.5 & 1.0

13. Creep Strain is
(a) caused due to live load only (b) caused due to cyclic load only
(c) caused due to dead load only (d) Independent of load

14. Six columns of building are to be located within the plot size of 15x10m. The expected load on each column is 600 KN. Allowable bearing capacity of soil is $120KN/m^{2.}$ The type of foundation to be used is
(a) Isolated foundation (b) Pile foundation
(c) Combined foundation (d) Raft foundation

15. A clay soil sample is tested in tri-axial apparatus in consolidated drained conditions at a cell pressure of $100KN/m^{2.}$ What will be the pore water pressure at a deviator stress of $40KN/m^2$
(a) $0KN/m^2$ (b) $20KN/m^2$ (c) $40KN/m^2$ (d) $60KN/m^2$

16. The number of blows observed in a standard penetration test (SPT) for different depth are given below:

Penetration of Sample	Number of blows
0-150mm	6
150-300mm	8
300-450mm	10

The observed 'N' value is
(a) 8 (b) 14 (c) 18 (d) 24

17. A sampling tube has an inner diameter of 80 mm and outer diameter of 88 mm. The area ratio is
(a) 0.21 (b) 0.12 (c) – 0.21 (d) – 0.12

18. A compacted sample of soil with bulk density of $2.0g/cm^3$ has a water content of 15%. What is its dry density? Assume G = 2.65
(a) 1.74 g/cm^3 (b) 17.4 g/cm^3 (c) 0.174 g/cm^3 (d) 0.471 g/cm^3

19. A wet sample of sand weighing 415g is taken for water content determination by a pyconometer. The mass of pyconometer, sand and water is 1667g and mass of pyconometer full of water alone is 1440g.Assume G = 2.67. Determine water content.
(a) 41% (b) 14% (c) 0.14% (d) 0.41%

20. Match the Dimensionless number in Group ‘A’ to their definitions in Group ‘B’.

Group ‘A’	Group ‘B’
a. Reynold’s number	A. Ratio of inertia force to the surface tension force
b. Froude’s number	B. Ratio of inertia force to the pressure force
c. Weber’s number	C. Ratio of inertia force to the viscos force
d. Euler’s number	D. Ratio of inertia force to the gravity force

(a) a-B, b-A, c-D, d-C
(b) a-C, b-D, c-A, d-B
(c) a-D, b-C, c-A, d-B
(d) a-A, b-B, c-C, d-D

21. When Mach number is less than unity, the flow is called
(a) sub-sonic flow
(b) sonic flow
(c) supersonic flow
(d) hypersonic flow

22. Coplanner concurrent force are those forces which
(a) meet at one point, but their lines of action do not lie in the same plane
(b) do not meet at one point and their lines of action do not lie in the same plane
(c) meet at one point and their lines of action also lie on the same plane
(d) do not meet at one point, but their lines of action lie on the same plane

23. The best hydraulic cross section for a open channel is the one
(a) with a maximum hydraulic radius
(b) with a maximum wetted perimeter
(c) with a minimum hydraulic radius
(d) with maximum resistance to flow

24. There is a free overall fall at the end of a long channel. For a given flow rate, the critical depth is less than normal depth What gradually varied flow profile will occur in the channel for the flow rate?
(a) M_1
(b) M_2
(c) M_3
(d) S_1

25. For an isotropic material, the relationship between Young’s Modulus(E), Shear Modulus(G), and Poission’s ratio(μ) is given by
(a) $G = E/2(1+ \mu)$
(b) $E = G/2(1+ \mu)$
(c) $G = E/1+2 \mu$
(d) $G = E/2(1- \mu)$

26. A standard measure of ductility of a material is
(a) Percent elongation in length
(b) Percent increase in the Area
(c) Percent decrease in the length
(d) Percent decrease in length & increase in Area

27. A rod of length L= 500 mm and cross sectional area A = $60mm^2$ is made of an elasto plastic material having a modular of elasticity E = 200 Gpa in its elastic range and yield point σy = 300 Mpa. The rod is subjected to an axial load until it is stretched 7 mm and the load is then removed. What is the resulting permanent set?
(a) 6.25mm
(b) 6.50mm
(c) 6.00mm
(d) 5.95mm

28. The change in the volume per Unit volume occurs when normal stresses are applied on an element of isotropic material is called as
(a) Bulk modulus of material (b) Shearing Strain of material
(c) Dilatation of material (d) Shearing stress of material

29 Determine the change in volume of a steel block of size 80mm x 40mm x 60mm when it is subjected to the hydrostatic pressure P = 180 Mpa. Use E = 200 Gpa and v = 0.29
(a) (-) 217.72mm^3 (b) (-) 812m m^3 (c) (-) 182m m^3 (d) (-) 128m m^3

30. Whisper concrete is used
(a) To increase the noise level of the road
(b) To reduce the noise level of the road
(c) To provide skid resistance and reduce noise level of the road
(d) To increase the noise level and reduce the skid resistance of the road

31. The compound formed due to interaction of oxides present in the raw material of cement in the kiln at a high temperature are called
(a) Simple compound (b) Complicated compound
(c) Bogue's Compound (d) Joseph's compound

32. Transition Zone represents
(a) The interfacial region between the particles of coarse aggregate & hard ended cement paste
(b) The region between the paste phase and plane of weakness
(c) The region between plane of weakness and the hardened paste
(d) The region between aggregate phase and plane of weakness

33. The amount of water required for the complete chemical reaction of cement is
(a) 40% by weight of cement (b) 60% by weight of cement
(c) 50% by weight of cement (d) 38% by weight of cement

34. High percentage of tricalcium silicate in cement results in
(a) No strength (b) High early strength
(c) Slow setting (d) Slow hardening

35. Aggregate impact value indicates the following property of aggregate
(a) Durability (b) Toughness (c) Hardness (d) Strength

36. A bar of copper and bar of steel form a composite system, which is heated to a temp of 40^0 C. The stress in steel bar is
(a) Tensile (b) Compressive (c) Zero (d) Shear

37. A single bay single storey portal frame has hinged left support and fixed right support. It is loaded with uniformly distributed load on the beam. Which one of the following statement is true with regard to the deformation of the frame
(a) It would sway to the left side
(b) It would sway to the right side
(c) It would not sway at all
(d) it would sway both ways

38. The permissible value of span/depth ratio will be the highest in the case of
(a) a simply supported beam (b) a cantilever beam
(c) a continuous beam (d) it will be same for all cases

39. In the limit state design of a flexural bending, the maximum strain in the concrete at the outermost compression fibre is
(a) 0.0020 (b) 0.0035 (c) 0.0055 (d) 0.0065

40. Under axial loading, a material will fail in shear, if the ratio of shear strength to tensile strength is less than
(a) 1 (b) 3/4 (c) 1/2 (d) 1/4

41. The important factor considered in the design of summit curve on highways is
(a) Comfort to passengers (b) Sight distance
(c) Super elevation (d) Impact factor

42. The super elevation needed on a horizontal circular curve of 150m radius for a design speed of 60 kmph with coefficient of friction of 0.15 is
(a) 38.8 cm (b) 3.88 cm (c) 0.388 cm (d) 388 cm

43. The rigid pavement are made of
(a) Bituminous binder (b) WBM
(c) RCC (d) Plain concrete

44. California Bearing Ratio (CBR)
(a) is a measure of soil strength
(b) is a procedure of designing flexible pavement
(c) is a method of soil identification
(d) is a measure to indicate the relative strength of paving materials.

45. The contact pressure P_c, tyre pressure P and rigidity factor R are related by
(a) $P/P_c = R$ (b) $P_c/P = R$ (c) $P.P_c = R$ (d) $R = \sqrt{}P.P_c$

46. Laterite is chemically classified as
(a) Calcareous rock (b) Argillaceous rock
(c) Siliceous rock (d) Metamorphic rock

47. An assembled product made up of veneers and adhesives are called
(a) Board
(b) Plank
(c) Plywood
(d) Batten

48. The purpose of seasoning of timber is to
(a) Change the direction of grains
(b) Remove voids
(c) Reduce moisture content
(d) Increase the weight of timber

49. A first class brick should not absorb more than……….. of its own dry weight after 24 hrs of immersion in water
(a) 10%
(b) 15%
(c) 20%
(d) 25%

50. A fixed point of reference of known elevation is called
(a) Change point
(b) Station point
(c) Bench mark
(d) Datum

51. The vertical distance between two consecutive contours is called
(a) Vertical interval
(b) Horizontal Equivalent
(c) Contour interval
(d) Contour Gradient

52. A benchmark has been established at the soffit of an ornamental arch at known elevation of 100.0 m above mean sea level. The back sight used to establish height of instrument is an inverted staff reading 2.105m. A forward sight-reading with normally held staff of 1.105m is taken on recently constructed plinth. The elevation of plinth is
(a) 103.21m
(b) 101.00mm
(c) 99.00m
(d) 96.79m

53. The method of leveling in which heights of mountain are found by observing the temperature at which the water boils is known as
(a) Barometric levelling
(b) Reciprocal levelling
(c) Longitudinal levelling
(d) Hypometry

54. According to the Fuller's formula, the flood discharge (Q) in cumsec is given by
(a) $CA^{0.8}.(1+0.80\log T)(1+2.67A^{-0.3})$
(b) $CA^{5/6}$
(c) $CA(0.993 - 1/14 \log A)$
(d) $123A/ \sqrt{A}+ 10.4$

55. A deflecting 'Groyove' in a river is
(a) Inclined towards upstream
(b) Perpendicular to bank
(c) Inclined towards downstream
(d) Parallel to bank

56. A hydraulic jump is formed when
(a) a sub-critical flow strikes against super-critical flow
(b) a super-critical flow strikes against sub-critical flow
(c) the two flows of super critical velocity meet each other
(d) the two flows of sub-critical velocity meet each other

57. A convective precipitation is
(a) it results from lifting of air masses converging into low pressure area
(b) it results from natural rising of warmer, lighter air in colder and dense surroundings
(c) it results from lifting of warm moisture laden air masses due to topographic barrier
(d) it results from lifting of air masses into high pressure area

58. A river meandering through an alluvial plain flows in a series of consecutive curves of reverse order (sinous Curve), the transverse distance between the apex point of one curve and apex point on the reverse curve is called
(a) Meander length (b) Meandering width
(c) Shoal (d) Meandering type

59. The maximum acidity in water will occur at a pH value of
(a) 0 (b) 2 (c) 7 (d) 14

60. In the process of screening, the screen are inclined at 45^0,the area of openings in screen should be such that the velocity of flow through them does not exceed,
(a) 0.75 to 1.0 m/s (b) 1.5 to 3.0 m/s
(c) 3.0 to 5.0 m/s (d) 5.0 to 6.0 m/s

61. The most common coagulant is
(a) Magnesium sulphate (b) Alum
(c) chlorine (d) Bleaching powder

62. Self cleansing velocity is
(a) the maximum velocity of flow required to maintain certain amount of solids in the flow.
(b) the minimum velocity of flow required to maintain certain amount of solids in the flow.
(c) such flow velocity as would be sufficient to flush out any deposited solids in the sewer
(d) such flow of velocity as would be sufficient to ensure that sewage does not remain in the sewer

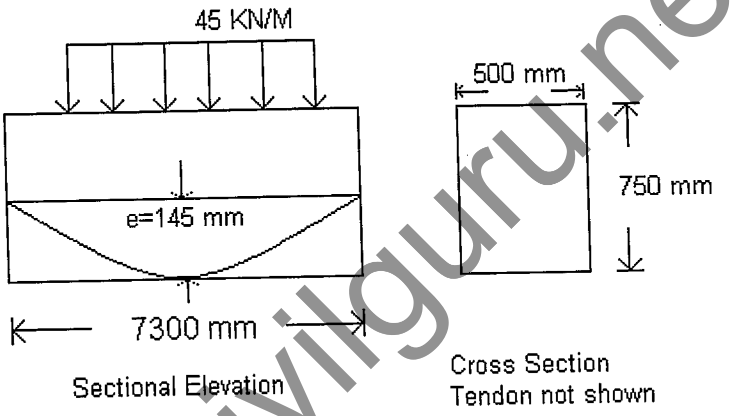
63. When design imposed load does not exceed three-fourths of the design dead load, the load arrangement on structural frame as per IS 456-2000 is
(a) Design dead load and design imposed load on all the span
(b) Design dead load on all the span with full design imposed load on alternate span.
(c) Design dead load on all span.
(d) Design imposed load on all span.

64. A rectangular column section of 250x400 mm reinforced with 6 steel bars of Fe_{500}, each of 25mm diameter. Concrete Mix is M_{30}. Axial load on column section with minimum eccentricity as per IS 456-2000 using limit state method can be applied upto:
(a) 1805.3 KN (b) 1707.37 KN (c) 2150.83 KN (d) 1903.7 KN

65. The effective length of circular electrical pole of length L and constant diameter erected on ground is :
(a) 0.8 L (b) 1.20 L (c) 1.50 L (d) 2.0 L

66. If φ is the nominal diameter of reinforcing bar, f_x is compressive stress in the bar and f_{bd} is design bond stress of concrete, the anchorage length L_a of straight bar in compression is equal to:
(a) $L_a = \frac{\varphi f_x}{f_{bd}}$ (b) $L_a = \frac{\varphi f_x}{2 f_{bd}}$ (c) $L_a = \frac{\varphi f_x}{\pi f_{bd}}$ (d) $L_a = \frac{\varphi f_x}{4 f_{bd}}$

67. A concrete beam prestressed with a parabolic tendon is shown in the sketch. The eccentricity of the tendon is measured from the centroid of the cross section. The applied prestressing force at service is 1620KN. The uniformly distributed load of 45 KN/m includes self weight.



Sectional Elevation

Cross Section
Tendon not shown

The stress (in N/mm^2) in the bottom fibre at Mid Span is

(a) Tension 2.94 (b) Compression 2.94
(c) Tensile 4.32 (d) Compression 4.32

68. As per IS 456-2000; in the limit state design of a flexural member, the strain in reinforcing bar under tension at ultimate state should not be less than
(a) $\frac{f_y}{E_x}$ (b) $\frac{f_y}{E_x} + 0.002$ (c) $\frac{f_y}{1.15 E_x}$ (d) $\frac{f_y}{1.15 E_x} + 0.002$

69. As per Indian Standard code of practice for prestressed concrete (IS 1343 – 1980), the minimum grade of concrete to be used for post tensioned and prestressed structural elements are respectively
(a) M_{20} for both (b) M_{40} & M_{30} (c) M_{15} & M_{20} (d) M_{30} & M_{40}

70. The final deflection of a structure due to all loads including the effects of temperature, creep and shrinkage and measured from the as – cast level of support of floor, roofs and all other horizontal forces should not normally exceed
(a) span/350 (b) span/250 (c) span/450 (d) span/550

71. A square footing 2mx2m is built in a homogenous bed of sand of density 1.9t/m^3 and having an angle of shearing resistance of 38^0.The depth of base of footing is 0.8m below the ground surface. What is the safe load according to Terzaghi analysis which can be carried by the footing with a factor of safety of 3 against complete shear failure? Assume $\varphi = 38^0$; $N_q = 65$, $N_r = 80$

(a) 298t (b) 928t (c) 892t (d) 829t

72. An elastic medium carries at its surface a uniform load of 10 t/m^2 (≈ 100 Kpa) covering a rectangular area of 4m x 3m. Find the vertical pressure at a depth of 5m below the center and corner of the loaded area. Assume influence factor of equal Quadrant is 0.0474 and influence factor for the point located at the corners of loaded area is 0.1247

(a) 1.896 t/m^2 ; 1.247 t/m^2 (b) 18.96 t/m^2 ; 12.47 t/m^2
(c) 189.6 t/m^2 ; 124.7 t/m^2 (d) 0.1896 t/m^2 ; 0.1247 t/m^2

73. A retaining wall, 4.5m high has a smooth vertical back. The back fill has a horizontal surface in level with top of the wall. There is a uniformly distributed surcharge load of 2 t/m^2 intensity over the back fill. The density of the soil is 1.9 t/m^3 ,its angle of shearing resistance is 30^0 and cohesion is zero. Determine the magnitude of the total active pressure per metre length of wall.

(a) 94.1t (b) 9.41t (c) 941t (d) 0.941t

74. The shape factor of a rectangular section is

(a) 1.00 (b) 1.50 (c) 2.00 (d) 2.50

75. At two points '1' and '2' in a pipeline, the velocities of fluid are v and 3v respectively. Both points are at same elevation. The flow can be assumed to be incompressible, inviscid, steady and irrotational. The difference in pressure P_1 and P_2 at point 1 and 2 is

(a) 0.5 ρv^2 (b) 2 ρv^2 (c) 3 ρv^2 (d) 4 ρv^2

76. The top width and depth of flow in a rectangular channel were measured as 4m and 1m respectively. The measured velocities on the center line at the water surface, 0.2m and 0.8m below the surface are 0.7m/s, 0.8m/s, 0.6m/s respectively. Using two point method of velocity measurement, the discharge (in m^3/s) in a channel is

(a) 1.4 (b) 1.2 (c) 1.0 (d) 0.8

77. A rectangular open channel of width 5m is carrying a discharge of 100 m^3/s. Froude number of flow is 0.8. The depth of flow in the channel is

(a) 4m (b) 5m (c) 6m (d) 20m

78. A concrete floor slab of 140 mm thick is reinforced by 16mm dia steel rods placed 38 mm above the lower face of the slab and spaced 150mm on center. The distance from the upper face of slab to steel is 100mm. The modulus of elasticity is 25 Gpa for concrete and 200 Gpa for steel. Knowing that a bending moment of 4.5KN-M is applied to each 0.30m width of slab, determine the maximum stress in the concrete and steel respectively

(a) 12.9 Mpa & 177.8 Mpa (b) 1.29 Mpa & 1.778 Mpa
(c) 129 Mpa & 17.78 Mpa (d) 0.129 Mpa & 0.177 Mpa

79. The Poisson ratios of soil sample 1 & 2 are μ_1 and μ_2 respectively and the coefficient of earth pressure at rest for soil sample 1 and 2 are k_1 and k_2 respectively. If $\mu_1/\mu_2 = 1.5$ and $(1-\mu_1)/(1-\mu_2) = 0.875$, then k_1/k_2 will be

(a) 1.3125 (b) 1.7143 (c) 1.8213 (d) 1.9687

80. Maximum cement content, maximum water cement ratio and minimum grade of concrete with nominal weight of aggregate of 20 mm size for very severe exposure condition as per IS456-2000 are respectively

(a) 340;0.45; M_{35} (b) 400;0.5; M_{40}
(c) 360;0.45; M_{40} (d) 320;0.5; M_{35}

1. Granite mainly composed of quartz and feldspar particles, is obtained from
(a) Sedimentary rocks (b) Metamorphic rocks
(c) Igneous rocks (d) Volcanic rocks

2. Inner part of a timber log surrounding the pitch, is called
(a) Sapwood (b) Cambium layer
(c) Heart wood (d) Soft wood

3. Galvanising means covering iron with a thin coat of
(a) Tin (b) Zinc
(c) Glaze (d) Coal tar

4. The arrangement of supporting an existing structure by providing supports underneath, is known as
(a) Shoring (b) Underpinning
(c) Jacking (d) Piling

5. The type of brick masonry bond in which every course contains both headers and stretchers, is called
(a) English bond (b) Flemish bond
(c) Russian bond (d) Mixed bond

6. The depth of an arch is the distance between
(a) Ground level and springing line
(b) Crown and springing line
(c) Crown and ground level
(d) Intrados and extrados

7. If height of the first storey of a building is 3.25 m and riser is 13 cm, the number of treads required is

(a) 12 (b) 18

(c) 24 (d) 25

8. The pile provided with one or more bulbs in its vertical shaft, is generally known as

(a) Under reamed pile (b) Friction-pile

(c) Bearing-pile (d) Sheet-pile

9. If R is the radius of earth and h is the altitude above mean sea level at a location then correction for length L for reduction to mean sea level is

(a) $(h/R)(L)$ (b) $(h)(L)(R)$

(c) $(R/h)(L)$ (d) $(h/L)(R)$

10. When the bubble of the level tube of a level remains central

(a) Line of sight is horizontal

(b) Axis of the telescope is horizontal

(c) Line of sight is inclined

(d) Geometrical axis of the telescope is horizontal

11. The direction of steepest slope on a contour is

(a) Along the contour

(b) At an angle of 45° to the contour

(c) At right angles to the contour

(d) At an angle of 60° to the contour

12. Closed contours of decreasing values towards their centre, represent

(a) A hill (b) A depression

(c) A saddle or pass (d) A river bed

13. The instrument which is used in plane tabling for obtaining horizontal and vertical distances directly without resorting to chaining, is known as

(a) Plane alidade (b) Telescopic alidade

(c) Clinometer (d) Tacheometer

14. Longitudes are measured from 0° to

(a) 180° eastward (b) 180° westward

(c) 180° east or westward (d) 360° eastward

15. If two equal forces of magnitude P act at an angle θ, their resultant, will be

(a) $P\cos\theta/2$ (b) $2P\sin\theta/2$

(c) $P\tan\theta/2$ (d) $2P\cos\theta/2$

16. The moment of inertia of a hollow circular section whose external diameter is 8 cm and internal diameter is 6 cm, about centroidal axis is

(a) 437.5 cm^4 (b) 337.45 cm^4

(c) 237.5 cm^4 (d) 137.45 cm^4

17. To double the period of oscillation of a simple pendulum

(a) The mass of its bob should be doubled

(b) The mass of its bob should be quadrupled

(c) Its length should be quadrupled

(d) Its length should be doubled

18. For perfectly elastic bodies, the value of coefficient of restitution is

(a) Zero
(b) 0.5
(c) 1.0
(d) Between 0 and 1

19. If l is the span of a light suspension bridge whose each cable carries total weight (w) and the central dip is y, the horizontal pull at each support, is

(a) $wl/4y$
(b) $wl/8y$
(c) $wl/2y$
(d) wl

20. A load of 500 kg was lifted through a distance of 13 cm by an effort of 25 kg which moved through a distance of 650 cm. The mechanical advantage of the lifting machine is

(a) 15
(b) 18
(c) 20
(d) 26

21. A simply supported beam of span L carries a total load W which is uniformly distributed. The maximum bending moment M is

(a) WL/2
(b) WL/4
(c) WL/12
(d) WL/8

22. If there are 'm' unknown number forces, 'r' unknown reaction components and 'j' number of joints, then the degree of static indeterminacy of pin-jointed plane frame is given by

(a) $m+r+2j$
(b) $m-r+2j$
(c) $m+r-2j$
(d) $m+r-3j$

23. The property of a material by which it can be beaten or rolled into thin plates, is called

(a) Malleability
(b) Ductility
(c) Plasticity
(d) Elasticity

24. If the depth of a simply supported beam carrying an isolated load at its centre, is doubled, the deflection of the beam at the centre will be changed by a factor of

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

25. Which is the correct statement as per Law of polygon of forces?

(a) If any number of forces acting at point can be represented by the sides of a polygon taken in order, then the forces are in equilibrium

(b) If any number of forces acting at point can be represented in direction and magnitude by the sides of polygon, then the forces are in the equilibrium

(c) If a polygon representing forces acting at a point is closed then forces are in equilibrium

(d) If any number of forces acting at point can be represented in direction and magnitude by the sides of polygon taken in order, then the forces are in equilibrium

26. Degree of kinematic indeterminacy of a pin jointed plane frame is given by

(a) $2j-r$
(b) $j-2r$
(c) $3j-r$
(d) $2j+r$

27. The shape of fire hose nozzle is generally kept

(a) Divergent
(b) Convergent
(c) Convergent divergent
(d) Cylindrical

28. Discharge over an ogee weir remains the same as that of

(a) Sharp crested weir
(b) Triangular weir
(c) Drowned weir
(d) Cippoletti weir

29. The ratio of hydraulic radius of a pipe running full to the hydraulic radius of a square section of a channel running full whose side is equal to the diameter of the pipe is

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

30. Kinematic viscosity equals to

(a) Dynamic viscosity ÷ density
(b) Dynamic viscosity × density
(c) Dynamic viscosity + density
(d) Pressure ÷ density

31. A fluid in equilibrium can't sustain

(a) Shear stress
(b) Compressive stress
(c) Tensile stress
(d) Bending stress

32. The line of action of the buoyant force acts through the

(a) Centroid of the volume of fluid vertically above the body
(b) Center of the volume of floating body
(c) Center of gravity of any submerged body
(d) Center of volume of the displaced body

33. Match list I with list II

	List I		List II
(A)	The flow is turbulent in pipes	(1)	Reynold number less than 2000
(B)	Proportional to the mean velocity	(2)	Loss of pressure head in laminar flow
(C)	The flow is laminar in pipes	(3)	Reynold number is more than 4000
(D)	Proportional to square of velocity	(4)	Loss of pressure head in turbulent flow

Codes :

	(A)	(B)	(C)	(D)
(a)	1	2	3	4
(b)	3	2	4	1
(c)	3	2	1	4
(d)	1	4	3	2

34. Isohytes are the imaginary lines joining the points of equal

(a) Pressure
(b) Height
(c) Humidity
(d) Rainfall

35. Match List-I with List-II and select the correct answer using the code given below the Lists:

	List-I (Impurity in drinking water)		List-II (Harm caused)
(A)	Excess of nitrates	(1)	Brackish water
(B)	Excess of fluorides	(2)	Goiter
(C)	Lack of iodides	(3)	Fragile bones
(D)	Excess of chlorides	(4)	Blue babies

Codes :

	(A)	(B)	(C)	(D)
(a)	4	2	3	1
(b)	1	2	3	4
(c)	4	3	2	1
(d)	1	3	2	4

36. Relative humidity is the ratio of actual vapour pressure to the saturation vapour pressure
   (a) At the same temperature
   (b) At the same pressure
   (c) In the same volume
   (d) In the same atmosphere

37. Toughness index of a soil is defined as the ratio of
   (a) Plasticity index to consistency index
   (b) Plasticity index to flow index
   (c) Liquidity index to flow index
   (d) Consistency index to liquidity index

38. According to BIS classification, the range of silt size particles is
   (a) 4.75 mm to 2.00 mm
   (b) 2.00 mm to 0.425 mm
   (c) 0.425 mm to 0.075 mm
   (d) 0.075 mm to 0.002 mm

39. The clay mineral with the largest swelling and shrinkage characteristic is
   (a) Kaolinite
   (b) Illite
   (c) Montmorillonite
   (d) Rock minerals

40. A soil has liquid limit = 32, plastic limit = 18, shrinkage limit = 8 and natural moisture content = 22%. What will be its liquidity index and plasticity index?
   (a) 0.67 and 15
   (b) 0.285 and 14
   (c) 0.67 and 25
   (d) 0.33 and 20

41. A cohesive soil yields a maximum dry density of 18 kN/m^3 during a standard Proctor Compaction test. If the specific gravity is 2.65, what would be its void ratio?

(a)	0.552	(b)	0.444
(c)	0.712	(d)	0.583

42. Effective stress on soil

(a) Increases voids ratio and decreases permeability

(b) Increases both voids ratio and permeability

(c) Decreases both voids ratio and permeability

(d) Decreases voids ratio and increases permeability

43. The slope of isochrones at any point at a given time indicates the rate of change of

(a) Effective stress with time

(b) Effective stress with depth

(c) Pore water pressure with depth

(d) Pore water pressure with time

44. Clay layer A with single drainage and coefficient of consolidation Cv takes 6 months to achieve 50% consolidation. The time to layer B of the same thickness with double drainage and coefficient of consolidation $\frac{Cv}{2}$ to achieve the same degree of consolidation

(a)	3 months	(b)	6 months
(c)	12 months	(d)	24 months

45. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always

(a) Zero
(b) Less than 1
(c) 1
(d) Greater than 1

46. To generate the jth column of the flexibility matrix

(a) A unit force is applied at co-ordinate j and displacements are calculated at all co-ordinates
(b) A unit displacement is applied at co-ordinate j and the forces are calculated at all co-ordinates
(c) A unit force is applied at co-ordinate j and the forces are calculated at all co-ordinates
(d) A unit displacement is applied at co-ordinate j and the displacements are calculated at all co-ordinates

47. The deformation of a spring produced by a unit load is called

(a) Stiffness
(b) Flexibility
(c) Influence coefficient
(d) Unit strain

48. For determining the velocity of flow of underground water, the most commonly used non-empirical formula is

(a) Darcy's formula
(b) Slichter's formula
(c) Hazen's formula
(d) Lacey's formula

49. An aquiclude is

(a) A non artesian aquifer
(b) An artesian aquifer
(c) A solid impermeable layer underlying or overlying an aquifer
(d) A large underground water body

50. Slenderness ratio of a compression member is

(a) Moment of inertia/Radius of gyration

(b) Effective length/Area of cross-section

(c) Effective length/Radius of gyration

(d) Radius of gyration/Area of cross-section

51. The thickness "*t*" of a single flat lacing should not be less than

(a) 1/30th length between inner end rivets

(b) 1/40th length between inner end rivets

(c) 1/50th length between inner end rivets

(d) 1/60th length between inner end rivets

52. Web crippling generally occurs at the point where

(a) Concentrated load act

(b) Shearing force is minimum

(c) Bending moment is maximum

(d) Deflection is maximum

53. Stiffeners are used in a plate girder

(a) To reduce the compressive stress

(b) To reduce the shear stress

(c) To take the bearing stress

(d) To avoid buckling of web plate

54. The normal scour depth D below the designed flood level of a river may be calculated from the Lacey's equation, where C = Constant, Q = Design flood discharge and f = Silt factor

(a) $D = C\,(Q/f)$
(b) $D = C\,(Q/f)^{1/2}$
(c) $D = C\,(Q/f)^{5/3}$
(d) $D = C\,(Q/f)^{1/3}$

55. A fall in a canal bed is generally provided, if

(a) Ground slope exceeds the designed bed slope
(b) Designed bed slope exceeds the ground slope
(c) Ground slope is practically the same as the designed bed slope
(d) Canal bed is flat

56. The steepest gradient permitted on roads which, in ordinary conditions, does not exceed, is known

(a) Ruling gradient
(b) Limiting gradient
(c) Exceptional gradient
(d) Floating gradient

57. While calculating the sight distances, the driver's eye above road surface is assumed as

(a) 60 cms
(b) 70 cms
(c) 80 cms
(d) 120 cms

58. The radius of curvature provided along a transition curve, is

(a) Minimum at the beginning and maximum at the end

(b) Same throughout its length

(c) Equal to the radius of circular curve

(d) Varying from infinity at the beginning to the radius of circular curve at the end

59. Staggered rail joints are generally provided

(a) On curves (b) On tangents

(c) On bridges (d) In tunnels

60. The critical activity has

(a) Maximum float (b) Minimum float

(c) Zero float (d) Variable float

61. According to BIS method of measurement, the order of the sequence is

(a) Length, breadth, height

(b) Breadth, length, height

(c) Height, length, breadth

(d) Length, height, breadth

62. Which one of the following types of samples is relatively employed for the design of waste water treatment plants?
(a) Grab sample
(b) Composite sample
(c) Integrated sample
(d) Any sample

63. In very first stage of decomposition of the organic matter in sewage
(a) Nitrites are formed
(b) Nitrates are formed
(c) Carbon dioxide is formed
(d) Ammonia is formed

64. The characteristics of fresh and septic sewage respectively are
(a) acidic and alkaline
(b) alkaline and acidic
(c) both acidic
(d) both alkaline

65. Ultimate strength to cement is provided by
(a) Tri calcium silicate
(b) Di calcium silicate
(c) Tri calcium aluminate
(d) Tetra calcium alumino ferrite

66. Strength of concrete increases with
(a) increase in water cement ratio
(b) increase in fineness of cement
(c) decrease in curing time
(d) decrease in size of aggregate

67. The compressive strength of 100 mm cube of concrete as compared to 150 mm cube is

(a) less

(b) more

(c) equal

(d) less or more as per grade of concrete

68. The individual variation between test strength of concrete cube sample should not be more than

(a) ± 5% of average (b) ± 10% of average

(c) ± 15% of average (d) ± 20% of average

69. The ratio of maximum shear stress to average shear stress of a beam circular in cross-section, is

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

70. In prestressed concrete

(a) forces of tension and compression change but lever arm remains unchanged

(b) forces of tension and compression remains unchanged but lever arm changes with moment

(c) both forces of tension and compression as well as lever arm changes

(d) both forces of tension and compression as well as lever arm remains unchanged

71. The value of $\Delta = \begin{vmatrix} 0 & 1 & 2 & 3 \\ 1 & 0 & 3 & 0 \\ 2 & 3 & 0 & 1 \\ 3 & 0 & 1 & 2 \end{vmatrix}$ is

(a) 56 (b) 88 (c) 2π (d) 0

72. The series $1+\frac{1}{2^2}-\frac{1}{3^2}-\frac{1}{4^2}+\frac{1}{5^2}+\frac{1}{6^2}-\frac{1}{7^2}-\frac{1}{8^2}+\cdots\infty$ is

(a) Divergent (b) Oscillatory
(c) Conditional convergent (d) Absolute convergent

73. The complete solution of the linear differential equation

$$\frac{d^2y}{dx^2}+(a+b)\frac{dy}{dx}+aby=0$$

(a) $c_1e^{-ax}+c_2e^{-bx}$ (b) $c_1e^{ax}+c_2e^{bx}$
(c) $c_1e^{-ax}-c_2e^{-bx}$ (d) $c_1e^{ax}-c_2e^{bx}$

74. To multiply a matrix by scalar K, multiply

(a) Any row by K
(b) Every element by K
(c) Any column by K
(d) Every element by $1/K$

75. If $A=\begin{vmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{vmatrix}$ and $B=\begin{vmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{vmatrix}$. Then the determinant AB has the value

(a) 4 (b) 8
(c) 16 (d) 32

76. The period of a simple pendulum is $T = 2\pi\sqrt{L/g}$. The maximum error in T due to the possible error upto 1% in 'L' and 2.5% in 'g' is

(a) 1.75%
(b) 2.5%
(c) 1%
(d) 5%

77. The value of $\int_0^{\pi} \sin^2\theta \cdot \cos^4\theta \cdot d\theta$ is

(a) π
(b) 2π
(c) $\pi^2/32$
(d) $\pi/16$

78. If $f(x, y) = x^3y - xy^3$, then what is the value of $[1/(df/dx) + 1/(df/dy)]$ $x = 1, y = 2$?

(a) 13/18
(b) –9/18
(c) 9/22
(d) –13/22

79. What is the complete solution for the equation $x(y-z)p + y(z-x)q = z(x-y)$?

(a) $\phi(x + y + z, xyz) = 0$
(b) $\phi(x + 2y + z, xz) = 0$
(c) $\phi(2x + y + z, xyz) = 0$
(d) $\phi(x + y + z, xy) = 0$

80. The solution of $d^2z/dx^2 + z = 0$, given that when $x = 0$, $z = e^y$ and $dz/dx = 1$ is

(a) $Z = \cos x + e^y \sin x$
(b) $Z = \sin x + e^y \cos x$
(c) $Z = \cos x + \sin x$
(d) $Z = e^{2y} \tan x$

1. The resultant of two forces each equal to P and acting at right angles is

(a) $P/\sqrt{2}$ (b) $P/2$ (c) $P/2\sqrt{2}$ (d) $\sqrt{2}P$

2. Non coplanar concurrent forces are those forces which

(a) Meet at one point, but their lines of action do not lie on the same plane

(b) Do not meet at one point and their lines of action do not lie on the same plane

(c) Meet at one point and their lines of action also lie on the same plane

(d) Do not meet at one point, but their lines of action lie on the same plane

3. The point through which the whole weight of the body acts, irrespective of its position, is known as

(a) Moment of inertia (b) Centre of mass

(c) Centre of percussion (d) Centre of gravity

4. The moment of inertia of a rectangular section 3 cm wide and 4 cm deep about an axis passing through its centre of gravity and parallel to width is

(a) 9 cm^4 (b) 12 cm^4

(c) 16 cm^4 (d) 20 cm^4

5. Modulus of rigidity is the ratio of

(a) Linear stress to lateral strain (b) Lateral strain to linear strain

(c) Linear stress to linear strain (d) Shear stress to shear strain

6. Two bars of different materials and same size are subjected to the same tensile force. If the bars have unit elongation in the ratio of 3:5, then the ratio of modulus of elasticity of the two materials will be

(a) 2:5 (b) 3:5 (c) 5:3 (d) 3:4

7. Modular ratio of the two materials is the ratio of

(a) Linear stress to linear strain

(b) Shear stress to shear strain

(c) Their modulus of elasticity's

(d) Their modulus of rigidities

8. The young's modulus of a material is 150 GPa and Poisson's ratio is 0.25, the modulus of rigidity of the material is

(a) 30 GPa (b) 50 GPa (c) 60 GPa (d) 100 GPa

9. A body is subjected to a direct tensile stress of 300 MPa in one plane accompanied by a simple shear stress of 200 MPa. The maximum normal stress will be

(a) – 100 MPa (b) 250 MPa (c) 300 MPa (d) 400 MPa

10. A vessel of 4 m^3 contains oil which weighs 30 kN. The specific weight of the oil is

(a) 4.5 kN / m^3 (b) 6 kN / m^3 (c) 7.5 kN / m^3 (d) 10 kN / m^3

11. The variation in the volume of a liquid with the variation of pressure is called its

(a) Surface tension (b) Compressibility

(c) Capillarity (d) Viscosity

12. The pressure of a liquid measured with the help of piezometer tube is

(a) Vacuum pressure
(b) Atmospheric pressure
(c) Absolute pressure
(d) Gauge pressure

13. A body floating in a liquid is said to be in a neutral equilibrium, if its metacentre

(a) Coincides with its centre of gravity
(b) Lies above its centre of gravity
(c) Lies below its centre of gravity
(d) Lies between the centre of buoyancy and centre of gravity

14. A Pitot tube is used to measure the

(a) Velocity of flow at the required point in a pipe
(b) Pressure difference between two points in a pipe
(c) Total pressure of liquid flowing in a pipe
(d) Discharge through a pipe

15. When the water level on the downstream side of a weir is above the top surface of a weir, the weir is known as

(a) Narrow crested weir
(b) Broadcrested weir
(c) Ogee weir
(d) Submerged weir

16. In open channels, the specific energy is the

(a) Total energy per unit discharge
(b) Total energy measured with respect to the datum passing through the bottom of the channel
(c) Total energy measured above the horizontal datum
(d) Kinetic energy plotted above the free surface of water

17. Newton's law of viscosity is a relationship between

(a) Pressure, velocity and temperature

(b) Shear stress and rate of shear strain

(c) Shear stress and velocity

(d) Rate of shear strain and temperature

18. The velocity at which the flow changes from laminar flow to turbulent flow is called

(a) Critical velocity
(b) Velocity of approach
(c) Subsonic velocity
(d) Supersonic velocity

19. When the length of chain used in measuring distance is longer than the standard length, the error in measured distance will be

(a) Positive error
(b) Mean error
(c) Compensating error
(d) Negative error

20. In a whole circle bearing system N 20^0 15' *W corresponds to*

(a) 69^0 45'
(b) 290^0 15'
(c) 200^0 15'
(d) 339^0 45'

21. The horizontal angle between the true meridian and a survey line is called

(a) Magnetic bearing
(b) Azimuth
(c) Dip
(d) Magnetic declination

22. The lines passing through points at which the magnetic declination is equal at a given time are called

(a)	Isogonic lines	(b)	Agonic lines
(c)	Isoclinic lines	(d)	Isochrite lines

23. When the whole circle bearing of a traverse line is between 90^0 to 180^0, then

(a) The latitude is positive and departure is negative

(b) The departure is positive and latitude is negative

(c) Both latitude and departure are positive

(d) Both latitude and departure are negative

24. The method of plane tabling commonly used for establishing the instrument stations only, is a

(a)	Method of radiation	(b)	Method of intersection
(c)	Method of traversing	(d)	Method of resection

25. The ratio between the area of a crop irrigated and the quantity of water required during its entire period of the growth, is known as

(a)	Delta	(b)	Duty
(c)	Base period	(d)	Crop period

26. Irrigation canals are generally aligned along

(a)	Contour line	(b)	Valley line
(c)	Straight line	(d)	Water shed

27. The vertical wells provided along the banks of a river to draw ground water in dry season are called

(a) Open wells (b) Tube wells

(c) Artesian wells (d) Infiltration wells

28. The desirable limit of chloride content as per BIS standards in water for domestic supplies should not exceed

(a) 250 ppm (b) 350 ppm (c) 450 ppm (d) 550 ppm

29. B-coli or E-coli are generally harmless organisms and their presence in water indicates the

(a) Presence of pathogenic bacteria

(b) Absence of pathogenic bacteria

(c) Presence of non pathogenic bacteria

(d) Absence of non pathogenic bacteria

30. The most common coagulant used in water treatment plants is

(a) Magnesium sulphate (b) Alum

(c) Chlorine (d) Bleaching powder

31. The permanent hardness of water can be removed by

(a) Adding alum (b) Adding chlorine

(c) Boiling (d) Zeolite process

32. Laterite is chemically classified as

(a) Calcareous rock (b) Metamorphic rock

(c) Siliceous rock (d) Argillaceous rock

33. Excess of alumina in the clay

(a) Makes the brick brittle and weak

(b) Makes the brick crack and warp on drying

(c) Changes colour of the brick from red to yellow

(d) Improves impermeability and durability of the brick

34. The central part of a tree is called

(a) Heart wood (b) Cambium

(c) Sap wood (d) Pith

35. Fender piles are

(a) Used to function as retaining walls

(b) Used to protect concrete deck or other water front structures from the abrasion or impact

(c) Driven at an inclination to resist large horizontal inclined forces

(d) Driven in granular soil with the aim of increasing the bearing capacity of the soil

36. A brick which is cut in such a way that the width of its one end is half that of a full brick, is called

(a) King closer (b) Mitred closer

(c) Beveled closer (d) Queen closer

37. The vertical distance between the springing line and the highest point on the intrados is called ————— of the arch.

(a) Depth (b) Extrados

(c) Haunch (d) Rise

38. The super elevation is

(a) Directly proportional to the velocity of vehicles

(b) Inversely proportional to the velocity of vehicles

(c) Directly proportional to the width of pavement

(d) Inversely proportional to the width of pavement

39. The minimum length of a valley curve should be such that the head light beam sight distance is equal to

(a) Stopping sight distance (b) Passing sight distance

(c) Braking distance (d) Chord distance

40. Junction between the flange and web of a beam is known as

(a) Lap joint (b) Butt joint

(c) Fillet (d) Shear joint

41. Rolled steel equal and unequal sections are designated as ISA followed by

(a) Length and thickness of legs

(b) Width of flange and depth of web

(c) Depth of section

(d) Weight per meter length

42. A strut is a structural member subjected to

(a) Tension in a direction parallel to its longitudinal axis

(b) Tension in a direction perpendicular to its longitudinal axis

(c) Compression in a direction parallel to its longitudinal axis

(d) Compression in a direction perpendicular to its longitudinal axis

43. Which of the following is a best compression member section?

(a) Single angle section
(b) Tubular section
(c) Double angle section
(d) I section

44. The longitudinal movement of the rails in a track is technically known as

(a) Buckling
(b) Hogging
(c) Creeping
(d) Cracking

45. When two tracks of same or different gauges cross each other at any angle, the crossing provided is

(a) Diamond crossing
(b) Scissors crossing
(c) Level crossing
(d) Tongue crossing

46. An activity in a project management network is

(a) The beginning or end of a specified job

(b) An element of work entailed in the project

(c) Represented by a circle in a network with a number in it

(d) The progress of work up to a certain limit

47. A critical activity in a project management network has

(a) Maximum float
(b) Minimum float
(c) Zero float
(d) Average float

48. The relation between void ratio (e), degree of saturation (s), water content (w) and specific gravity of solids (G) is given by

(a) e + s = w + G (b) e x s = w x G

(c) e/s = w/G (d) s + e / w = G + e /s

49. The difference between maximum void ratio and minimum void ratio of a sand sample is 0.25. If relative density of this sample is 60% at a void ratio of 0.40, then the void ratio of this sample at its loosest state will be

(a) 0.40 (b) 0.75 (c) 0.70 (d) 0.55

50. Which of the following clay mineral gives maximum swelling?

(a) Kaolinite (b) Montmorillonite

(c) Illite (d) Mica

51. Toughness index of the soil is the ratio of

(a) Flow index and plasticity index

(b) Plasticity index and flow index

(c) Liquidity index and flow index

(d) Flow index and liquidity index

52. A flow line in seepage through a soil medium is defined as the

(a) Path of particles of water through saturated soil mass

(b) Line connecting points of equal head of water

(c) Flow of movement of fine particles of soil

(d) Direction of the flow particle

53. The ratio of decrease in voids ratio of soil due to increase in effective stress is called

(a) Coefficient of permeability

(b) Coefficient of curvature

(c) Coefficient of volume compressibility

(d) Coefficient of compressibility

54. A simply supported beam A carries a point load at its mid span. Another identical beam B carries the same load but uniformly distributed over the entire span. The ratio of the maximum deflection of the beams A and B will be,

(a) 8/5 (b) 5/8 (c) 3/5 (d) 5/3

55. A cantilever beam 2.5m long carries a uniformly distributed load 50 KN per meter over length of 1.5m from the free end. The value of maximum shear force and bending moment for the beam will be respectively;

(a) 15 KN & 150 KNm (b) 10 KN & 131.25 KNm

(c) 15 KN & 131.25 KNm (d) 10 KN & 150 KNm

56. When the water table is close to the ground surface, the bearing capacity of a soil is reduced to

(a) One fourth (b) One half

(c) Two third (d) Three fourth

57. Harsh mix of concrete

(a) Lacks plasticity (b) Is cohesive

(c) Has high cement content (d) Can be easily moulded

58. The chemical ingredient of cement which provides quick setting property to the cement is

(a) Lime (b) Silica

(c) Alumina (d) Iron oxide

59. Which of the following cements is expected to have the highest compressive strength after 3 days?

(a) Ordinary Portland cement (b) Rapid hardening cement
(c) High alumina cement (d) Sulphate resisting cement

60. The phenomenon by virtue of which the cement does not undergo large change in volume when mixed with water, in known as

(a) Fineness (b) Soundness
(c) Setting time (d) Efflorescence

61. A compaction factor of 0.88 indicates that the workability of concrete mix is

(a) Very low (b) Low
(c) Medium (d) High

62. Vertical sides of concrete columns shuttering may be stripped after

(a) 1 to 2 days (b) 7 days
(c) 14 days (d) 21 days

63. The section in which concrete is not fully stressed to its permissible value when stress in steel reaches its maximum value, is called

(a) Under reinforced section (b) Over reinforced section
(c) Critical section (d) Balanced section

64. The effective depth of a singly reinforced rectangular beam is 400 mm. The section is over reinforced and the neutral axis is 180 mm below the top. If the maximum stress attained by concrete is 5 N / mm^2 and the modular ratio is 18, then the stress developed in the steel will be

(a) 110 N / mm^2 (b) 135 N / mm^2

(c) 160 N / mm^2 (d) 180 N / mm^2

65. If the bond stress developed in a reinforced concrete beam is more than permissible value, it can be brought down by

(a) Decreasing the depth of the beam

(b) Decreasing the number of bars

(c) Decreasing the diameter of the bars

(d) Increasing the diameter of the bars

66. A T beam behaves like a rectangular beam of width equal to its flange, if neutral axis

(a) Remains outside the flange

(b) Remains within the flange

(c) Remains below the slab

(d) Remains anywhere in the web

67. The analysis of slab spanning in one direction is done by assuming it to be a beam of

(a) 1m length (b) 1m^2 area

(c) 1m width (d) Least thickness

68. A reinforced concrete slab is 75 mm thick. The maximum size of reinforcement bar that can be used is

(a) 6 mm dia (b) 8 mm dia

(c) 10 mm dia (d) 12 mm dia

69. The drops are provided in flat slabs to resist

(a) Torsion (b) Compression

(c) Thrust (d) Shear

70. In a reinforced concrete retaining wall, a shear key is provided if the

(a) Shear stress in the vertical stem is excessive

(b) Shear force in the toe slab is more than that in the heel slab

(c) Retaining wall is not safe against sliding

(d) Retaining wall is not safe against overturning

71. The value of $\underset{x \to 0}{Lt} (\tan x \log x)$ is

(a) 1 (b) $\tan x$ (c) $\log x$ (d) 0

72. The general solution of the differential equation $9yy'+4x = 0$ is, $(y' = \frac{dy}{dx}$, C = constant)

(a) $9x^2 + 4y^2 = C$ (b) $\frac{x^2}{9} + \frac{y^2}{4} = C$

(c) $4x^2 + 9y^2 = C$ (d) $\frac{x^2}{4} - \frac{y^2}{9} = C$

73. The Laplace transform $L(e^{at})$ is , [Note:– $L(f(t)) = \bar{f}(s)$]

(a) $\frac{1}{s}$ (b) $\frac{a}{s+a}$

(c) $\frac{1}{s-a}$ (d) $\frac{s}{a}$

74. The number of sub matrices (1×2) of a matrix (2×3) is

(a) Three (b) Four

(c) Five (d) Six

75. If $A = \begin{bmatrix} 3 & 2 & -1 \\ 0 & 4 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 & 2 \\ 5 & 3 & 1 \\ 6 & 4 & 2 \end{bmatrix}$ Then the product of the matrices AB is

(a) $\begin{bmatrix} 4 & 7 & 5 \\ 0 & 12 & 4 \end{bmatrix}$ (b) $\begin{bmatrix} 7 & 2 & 3 \\ 16 & 51 & 36 \end{bmatrix}$

(c) $\begin{bmatrix} 7 & 2 & 6 \\ 56 & 36 & 16 \end{bmatrix}$ (d) $\begin{bmatrix} 16 & 2 & 7 \\ 56 & 6 & 36 \end{bmatrix}$

76. If 2 is root of the equation $2X^2 + X^2 - 13X + 6 = 0$, then the equation is exactly divisible by the factor

(a) $X-2$ (b) $2X$ (c) $X+6$ (d) $X+13$

77. A determinant (Δ) of 3 rows (R_1, R_2, R_3) and 3 columns (C_1, C_2, C_3) has a value $\Delta = 15$. If two columns C_2 and C_3 of the determinant (Δ) are interchanged, then the value of determinant will be

(a) 15 (b) –15 (c) 45 (d) –45

78. If $u = \sin^{-1}\dfrac{(x+y)}{\sqrt{x}+\sqrt{y}}$ then by Euler's theorem, $x.\dfrac{\partial u}{\partial x} + y.\dfrac{\partial u}{\partial y}$ will be

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

(b) $\frac{1}{2}\tan u$

(c) $x + y$

(d) $\sin x + \sin y$

79. While calculating the cost of a pile of bricks measured as 2 m × 15 m × 1.2 m, the tape is stretched 1% beyond the standard length. If the count is 450 bricks per cubic meter and cost of bricks is Rs. 5,000 per 1000 no's, the approximate error in the cost is

(a) Rs. 2,430

(b) Rs. 1,215

(c) Rs. 5,000

(d) Rs. 1,000

80. The series $1-\frac{1}{2}+\frac{1}{3}-\frac{1}{4}+....$, is

(a) Convergent

(b) Divergent

(c) Conditionally Convergent

(d) Oscillatory

Space for rough work

Space for rough work